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VOLUME VIII.

ORIGINAL COMMUNICATIONS:

ORIGINAL COMMUNICATIONS.

I.—On the Periodical Opening and Closing of Flowers. By Karl Fritzsch.

(Translated and abridged from the German.)

THE greater portion of the work before us, which appeared originally in the Transactions* of the Bohemian Society of Natural History, and which contains an account of a series of observations extending through many years, on those plants whose corolla opens and shuts periodically, is occupied with long lists of the plants, which were under examination, and voluminous complicated tables of the results obtained. It would obviously be impossible for us to reproduce these at length; we think, however, that such an abstract may be given as may be perfectly intelligible, and may afford our readers some definite notions of the conclusions at which the author has taken so much pains to arrive.

It is well known to every observer of what passes around him in nature, that plants exhibit day by day certain periodic phenomena analogous to those of sleep in animals. Either the leaves alter their position so as to exhibit a totally different appearance, or the flowers close more or less partially; either phenomenon taking place within certain fixed limits of time and circumstance. It is to the former of these cases that our author has directed his attention, as, in his opinion, more strictly allied to the periodic rest which is so essential to the sustenance of animal life in health and vigour. He shall, however, speak for himself.

"The intention of the observations now recorded is not to point out what phenomena accompany sleep in plants, or to explain how this function of vegetable life is effected, though I do not see why the periodic opening and shutting of flowers should

* *Abhandlungen der Kön. böhm Gesellschaft der Wissenschaften,* V. Folge, 7. Band.

Resultate mehrjährige Beobachtungen über jene Pflanzen deren Blumenkronen sich täglich periodisch öffnen und Schliessen von Karl Fritzsch. 4to Prag. 1851, pp. 164 incl. sched. 17. tab. 1.

not be regarded more properly as a symptom of sleep in plants, than the alternate approximation or divergence of neighbouring leaves, or the folding together of leaflets and other analogous phenomena depending on the position of such organs: exactly as in men and animals, the closing of the eyes is to be regarded rather as a sign of sleep, than the sinking of the hands and the repose of the feet. The strongest argument against a contrary view rests on the fact that plants bear leaves during the whole time of active vegetation, whereas their flowers are of short duration, and that, consequently, observations of the change of position of leaves would be more consistent with a general inquiry into the sleep of plants than those on the phases of blossoms, especially since these can only be made in the case of regular corollæ. It may be replied, however, that the changes of position in leaves, as regards the sleep of plants, are so multifarious, not only in different species, but even in different individuals or even different leaves of the same species, that observations on a number of species are not easily comparable with one another, and, moreover, cannot be the object of admeasurement after a definite scale, whereas the phases of blossoms may be regarded as describing the arc of an angle, which in every case admits of an approximate estimation.

"Nor can periodic phenomena be denied to blossoms because many last no longer than a single day, since those which fade are replaced by new blossoms, which exhibit the same alternations; and in many cases the same individual corollæ go through the same alternation of phases for many successive days. To this may be added the more important destination of these organs in the economy of the plant, their finer texture, their greater number and variety, circumstances which make them far more fit for the exhibition of vegetable life, than the leaves which are in every respect of inferior dignity. While, however, I leave these and similar questions to the determination of Vegetable Physiologists, I would remark that, in the following results of the phenomena of sleep in plants, the question is confined to the periodic changes in the close or expansion of flowers, while a more complete representation of the subject remains for future inquiry."

Our author made his first observations in the neighbourhood of Prag, in the year 1840. His immediate object was to note the epochs at which plants go through distinct phases of evolution, and in time, when the number of observations should allow, to distinguish the normal epochs for certain phenomena of development in particular plants, establishing, meanwhile, some allied inquiries on the relative conditions of Vegetation, and their dependence on season and other circumstances.

The motion of the petals in all plants which have a regular corolla may be compared with the motion of two connected lines which form an angle with each other, which may be exactly estimated in every position.

The opening and closing of blossoms are very rarely momentary, but are in general slow and continuous processes, which at all hours of the day are in varying degrees of intensity, and by no means bear any regular ratio to the time which has elapsed since the commencement of the phase, but still subject to laws, which can be numerically enunciated, when the nature of the phenomena and their dependence on the contemporaneous incidents in the immediate neighbourhood of the plants shall be recognised. Thence arises the necessity of noting hourly through the whole day and the entire duration of each particular blossom the magnitude of the change which has taken place and the relations of coincident meteoric phenomena.

It was therefore obviously necessary to have constant access to the plants under observation, though the results would necessarily be somewhat modified, still to a degree more or less appreciable, by the artificial conditions in which they were placed. The series of observations, after certain preliminary steps during the six preceding years, was commenced by Mr. Fritzsch, in earnest, at the beginning of 1844, and was kept up with scarcely any intermission for four years, his sister and wife giving him most important assistance in his inquiries, without which, in fact, it would have been almost impossible to have made any satisfactory progress.

Indigenous plants were carefully removed from their native place of growth and planted in pots, old individuals being used in preference to seedlings as possessing greater vigour; a point of the greater consequence as the confined situation in which the observations were made required as speedy a change as possible of the species to be examined. Exotic plants were placed for examination in the same place with those which were indigenous, the individuals being necessarily such as could conveniently be procured, sometimes in the pots in which they had been raised from seed or cuttings, and sometimes immediately transplanted like the indigenous species. At different times the aspect in which the plants were set varied from East and West to South, and consequently in very different positions as regards the direct rays of the sun, or the duration of their action. The temperature and clearness of the air, in consequence of their evident influence on the progress of the phases under observation, were regularly noted. The temperature was marked by two thermometers of the same range, one of which was exposed to the direct rays of the sun, while the other hung in the shade. That which was placed in the sun was either in a blackened hollow ball of brass, or in a blackened cylinder of the same metal. The difference between the two thermometers was carefully recorded, as affording an exact measure of the degree in which the flowers had been exposed to the direct rays of the sun. The quantity of moisture in the air and its barometrical pressure, as distinguished from that of dry air, were not so constantly registered as of only secondary influence. For the same reason the temperature of the soil was generally neglected, and the more especially as the plants were under artificial circumstances, from which no safe conclusions in that respect could be formed.

The number of species observed amounted to 140, belonging to 29 different orders of plants, of very different degrees of affinity.

The results of the observations appear under the following heads:—

1. Phases exhibited by flowers.
2. Dependence of the degree of expansion on temperature.
3. Insolation, or exposure to the direct rays of the sun.
4. Dependence of the sleep of plants upon the colour of their corolla.
5. Dependence of the same on the natural orders to which the species belong.

1. *Phases exhibited by flowers.*—If the duration of the sleep of a plant be reckoned from that hour at which the blossom has closed, as far as the mean daily expansion, to that when it has a second time opened to the same extent, extending over the minimum of the phase, we have the following results:—

Number of species.		Duration of sleep.
	2	10 hours.
	2	11 "
	10	12 "
	16	13 "
	16	14 "
	18	15 "
	10	16 "
	5	17 "
Mammillaria polythela.	1	18 "
Scorzonera laciniata .	1	19 "
	2	20 "

The time, therefore, varies from ten to twenty hours, the mean being somewhat above fourteen, those hours only being reckoned in which the phase is less than the mean of the whole day.

The species observed afford the subjoined results according to the difference of the hour at which the plants awake from their sleep, or reach the mean daily phase.

Number of species.		Hour of waking.
Ipomœa purpurea . .	1	2 A.M.
	2	3 „
	4	4 „
	8	5 „
	11	6 „
	23	7 „
	21	8 „
	7	9 „
	2	10 „
Passiflora cœrulea . .	1	12
Pyrethrum corymbosum	1	2 P.M.
Œnothera biennis . .	1	6 „
Lychnis vespertina .	1	7 „

Though there seems to be no time of the day when the blossoms of certain plants cannot open, yet in the greater number of cases they are closed soon after sunset; the number of species increases at first slowly, then more rapidly from 2 A.M. to 7 A.M., and then decreases again rapidly till midday. After that hour, only those species open which are night-bloomers.

COMMENCEMENT OF SLEEP.

Number of species.		Hours of the day.
Pyrethrum corymbosum .	1	2 A.M.
Œnothera biennis . . .	1	6 „
Lychnis vespertina . . .	1	7 „
Sonchus asper	1	9 „
Lactuca scariola	1	11 „
Scorzonera laciniata . .	1	12
	6	1 P.M.
	3	2 „
	13	3 „
	13	4 „
	11	5 „
	17	6 „
	8	7 „
	2	8 „
	4	9 „
Passiflora cœrulea . . .	1	10 „
Gentiana cruciata . . .	1	11 „

With the exception of a few hours about midnight, there is on hour in the course of the day at which blossoms do not beg n to close, yet there are a few only in which this is the case about midday, from which time the number increases, reaching its maximum at six, and then again decreasing.

The results may be arranged in a table as follows:—

TABLE A.

Hour.	Commencement of sleep. Number of species.	Awakening. Number of species.	Difference between the third and second column.
P.M. 0·5	7	1	— 6
„ 2·5	16	1	— 15
„ 4·5	24	0	— 24
„ 6·5	25	2	— 23
„ 8·5	6	0	— 6
„ 10·5	2	0	— 2
„ 12·5	0	0	0
A.M. 2·5	1	3	+ 2
„ 4·5	0	12	+ 12
„ 6·5	2	34	+ 33
„ 8·5	1	28	+ 27
„ 10·5	1	2	+ 1

It appears from this table, that the hour (6 P.M.) at which the greater number begin to close is twelve hours distant from that (6 A.M.) at which the greater number begin to expand, and that in general there is an opposition between the two phenomena, so far as regards the fact, that at those times of the day when the greater number of flowers are open, a smaller number also are closed, and the contrary.

In the table of differences in the fourth column, it is observable that the difference is negative up to midnight, that is, during that part of the day during which the tendency to sleep is the greatest, and positive during the other twelve hours; negative that is while the sun is westward, positive while it is eastward.

From sunrise, and so long as the height of the sun increases, with few exceptions blossoms are opening; from midday, while the height is decreasing, the contrary takes place. But not only does this connection between the situation of the sun and the phases of the blossoms exist in the principal epochs, but also in the magnitude of the alterations in either kind of phenomenon. At midnight, at the time of the inferior culmination of the sun, when the expansion of the petals is at zero, we find, as also at mid-day, when, as will appear afterwards, it reaches its maximum, there is no alteration of phase, whereas the change is the most striking exactly at those periods of the day when the angle of the sun's altitude changes most rapidly.

The duration of expansion is clearly merely the complement of that of remaining closed within the twenty-four hours. The time of the day, however, at which the greatest expansion takes place deserves notice, for the vital powers are there exhibited in the greatest action.

TIME OF GREATEST EXPANSION.

Lychnis vespertina	1	1 A.M.
Sonchus asper	1	7 „
	9	8 „
	7	9 „
	15	10 „
	11	11 „
	15	12
	12	1 P.M.
	8	2 „
	4	3 „
	3	4 „
Passiflora cœrulea	1	5 „
Pyrethrum corymbosum	1	10 „
Œnothera biennis	1	11 „

In general, the number of species whose blossoms attain the maximum of their phase increases from sunrise to midday, and then decreases till sunset. None of the day-bloomers is open till 7 A.M., or later than 5 P.M. A similar law seems to hold good with the night-bloomers, which generally seem to open their cup fully towards midnight, while at mid-day they are completely closed. Now if these results are arranged as in Table A. we have,—

TABLE B.

Time of greatest expansion.	Night blossoms.	Day blossoms.	Difference between third and second column.
P.M. 0·5	0	27	+ 27
„ 2·5	0	13	+ 13
„ 4·5	0	4	+ 4
„ 6·5	0	0	0
„ 8·5	0	0	0
„ 10·5	2	0	— 2
„ 12·5	1	0	— 1
A.M. 2·5	0	0	0
„ 4·5	0	0	0
„ 6·5	0	1	+ 1
„ 8·5	0	16	+ 16
„ 10·5	0	26	+ 26

It appears then that at the inferior culmination of the sun the night-bloomers are most expanded; that the expansion decreases as the sun approaches the horizon; that at sunrise they close, when the day-bloomers commence their phases, being most expanded at midday, and closed again towards sunset, when the night-bloomers in turn recommence their course.

From these tables it is clear that the phenomena of flowers, so far as they relate to the sleep of plants, and the diurnal periodical change in the state of the blossoms, are in close causal connection with the apparent daily course of the sun, and therefore its insolation and diurnal variation must be regarded as the proximate cause of the diurnal periodical return of the interchange between sleep and waking.

The next point which engages our notice is the connection of the duration of sleep with the epoch of the greatest expansion.

The author,* in another treatise, had proposed certain laws as regulating the sleep of plants. The first is as follows:—" In those blossoms which are fully expanded in the morning, the duration of expansion is short." New observations have afforded the following results with respect to those flowers which are fully expanded from 12 P.M. to mid-day:—

	Hour of complete expansion.	Duration of sleep.
Lychnis vespertina.	1 A.M.	12 Hours.
Sonchus asper	7 „	20 „
10 species	8 „	14·1 mean.
7 „	9 „	16·6 „
13 „	10 „	13·8 „
11 „	11 „	15·5 „

The mean duration of sleep in forty-one species which expand in the morning is 14·8 hours, that is, 0·8 greater than the mean duration of sleep in eighty-six species for which the duration of sleep has been determined without respect to the diurnal epoch of the maximum change. In twenty-six species the duration is greater, and only in sixteen species less than 14·2. The law is therefore strengthened by a multiplication of observations.

A second law was, " In those plants whose blossoms expand in the afternoon, the condition of waking is limited by the duration of the physical day, or the length of time the sun is above the horizon."

* *Abh. der. Kön. Gesell. der Wissenschaften, V. Folge, 4 Band.* p. 83.

	Hour of complete expansion.	Duration of sleep.		Hour of complete expansion.	Duration of sleep.
12 species . .	1 P.M.	13·4 mean.	Passiflora cœrulea . .	5 P.M.	14
8 „ . . .	2 „	13·7 „	Pyrethrum corymbosum	10 „	11·5
4 „ . . .	3 „	12·6 „	Œnothera biennis . .	11 „	12

The mean duration of sleep in twenty-seven species whose flowers expand after midday is 12·9, that is, 1·3 less than the normal duration. In those cases where the full expansion takes place at mid-day, observations on fifteen species give a mean of 14·2. The second law is therefore confirmed.

A third is, "Those plants which expand at night seem never to fall completely into the state of sleep." In the author's former observations the duration of sleep was confined to those hours in which no alteration takes place in the phases, whereas in the treatise before us it is extended to the time at which the expansion has attained its mean diurnal condition. The law therefore must be stated in the following terms:—"In those plants whose blossoms are fully expanded in the night, the duration of sleep is the shortest." The mean duration of sleep in the three night-blowing plants which have been so often quoted is 11·8, that is, less than twelve hours, and therefore the third law also is established.

The following list contains a comparative view of the duration of sleep in flowers which open at different times of the day:—

Morning bloomers (41 species)	14·8	Afternoon bloomers (27 species)	12·9
Mid-day bloomers (15 species)	14·2	Night bloomers (3 species) . .	11·8

A fourth law was laid down in the following terms:—"Those blossoms which are fully expanded in the morning open in general more rapidly than they close, while in those which open in the afternoon the contrary law prevails." This will appear from the following table:—

Time of full expansion.		Phase increasing.	Phase decreasing.	Difference between inc. and dec. phase.
Lychnis vespertina	1 A.M.	6 Hours	6 Hours	0
Sonchus asper . .	7 „	2	2 „	0
9 species . . .	8 „	3·9 mean	6·0 mean	— 2·1
7 „ . . .	9 „	2·6 „	4·8 „	— 2·2
12 „ . . .	10 „	4·1 „	6·1 „	— 2·0
11 „ . . .	11 „	3·4 „	5·1 „	— 1·7
15 „ . . .	12	4·6 „	5·2 „	— 0·6
12 „ . . .	1 P.M.	5·3 „	5·3 „	0·0
8 „ . . .	2 „	5·6 „	4·6 „	+ 1·0
4 „ . . .	3 „	8·0 „	3·5 „	+ 4·5
Passiflora cœrulea .	5 „	5	5	0·0
Pyrethrum corymbosum .	10 „	8·5	4	+ 4·5
Œnothera biennis .	11 „	5	7	— 2·0

In those plants, therefore, which are fully expanded in the morning, the increase of the phase does not last so long as the decrease, while in those which are fully open after mid-day the contrary takes place.

When blossoms begin to open in consequence of the cessation of sleep, the change takes place generally at first slowly, then more rapidly; as it approaches its maximum, the increase is again retarded; in a few plants only the complete expansion lasts an hour—more commonly not so much; and then they begin to close again at first slowly, then more rapidly, and as they approach the maximum of approximation of their petals, the progress is again slow, till the flower, in a more or less closed condition, remains, without any regularity, many hours, till the time comes round for a new cycle of phases.

Estimating therefore the angular value of the degree of expansion as follows:—

Angular Value of phase.		Corresponding angle.
Perfectly closed	0	0
Half open	50	45°
Completely expanded	100	90°
Half reflected	150	135°
Completely reflected	200	180°

We have—

Minimum in	17 species	= 0
„	28 „	= 1 — 10
„	18 „	= 11 — 20
„	5 „	= 21 — 30
„	10 „	= 31 — 40
„	4 „	= 41 — 50

The maximum therefore approaches more or less 0°, and in no case exceeds 45°. Anthemis cotula, Chrysanthemum carinatum, and Pyrethrum corymbosum are exceptions to this rule, whose blossoms are reflected at the time of the maximum of expansion.

The mean degree of expansion not only depends on the duration of sleep, and is, in plants with a longer duration, smaller than in those whose sleep is shorter, but is affected by the magnitude of the extremes, and the daily variations of the degree of expansion. Therefore the number of plants in the different gradations remains nearly the same, and decreases rapidly only when the phases approach the mean minimum or maximum.

The limits of the mean expansion, excepting Pyrethrum corymbosum, are 5° and 67°.

As regards the maximum :—

Maximum in	Crocus vernus	=	31 — 40
„	4 species	=	41 — 50
„	10 „	=	51 — 60
„	14 „	=	61 — 70
„	15 „	=	71 — 80
„	16 „	=	81 — 90
„	13 „	=	91 — 100
„	4 „	=	101 — 110
„	8 „	=	111 — 120
„	Borkhausia fœtida . .	=	121 — 130
„	Solanum vulgare . .	=	131 — 140
„	Scorzonera hispanica .	=	141 — 150
„	Tigridia pavonia . .	=	180
„	Pyrethrum corymbosum	=	190

The same proportions hold good as with respect to the mean expansion. The number of species increases as the phase approaches 100 (90°), and then decreases. The usual limits of the maximum lie between 30 and 130.

With reference to the whole amount of expansion, or difference between the maximum and minimum, the case is much the same as with the maximum. The number of species increases when the variation amounts to 75, and decreases when it exceeds that measure. The limits of the diurnal change lie between 25 and 130, corresponding to angles of 22° and 112°.

2. *Dependence of the degree of expansion on temperature.*—We have seen that the time of sleep, as well with regard to its duration as to the period at which it begins or ceases, is in close connexion with the apparent daily course of the sun. This is not the case with the degree of expansion, inasmuch as the temperature of the air and other cosmical conditions are important agents in the matter, as is evident on theoretic grounds: for the influence of the sun's rays (insolation) on plants is greatly modified by meteoric conditions, though the duration of the sun's influence is always the same, at the same time of the year, as its apparent diurnal course. The following table shows the temperature at which the flowers of different species begin to expand. Since the time of the year seems to influence the temperature at which plants wake from their sleep, the mean epoch of observation for every group is reckoned from the time appended in the tables to each individual species :—

Degree of temperature.	Mean time of observation.
* 38·75 two species	April 3.
43·25 five „	April 18.
47·75 nine „	May 18.
52·25 sixteen „	June 16
56·75 fourteen „	July 5.
61·22 six „	July 12.
66·75 (Malva Alcea)	July 7.

The limits of temperature between which flowers begin to open are 38·75° and 65·75°. The number of species increases up to about 54·5°, and then decreases. We observe too that the temperature requisite is so much the higher, as the time at which the plants blow advances in the year. But since plants in general, in the same degree, require a higher temperature for their expansion, the position may be regarded as sure that species which require a higher temperature to attain certain stages of expansion awake from their sleep at a higher temperature.

The following table indicates the temperature at which the greatest degree of expansion takes place :—

Degree of temperature.		Mean time of observation.
47·75	Mirabilis Jalapa (night-bloomer)	
56·75	Erodium cicutarium, Lychnis vespertina (night-bloomer)	May 6.
61·25	four species Funkia japonica (night-bloomer) Œnothera biennis (night-bloomer)	Aug. 10.
65·75	three species	July 2.
70·25	eleven „	May 27.
74·75	thirteen „	May 30.
79·25	fifteen „	June 26.
83·75	twenty „	June 29.
88·25	thirteen „	July 13.
97·25	Echinocactus Ottonis	July 15.
106·25	Carlina acaulis	Sep. 1.

The night-bloomers reach the maximum of expansion at from 47·75°—61·25°. The day-bloomers from 79·25°—88·25°. The remaining two species are exceptional. The number of species whose blossoms are fully expanded in the day increases from 56·75°—83·75°; many species, however, expand under 81·25°, above that temperature extremely few, and so far from the expan-

* The temperature is given in the original according to Reaumur's scale, but is here adapted to Fahrenheit.

negative between (T . . . t′) where t′ is the temperature at which all motion ceases.

Co-efficient of temperature, or change produced by increase of temperature. 22 5 degrees.		Mean daily alteration of phase.
Aphelexis humilis	+ (11 — 20)	
5 species . . .	+ (21 — 30) . . .	40·2
6 „ . . .	+ (31 — 40) . . .	59·2
20 „ . . .	+ (41 — 50) . . .	61·8
11 „ . . .	+ (51 — 60) . . .	68·9
15 „ . . .	+ (61 — 70) . . .	74·1
10 „ . . .	+ (71 — 80) . . .	(61·8)?
7 „ . . .	+ (81 — 90) . . .	84·6
7 „ . . .	+ (91 — 100) . . .	84·4
2 „ . . .	+ (101 — 110) . .	69
2 „ . . .	+ (111 — 120) . .	56
2 „ . . .	+ (121 — 130)	
Tigridia pavonia .	+ (180)	

This shews clearly the immense influence of temperature. In a few plants only the petals approach the horizon, on an increase of 22·5°, less than 30°, or what is the same thing, diverge from each other when opposed less than 60°. In most cases the increase of divergence extends from 80°—170°, in individual cases as much as 240° and in Tigridia pavonia above 320°.

Even those blossoms, whose phase is altered together with the temperature, in the same sense, change their range into the opposite when the temperature exceeds certain limits. This is the case with those plants which form the transition from day-bloomers to night-bloomers. Though it cannot be denied, taking these observations into consideration, that temperature is far the most important agent as regards the magnitude of the changes which take place in the phases of flowers, such alteration cannot be sufficiently explained from the diurnal range of temperature alone, but other meteoric agents probably are at work. The answer to this question supposes the co-efficients of temperature and its limits to be more accurately and fully determined than is at present the case.

3. *Insolation.*—The inquiry with respect to the influence of insolation, or exposure to the direct rays of the sun, has the most intimate connexion with what has been said, for at that time of the year when plants expand their blossoms, insolation is the most productive source of high temperature. Beyond doubt, however, it exercises not only this but also an immediate influence on the expansion of flowers, in consequence of their susceptibility for the

excitement of light. As the higher temperature of summer is produced especially by the degree and duration of insolation, so this in turn may be regarded as a function of the apparent daily course of the sun. But if the duration of sleep, its limits, and the times of the greatest expansion are immediately dependent on insolation, the epochs relative to the sleep of plants in different species are only so far comparable with one another, as they are referred to the same length of day.

The following tables in connexion with this subject now demand our attention:—

Plants which wake from sleep before sunrise:

Anthericum ramosum.
Ipomœa purpurea.
Catananche versicolor.

Plants which wake before the beginning of insolation:

Ipomœa purpurea, 5 hours before or	— 5
2 species	— 4
7 "	— 3
9 "	— 2
19 "	— 1

While then 4 per cent. of the plants examined open their blossoms before sunrise, this is the case with 45 per cent. before they are reached by the first direct sunbeam. As many species, therefore, seem to require the direct light of the sun in order to their expansion, as those which need only that which is diffused in the atmosphere; a very few only are so delicately susceptible, as to expand at the glimmer of twilight.

Plants which wake at sunrise: 6 species.

Plants whose blossoms open at the commencement of insolation: 22 species.

It is clear that sunrise is only so far an important moment for the physiognomy of the floral world, as the position in which plants are placed is favourable to their immediate insolation, which can only be the case where the field of view is perfectly clear. Although the greater number of plants must be exposed to the direct rays of the sun before their flowers expand, yet we cannot suppose that this must necessarily take place at sunrise, when the position is such that it is accessible to the rays of the rising sun, and is not first insolated when the sun has attained a high angle. It is more probable that the latter condition is requisite, in order that the insolation may have attained a due intensity. The author's observations were made in a position where the insolation did not begin till three hours after sunrise.

Plants which wake after sunrise:

9 species, 1 hour after or	+ 1
15 "	+ 2
25 "	+ 3
19 "	+ 4
3 "	+ 5
Passiflora cœrulea	+ 8
Pyrethrum corymbosum (night-bloomer)	+ 10
Œnothera biennis " .	+ 14
Lychnis vespertina .. .	+ 15

Plants whose blossoms open after the commencement of insolation:

15 species, 1 hour after or	+ 1
6 "	+ 2
Passiflora cœrulea	+ 5
Pyrethrum corymbosum (night-bloomer)	+ 6
Œnothera biennis "	+ 10
Lychnis vespertina	+ 12

Since the number increases up to three hours after sunrise, and then rapidly decreases, when, at that period, insolation has commenced, the beginning of insolation may be regarded as the normal period for the cessation of sleep.

On a consideration of the results of these observations, the following general position may be considered as proved:—Plants require the light of the sun, in order to awake from sleep, either immediately from insolation, or indirectly from diffusion in the atmosphere. In the last respect, the sensitiveness of some plants for light is so great, that their blossoms begin to open the moment the rays of the sun illuminate the higher regions of the atmosphere, which in summer is the case to a greater or less degree through the whole of the night. A few blossoms therefore expand before sunrise. Since this is connected with no quick accession of intensity of light, but with the transition from the faintest glimmer of twilight to the weakest insolation, the great diurnal periodically returning act of sunrise is not accompanied by any striking effect on the floral world.

More blossoms do not expand at sunrise than the general and steady accession of intensity of light would lead one to expect. As, however, the intensity of light increases, the number increases which expand, in order to be in readiness to receive the breath of life through the falling rays, till the moment when insolation commences, after which the number again decreases. At mid-day, with few exceptions, and those of night-bloomers, every flower has opened its cup.

It is time, however, to institute a similar inquiry into the circumstances attendant on the cessation of insolation and the setting of the sun.

Plants whose blossoms close before the end of insolation:

Sonchus asper, 10 hours before, or	— 10
Lactuca scariola	— 8
Scorzonera laciniata	— 7
5 species	— 6
5 "	— 5
10 "	— 4
6 "	— 3
12 "	— 2
14 "	— 1

The number of species increases as the hour approaches at which insolation ceases. No blossom closes before the insolation begins, for even those plants whose cups are closed before mid-day remain for some hours with open cups exposed to the direct rays of the sun.

Plants whose blossoms close with the cessation of insolation: 11 species.

Plants whose blossoms close after the cessation of insolation:

2 species	+ 1
2 "	+ 2
3 "	+ 3
3 "	+ 4
2 "	+ 5
2 "	+ 6
3 "	+ 7
Lychnis vespertina .	+ 12
Œnothera biennis .	+ 15

When insolation, and therewith a higher degree of intensity of light, has ceased, a peculiar apathy, as regards the light which still remains, seems to possess the vegetable kingdom, for though with the rapidly decreasing intensity one might expect a rapid increase in the number of plants which close their blossoms, almost an equal number of cases occurs at every hour after the end of insolation. We must suppose, therefore, that in consequence of many hours' exposure to the influence of the direct rays, their susceptibility towards the far fainter light which is dispersed in the atmosphere is lost, and therefore some other cause than the decreasing sunlight is at work in closing the flowers, which does not depend on any diurnal period.

Plants which close their blossoms at or before sunset:

Sonchus asper, 11 hours =	— 11
Lactuca scariola . . .	— 9
Scorzonera laciniata . .	— 8
4 species	— 7
5 "	— 6
12 "	— 5
10 "	— 4
13 "	— 3
13 "	— 2
9 "	— 1
4 "	0

Sunset then, like sunrise, is no decisive element in the question, for the number of flowers which close is far less at that hour than some hours earlier. As, however, the sun advances in its course, the number of plants which fall asleep increases.

Plants which close their blossoms after sunset:

2 species	+ 1
4 "	+ 2
Gentiana cruciata . . .	+ 3
Pyrethrum corymbosum .	+ 6
Œnothera biennis . . .	+ 10
Lychnis vespertina . .	+ 11

A few hours after the insolation has begun in the morning, the corolla of most plants is expanded, others begin to close as the insolation becomes more intense, while a few still expand. After mid-day the number of closed blossoms rapidly increases when the insolation has reached its maximum. With the exception of night-bloomers there are no plants whose cup has not been expanded, and is now rapidly closing. As the insolation declines, the number of closing blossoms increases, and becomes small at the moment of the cessation of insolation. Later in the day, the number of blossoms which close is from hour to hour nearly equal; neither the decrease of intensity of diffused light, nor the departure of the sun, nor the far less intensity of twilight, seems to have any influence on the law of the decrease of the number of closing flowers.

4. *Dependence of the sleep of plants upon the colour of their corolla.*—Those plants, the progress of whose phases can be graphically

represented, are ninety-three, which, arranged according to the colours of the blossoms, are—

White . .	22	or 23·8 per cent.
Blue . .	12	„ 12·9 „
Yellow .	39·5	„ 42·5 „
Red . .	19·5	„ 20·9 „
	93	100·1

The result is the same as what had been previously announced by the author:—"That with the exception of yellow blossoms, the white possess the strongest tendency to contract and expand, and then the red and blue in equal proportions;" and the same holds good if every plant which is not indigenous be struck out of the list. Now if all plants indigenous to Bohemia be arranged according to colour, the result is,

White . .	677 =	37 per cent.
Blue . . .	165 =	9 „
Yellow . .	586 =	32 „
Red . . .	403 =	22 „

Since then for every hundred species of each kind of colour there is the following number of observed species whose blossoms open and close,—

White . .	= 2·21
Blue . . .	= 5·15
Yellow . .	= 5·56
Red . . .	= 1·49

we have the following law:—"The relative number of plants whose blossoms open and close is the greatest in the yellow and blue, and smallest in the white and red."

The tables which show the dependence of the duration of sleep and its limits on the colour of the flowers are too long and complicated for insertion; it appears, however, that the duration of sleep in the white and red blossoms

$\frac{1}{2}$ (13·1 + 13·7) . . . . = 13·4
In the blue and yellow, $\frac{1}{2}$ (14·9 + 14·6) = 14·75

As the number of species which periodically close and expand was found to be greater in the blue and yellow than in the white and red, so the duration of sleep is found to be 1·35 hours longer in the one case than in the other. It appears, also, that the blue and yellow blossoms are more susceptible of the influence of the light of the sun than the white and red, for in a like number of species of each colour there is in both the first groups not only a far greater number of plants whose blossoms open and shut periodically, but there is a far shorter period of the operation of light on them, by which the plants wake from sleep, and completely expand their flowers, and consequently they fall the sooner into a state of repose.

Again, as regards temperature we have—

Colour.	Temperature at which flowers wake from sleep.	Temperature at which flowers attain the greatest expansion.	Temperature at which flowers lose all motion.	Co-efficient of temperature determined as above.
White and red. .	51·125	75·65	88·7	41·7
Blue and yellow.	51·125	78·8	93·65	34·3

While then the colour of the blossoms seems to have no influence on the temperature at which plants wake from sleep, those which have blue and yellow flowers require a higher temperature for full expansion, and are capable of enduring greater heat than the white and red, and consequently the co-efficient of temperature is less. In general, the difference of this influence of temperature seems to increase in proportion as it is raised above that degree at which plants wake from sleep.

White and red blossoms need a longer action of the light of the sun, and a higher temperature of the air, in order to expand their petals, than blue and yellow; but when the epoch has arrived at which sleep ceases, this proportion is changed, and the maximum expansion of the latter requires a higher temperature, and this ratio continues to that time of the day when sleep again takes place, since the blue and yellow fall into that condition earlier, and at a higher temperature, than the white and red.

There is a very close connection between this last inquiry and the question what influence insolation has on the time of sleep and its limits, taking colour into consideration. The following result is yielded by the tables :—

Colour of petals.	End of sleep.	Beginning of sleep.
White and red (after beginning or end of insolation)	+ 0·5 . . .	+ 0·9
Blue and yellow (before beginning or end of insolation) . . .	— 0·5 . . .	— 1·6

The white and red open after the commencement of insolation, and close after the insolation has ceased, while the blue and yellow

II.—On Magnolia grandiflora. By John Saul; Washington, United States.

(Communicated December 7th, 1852.)

Among evergreen trees few, if any, can compare in beauty or stateliness with this Magnolia; whether we look at its fine broad expansive foliage, the size, beauty, and fragrance of its flowers, or the noble grandeur of the tree, all must admit it to be one of the greatest ornaments a garden can possess. It is pretty generally known in England, but what are the finest trees in that country compared with specimens of it here! In the Isle of Wight, and some parts of Devonshire, I have seen, perhaps, some of the best examples of it in England; these were principally standard trees. I have also remarked in various parts of the country very fine trees trained to walls. It appears to me, however, that the majority of cultivators of this tree in England err in its management, as I shall presently attempt to show; but first let us view it in this its native country.

The Magnolia is quite at home in the southern states, commencing with South Carolina, in which it attains a large size, and is one of the greatest ornaments of the forest, but my present purpose is to draw attention to its cultivation in the middle states, where the winters are more severe. About New York this tree is not hardy, a circumstance at which one need not be surprised when it is recollected that the thermometer occasionally sinks as low as from 15° to 20° below Zero, yet even here Magnolias may be kept alive out of doors if they are well protected. About Washington it is perfectly hardy, braving with indifference the greatest cold: the past winter was unusually severe, the thermometer having sunk as low as 5° and 6° below Zero, yet no injury was sustained by this tree: exposed and unprotected, not a leaf or young shoot was harmed; some of the gardens here can boast of handsome specimens, though they are not very remarkable for large size. On the opposite shores of the beautiful Potomac River, a few miles below Alexandria, is Mount Vernon, the once quiet retreat of the illustrious Washington, and still his resting place. This great man, who was well known to have enjoyed more real delight and happiness in rural affairs than in military exploits, planted and enriched his place with many rare and beautiful trees of his native land; the Magnolia, among other species, here found a home; at the present time one magnificent specimen cannot measure less than from fifty to sixty feet in height, feathered to the ground with branches; this is one of the most beautiful trees of the kind I have ever seen.

Let us inquire under what circumstances these plants have been grown. Mount Vernon consists of high ground, sloping to the river; by nature, it is therefore well drained; the soil is a sandy loam on a gravelled bottom; under such conditions is it to be wondered at that plants thrive? The winters there must be fully as severe as about Washington; cold, therefore, such as I have been describing, will not hurt the plant. The summers are long and intensely hot; the dry burning heat and brilliant sun which are so fatal to many English evergreens, roasting their foliage completely off, have no ill effect upon the Magnolia; on the contrary, they have a good effect, for the trees evidently enjoy the warmth, and why not? they are at home in it; and this intense heat, burning sun, and well-drained soil, have produced the fine Magnolias, about which we have been speaking.

If cultivators in England, therefore, wish to follow nature and attain success, they must plant in well-drained soil, (no matter what sort if well drained,) in an open airy situation where the tree will get all the sun that the British climate can possibly afford, and there is not much fear of the results. No cold in England will hurt the Magnolia, provided the wood is well ripened, and it may be planted out, as standards in the most northern counties. In this country, where the wood is well matured, it blooms in a very young state and most abundantly, from the middle to the end of June. I have known persons in England regularly house their young plants in winter; there is, however, no necessity for this if the wood is ripe. How often is this plant turned out against a south wall on a well-made border, and well sheltered: in such situations the plant grows freely, very often too freely and late, if it is not injured by frost; the wood is so soft and unripe that it cannot produce a bloom, until the plant is comparatively old and stunted. The only trees in Britain which I should consider properly placed were those to which I have alluded in the Isle of Wight and Devonshire; there they appeared to me to have been planted chiefly in the natural well-drained soil, in which they did not grow so rapidly as in rich borders; they grew moderately, very bushy, ripened their wood well, and the result was abundance of bloom. As to plants, seed to any extent might be had from the southern states, and the plants might be raised, grown, and offered in quantities as cheap as Portugal Laurels.

If this tree looks grand in sequestered spots, will it not also prove effective in masses or clumps in the garden, the shrubbery, or the extensive park? There it would be at home, giving a massiveness and boldness to the landscape.

III.—Pears, Peaches, etc., at Oulton Park, Tarporley, Cheshire. By Robert Errington, C.M.H.S., Gardener to Sir Philip de Malpas Grey Egerton, Bt., F.H.S.

(Communicated December 7th, 1852.)

This has been the best season for Pears and Peaches I ever knew; they have been unusually abundant, of fine size, and excellent in quality for a northern climate. There is one feature in the autumn worthy of particular remark, and that is the unusually protracted mildness of it, as compared with the majority of autumns. Up to this period, December 4th, we have had in the main what may fairly be termed September weather; and no doubt the average of the thermometer would range some 6° or 8° over ordinary seasons. Now, if this be correct and Pears are finer flavoured than usual, to what does it point but the propriety of using a little artificial warmth, under ordinary autumnal conditions, to promote those chemical changes in the fruit at that critical period when nature intended them to ripen: for, doubtless, every fruit has one period more fitting than another.

I, for one, have for years contended for a small artificially warmed room, to ripen off and do justice to fruits; and experience only confirms the opinion. But my chief purpose in these remarks is to point to a few useful practical facts which concern every fruit-grower in the kingdom.

It is now more than twenty years since I drew attention to the propriety of shallow soils for tender fruit-trees, taking as the basis of my recommendation the ripening of the wood, which indeed constitutes in itself the only solid foundation for all practice. Since then I have had ample opportunities of confirming the soundness of such views; this year more than usual. I have a flat table of Pears here, about thirty yards in length, which was a perfect picture, and which produced some of the finest Pears in the gardens, many of them far superior to the walls. This was originally intended for a table trellis, but somehow the trellis was never applied, and they were trained out with rough stakes: now they are so stout with age as to be capable of sustaining themselves at about one foot from the soil, and parallel therewith. We had here, Beurré Bosc, Winter Nelis, Beurré Diel, Glout morceau, and Marie Louise, in the highest perfection, so fine, indeed, that Mr. Yates the great Manchester fruiterer, who happened to call, said that he had never in all his life seen such a sight. Now these Pears were planted some fifteen years since on platforms ten inches deep in soil: a rather adhesive loam without any admixture; they have never received the least culture at root; the soil, indeed, is hard as a footpath over their roots.

A Beurré d'Aremberg tree was planted in an imitation alluvium about sixteen years since; this tree is on a quince stock, and never fails to produce good crops. It is about twenty feet high, a noble standard, the stem ten inches diameter, and the general form a drooping pyramid, if the term may be allowed: this tree produced this year more than a bushel of excellent Pears, thus proving that tender French Pears may be grown as standards much further north than people imagine.

The wood on these trees, planted on shallow platforms, is, as might be expected, exceedingly short-jointed and stubby, and covered with spurs. All coarse breast wood is, if time permit, rubbed away as produced, in summer, and every short-jointed young shoot showing opposite indications left to be tied down to the branch whence it proceeds. In the end of July or early in August, every young shoot is pinched; that is to say, the point removed by the hand, or, if labour be scarce, the shears; and, henceforth, I hold it good practice to continue at intervals to repeat the operation: this gradually removes the incentives to a fitful root-action, which, by continued excitement, throws more fluid matter into the tree than can be elaborated through the medium of our chilly autumns; and the sure consequences of which are an arrest of that amount of solidification in the wood, which is nature's aim, and a certain concomitant of both health and fruitiferous tendencies. I therefore beg again to direct attention to those parts which lie at the bottom of all tender fruit-culture: it may be added that our most hardy fruits have not a perfect immunity from these conditions.

As for Peaches and Nectarines, how strange it is that we still hear such complaints about their failure out-doors; and that too by men of first-rate practice, who perhaps possess two or three Peach-houses in their forcing establishments, in which, on the average, they succeed admirably. Does not this point to the extra precautions necessary in dealing with out-door matters in Britain? Not in making deep and rich borders, but in avoiding them. The out-door borders here are just ten inches deep, but then they have had a surface-dressing of six inches. These trees always bear a very full crop of first-rate Peaches; so good that they command the highest price in the market: my note-book tells of more than one hundred dozen from a space of wall fifty yards long by three yards high; all first-rate Peaches and Nectarines.

Here again, the trees on shallow platforms; top dressings resorted to occasionally by anticipation in the original plan, and a total absence of all cultural operations to a distance of six feet from the wall; with the exception of the surface-dressing, which is a part of the system.

One other point may be adverted to, and that is the protection of the blossoms; I here must allude to the retarding principle of covering very early in the spring, in order to throw the blooming period later, and thereby increase the chances as regards atmospheric conditions. If there be any merit in this practice, I must lay claim to a considerable portion of it. There can be no question now, that such practice, rightly carried out, will suit well the average of seasons: it will, to use a parliamentary phrase, "command a majority." I must here candidly confess, that my attention was mainly directed to this view of the question, originally, by the marginal remarks in the Society's fruit catalogue. Many years since, my attention was attracted to such marginal notes as these:—"bloom late, escape the spring frosts," &c. Such should naturally suggest the idea of retardation, if it could be practically and economically carried out; and all I can say is, that if it depended on a vast amount of labour it would long since have fallen through. As it is, we stick lots of fir boughs, the spruce if possible, amongst the branches early in February, and by such means we seldom miss a crop. This of course refers to the Espalier Pears, as also most of those on walls: the Peaches are covered in the end of January with canvas, which is withdrawn two or three times a week on dull days, in order to keep the bud hardy; they are, however, sedulously closed during sunshine, in order to carry out the retardation principle.

In concluding these remarks, I would observe, that within little more than a score miles of this place, are gardens in which flued walls are considered indispensable in the out-door culture of the Peach and Nectarine. I have seen as many as from four to six fire holes to a south Peach wall; and they really look very expensive things.

IV.—On the premature Decay of Peach and Apricot Trees. By J. B. Whiting, C.M.H.S., Gardener to H. J. Hope, Esq., the Deepdene, near Dorking.

(Communicated December 7th, 1852.)

In a paper (Vol. VI. p. 128) on the short duration of wall-trees, Mr. G. Lovell ascribes the premature failure of the Peach and its allies *chiefly* to improper management of the trees during the first stages of their growth, and as a remedy he recommends a course of treatment differing but little from a method described in Vol. II. of *Loudon's Gardener's Magazine*, but which has never been brought regularly into practice, principally, perhaps, on account of its requiring more time and attention than the mode of management now generally followed in nurseries. It is reasonable to suppose, that the present system is to a certain extent injurious to the constitution of the Peach and the Apricot-tree, which, being natives of much better climates than our own, require to be placed under the most favourable conditions to ensure even a moderate amount of success in their culture; still I cannot altogether coincide in the opinion Mr. Lovell has expressed, that "to the disagreement between the scion and the stock, and to the early and ruthless application of the knife, may be attributed, in the majority of cases, the early death of the Peach and its allies." I think that the premature decay of our Peach-trees ought rather to be attributed to a conjunction of various causes, not one of which singly equals in evil effect an unfavourable season. In proof of this, we need not go back beyond the springs of 1850 and 1851, when the protracted cold weather blistered and destroyed much of the foliage, and even many of the tender shoots that were first unfolded, so that the young wood made very little progress till nearly the middle of May. Many Peach-trees suffered so much in consequence, that they lingered for a month or two, and then died; and still more had their constitutions irretrievably weakened.

Another bad result of injury to the earliest shoots is, that the length of the growing season is thereby curtailed, and the young wood in the following autumn wants that firmness of structure which gardeners term "well-ripened," and is consequently much more subject to gum; neither are the future flower-buds so perfectly formed as is necessary for the production of fruit. Untoward circumstances like the foregoing I hold to be a more fertile source of destruction to Peach-trees than the present system of pruning them while young; but then *climate* is the cause of these evils, and "climate we cannot control." True; but if we cannot absolutely *control*, we can *modify* climate; and on that principle I maintain that the cheap frames and sashes, or lilliputian Peach-houses, which some writers have so strenuously recommended, can be much more profitably employed in covering bearing trees now growing against walls. With the aid of the saw-mill, cheap timber, and cheap glass, an inexpensive structure can be built which will effectually protect both blossoms and young wood against chilling spring frosts, and when by this means a crop of fruit has been insured, the same apparatus will assist in ripening it in a wet and sunless autumn, such as we have lately passed. Several of these erections are now in use in this neighbourhood, and (with one exception) all that I have seen answer exceedingly well.

Another fertile source of injury, acting also by preventing the proper development of the young shoots, is the *aphis*. This insect frequently does incalculable mischief to wall-trees by being suffered to establish itself upon them early in the season. It will, perhaps, be said that, as this evil might so readily be removed by a few syringes with tobacco-water, it can only occur through the negligence or the laziness of the gardener; in answer to which I would beg to observe, that in eight out of ten cases where it does occur, the discredit ought in justice to rest upon the gardener's employer for refusing to allow sufficient help at that most harassing season of the year. No person who has not himself had the management of a wall of full-grown Peach-trees can form any notion of the great amount of attention, and consequently of time, they require to keep them in good condition.

Generally speaking, a vigorous Peach-tree is not afforded sufficient space to extend its branches, for either the wall is too low (some eight or nine feet, whereas it ought not to be less than

though pruned with a knife, and budded on a plum-stock, might not live and thrive for an indefinite number of years.

As regards the Apricot-tree, Mr. T. A. Knight entertained a notion that the short duration of the Moorpark trees arose in a great measure from its unnatural connection with the plum-stock; and many years ago he pointed out to me, in his own garden, the greater healthiness of a particular tree on an Apricot-stock than that of another tree growing beside it which had been worked upon a plum-stock. As the Apricot does not thrive in the light sandy soil of this garden, I determined upon trying Mr. Knight's plan, and with that view I sowed a few stones of several sorts of Apricots. Four young plants thus obtained were planted against a wall for the purpose of being budded with the Moorpark; finding, however, that they exhibited unequivocal symptoms of a delicate constitution, I did not bud them, but trained their branches to the wall till they produced fruit. One of these trees is a genuine Moorpark, and already some of its principal branches have perished by that peculiar disease which detracts so much from the value of the otherwise excellent variety; thus proving that mis-alliance is not the cause of the disease in question. Of the other trees, one is a Breda, one an orange, and the third an inferior variety of Moorpark; this last also shows symptoms of the same malady. This experiment seems also to show that some varieties of Apricot can be reproduced from seed.

V.—On the Cultivation of Orchis longicornu. By William Barnes, Camden Nursery, Camberwell.

(Communicated November 18th, 1852.)

Among the many plants now cultivated for ornamenting the conservatory as well as for purposes of exhibition, none, perhaps, have excited more admiration when in bloom than this delightful species of Orchis. I have had collections of plants under my care for these twenty years past, which have been considered by competent judges to be second to none, as far as cultivation was concerned, but among all I have had to deal with, none have been so satisfactory as the plant now under consideration. I have grown it successfully for nineteen years, and I have always observed that however gay my show-house or conservatory may have been, with all the gems that usually occupy such structures, visitors have often passed the flattering compliment, "how beautiful your plants look, how brilliant and how grand," but as soon as they had seen the handsome Orchis longicornu, their exclamations have been, "O dear, what charming thing is this? what a most beautiful plant! this is certainly the finest in the collection;" and in comparison with it, all others previously admired have been thrown, as it were, into the shade.

In growing it, the grand secret is to pay it the greatest attention when in a dormant state; keep it then quite dry and cold; for it is one of the southern species and subjected to the hot rays of the sun at the time when it is in full growth, and it receives little or no moisture when at rest. My first bulb came from Algiers, and I treated it as follows:—I broke a quantity of light fibrous peat up roughly, adding half the quantity of well decomposed leaf-mould, and a fourth part of good sharp sand with a few clean and broken potsherds intermixed with it. Having my compost mixed in this manner, I then prepared some nice clean dry pots; the size entirely depends upon the taste of the cultivator; but what I have generally used are five-inch pots (or 48s) for single bulbs, or I put three bulbs into six-inch pots (or 32s), four bulbs into a seven-inch pot (or 24s), and five bulbs into an eight-inch pot (or 16s), always placing the largest bulb in the centre, in order that its strength might induce it to throw its spike of bloom above the others. Great care must be taken to drain the pots well by placing in the bottom about two inches in depth of broken potsherds and rough charcoal. Upon the top of that I place some of the most fibrous peat from the mixture, and then the soil, planting the bulb about an inch deep, and not pressing it down too hard, as it delights in a porous soil. When potted, I place them in a cold frame or pit, never allowing frost to touch them, I keep them quite dry until they begin to show symptoms of growth, when they receive a little water, and as vegetation advances, a more liberal supply is given. Abundance of air is admitted, but I never allow the lights to be off in rainy weather, as I have seen the plants severely injured by their hearts becoming filled with water. I always use the greatest caution, in watering, never to allow it, if possible, to touch their foliage.

The proper time for potting is in September, and Orchis longicornu blooms from November until May. There is no plant with which I am acquainted that remains in bloom the length of time which this does. I have had one pot in perfection six months. I find that, by having several bulbs, some can be started so as to come into bloom earlier than others, while the rest may be kept in a dormant condition for another month. By thus potting them in succession, blooming plants may be had for a very long time. I have grown them from fifteen to twenty inches in height, with flower-spikes from six to nine inches in length, the lip of the blossoms being striped with lilac, and the upper part jet black, like most beautiful silk velvet. The contrast thus produced in the flowers is so striking, and the beautiful black so uncommon, that they form objects of the greatest beauty, vastly superior to all their associates.

I find this plant very difficult to increase; the bulbs it forms are about the size of Radish seeds, and unless the soil is sifted through a very fine sieve they escape observation. As regards cultivation, however, follow the advice given above, and such success will follow, that you will have examples of this fine Orchis that will fully bear out the statement made by Dr. Lindley in a recent number of the *Gardener's Chronicle*, viz.: "that when grown as Mr. Barnes grows it, it is one of the most charming of greenhouse plants."

VI.—Effect of a Tropical Climate upon Plants of a Temperate Zone. By Sir R. H. Schomburgk.

(Communicated April 2nd, 1852)

Santo Domingo, the oldest city in the New World, cannot boast of extensive or finely laid-out gardens, but the admiration and love of the Spaniards for flowers seems innate, and few houses, as humble as they may be, are without some Rose-trees, Pinks, and Heliotropes in their patios.

The thin superstratum of soil in the city rests upon coralline limestone, which the freshets are very apt to carry away. The beds are therefore surrounded with masonry.

The favourite flowers of the Spanish ladies are Roses, of which the following kinds are principally cultivated:—Rosa damascena, var. bifera (le rosier de tous les mois); R. centifolia (of the latter the White variety is rare); R. multiflora, R. Banksiæ, R. indica. Recently three varieties of Tea-roses have been introduced, R. Devoniensis, General Lamarck, and magnolia. They succeed very well, and frequently bear flowers, especially the Devonshire Rose, which possesses an exquisite scent under the tropics.

The beauty of the large panicles of rose-coloured flowers of the Lagerstrœmia indica cannot be imagined by any person who has seen that handsome plant merely in our hothouses. Here it reaches the height of a moderate-sized tree. It is called by the Spaniards Almira. The other flowers mostly cultivated are: Garden Balsams (Impatiens Balsamina); Four o'clock flowers (Mirabilis Jalapa), of all possible colours; Indian Cress (Tropæolum majus); a large variety of the common Pink; Periwinkle (Vinca rosea and alba); Marigolds (Tagetes); Chinese Aster; Chrysanthemums; Centaureas; Zinnias; Tuberoses; Amaryllis formosissima, and a few other tropical bulbs, all of which, as far as enumerated, may be called acclimatised.

The acclimatisation of a plant under the tropics, either indigenous or already inured to a temperate zone, is as interesting as the acclimatisation of a tropical plant in a temperate zone. My observations and experiences in this respect may prove therefore acceptable, the more so since among the plants to which my attention was directed, were some that originally belong to a warm climate, but which had been raised in a hothouse.

When I left England in December, 1848, I received, through the kindness of the Director of the Royal Gardens at Kew, several plants which seemed qualified for the West Indies. Before I enumerate such as arrived in good order in Santo Domingo, I will observe that the Consulate lies a few hundred yards from the sea shore, and that the little spot which I have turned into a garden consists of coralline limestone, covered with about twelve inches of good soil; however, since the coral rock has numerous crevices or fissures, the roots may penetrate much deeper. The mean annual temperature is about 78° Fahr., and an 18-inch terrestrial thermometer (the only one which I brought safely to Santo Domingo out of four of different sizes) gives me as the mean temperature of the soil at that depth about 75° Fahr. The elements which I possess for a more exact calculation of the mean annual temperature of the air and the soil have not been calculated as yet in detail, but the above may be assumed as a close approximation.

A Wardian case was filled with so-called fashionable flowers. Among these were some Fuchsias, which arrived in a tolerably good state, but with the exception of one, they died before they came into flower. This refers likewise to the Pelargoniums.

Tom Thumb blossomed several times from young shoots, but, like the rest, it became ultimately yellow, and perished. Of Roses, the White and Red Chinese, R. Bouguera, Devoniensis, Provins Moss, Paul Joseph, and La Birch arrived in good order. Provins Moss produced some new shoots, but soon took a sickly appearance and died. I have never seen, during my wanderings among the West India Islands, a Moss-rose, and my numerous friends all concur that the endeavours to bring it into blossom, or to keep it for more than two or three years, have proved in vain.

The Red and White China, the latter for the first time introduced here, thrive lustily, and are never without flowers. In the commencement the White China was very delicate, but by transplanting it into a more sunny spot, it soon recovered, and seldom a morning passes now without my finding a bud opened. The flower possesses, when opening and before the sun has touched it, a slight agreeable scent. Paul Joseph perished without producing flowers; Bonguere likewise; and La Birch thrives so much in the wood, that it has no strength to produce flowers. The usual measures here resorted to to check the growth of a rose-plant and to make it bloom, as ringing, cutting down the shoots, depriving it of its leaves, &c., have not produced the desired result. As already observed, the climate agrees very well with Tea-roses; they produce a succession of flowers.

The above came here in Wardian cases; of others I brought safely to Santo Domingo, I may mention Ixora Bandhucca, which is constantly in flower, presenting a mass of handsome scarlet blossoms. My endeavours to propagate it by cuttings have hitherto failed. Ixora alba looked for two years sickly, the leaves yellow; it commences now to recover, but it has not flowered as yet, although it is a large-sized shrub. Gardenia Fortuni, after just vegetating for two years, is hastening to decay. Dillenia speciosa, from a small plant about 6 inches high in 1849, is now 10 feet, but it has not blossomed as yet. Ardisia Wallichii is just alive; it has regularly shed its leaves twice a year, and every time after that period it has looked sicklier than before, and the shoots became less in size. I have not much hope that I can preserve it. Cœlobogyne ilicifolia seemed to thrive very well for the first eighteen months; the leaves then became yellow, fell off, and the plant died since. Combretum comosum seems to recover, although for the past three years its life was doubtful; it has not blossomed as yet. Eranthemum coccineum has become a large plant, and is easily propagated; the scarlet flowers are pretty, but they stand wide asunder on the long spikes, which does not give to it a striking appearance. Noronhea chartacea survived only a few months after its arrival. Blaperopus nerifolius has flowered once; since that period it has declined, and it possesses at this time a single shoot. Kigelia pinnata has grown considerably, being now 5½ feet high, but it has not as yet been in blossom. The greatest success has been connected with Hibiscus rosa sinensis fl. pl., which is now a shrub 12 feet high, and presents the whole year through a mass of fine scarlet flowers, some 7 inches in diameter. It was new in Santo Domingo, and the flower is greatly admired. During holidays the altars of the churches are, according to Spanish fashion, ornamented with it; and as the original plant came from Kew, it has received here the name of La flor de la Reina Victoria. The cuttings "take" with great facility, and as I have been very liberal in distributing them, Queen Victoria's flower is now found in all the principal gardens in the Republic; it serves for ornamenting the altars for Divine Service, and the half-opened buds contribute to embellish, by their contrast with the shining black of the luxuriant hair of the fair Señoritas, the sylph-like figures at the festive dance.

Another great favourite with the ladies is the pretty yellow thyrse-flowered Galphimia, which I brought with me from Jamaica; it has received the name of Consulita from my having introduced it into Santo Domingo.

We are told that Baron de Wimpfens brought the first Narcissus, Hyacinths, Tulips, and Violets to Santo Domingo in 1789. If I except the latter, of which the Double Violet especially succeeds well, bulbous plants do not blossom here. I recently succeeded in raising the Reseda odorata, and bringing it into blossom; the first perhaps that ever flowered in Santo Domingo. A lady friend of mine tells me that all her endeavours to get it to flower in Porto Rico, Saint Thomas, and here, proved in vain. It grew up, she says, in long stalky plants, that dried up without coming into bloom. The scent of my Mignonette was as sweet, if not stronger than in England; it produced seed-vessels but no seeds. The Stock (Mathiola annua), that great favourite with us at home, thrives here, as far as leaves are concerned, taking the appearance of M. incana, without producing flowers. I have now some already fifteen months old, having therefore passed the annual period, or rather two tropical seasons. The Dahlia roots brought here from Europe do very well the first year; but in succeeding seasons the flowers become less and less in size, and in lieu of double flowers the plants ultimately produce single ones. The roots dwindle away, and at last dry up.

A Hollyhock and the common Sunflower (Helianthus annuus) may occasionally be met with; the latter principally in the Cibao district, which is about from 500 to 600 feet above the level of the sea. In the valley of Constanza, which is so high that frosts occasionally kill the tender vegetation, leaving only the leaves on the fir trees, Pinks and Sunflowers are as luxuriant as in England. I saw in Constanza a bed with White and Red Pinks, that had propagated themselves uncared for in such a manner that they covered a large terrain, yielding a mass of flowers that diffused a most delicious scent.

The existence of a six months' course of seasons in intertropical countries in lieu of twelve months, which period includes the sleep of winter of the temperate zone, urges the plants, indigenous or inured to the latter, to a constant exertion, which ultimately seems to exhaust their powers. Such a state of things would not, however, refer to the tropical plants of Asia and Africa in my collection; but it is not my intention to enter into any disquisition on the causes, but merely for the present to give the effects as they have come under my observation. The shedding of the leaves of some tropical trees, and the formation of new wood, may hereafter form the subject of another article.

VII.—Note on a New Sulphurator. By Robert Thompson.

The Vine mildew having become so universally prevalent, and sulphur proving the best remedy, various contrivances for distributing this substance have, in consequence, been brought forward. One of the most recent is called "Egginton's Sulphurator, of which the accompanying figure is a representation.

The instrument was made by Mr Edward Egginton, of Ludlow, under the direction of Mr. Corbett, gardener at Downton Castle. It consists of a copper cylindrical box, about 4½ inches diameter at the base, and 4 inches diameter at the top; the height being also 4 inches. A copper tube, A, $\frac{8}{10}$ of an inch diameter, enters the top, extends nearly to the bottom, and is then bent upwards to within an inch of the top. The bottom is flat,

VIII.—A Note upon some new Caffrarian Plants, and the Cape Gooseberry. By Thomas Moore, F.H.S., Curator of the Apothecaries' Garden, Chelsea.

I have the permission of the Rev. Thomas Rooper, of Wick Hill, Brighton, to transmit the accompanying extract from a letter received from him, on a subject which may be interesting to some of the Fellows of the Horticultural Society. The plants cultivated in Mr. Rooper's garden are, I understand, the produce of seeds transmitted from the Cape of Good Hope, by Captain E. Rooper, who has been successful in introducing some interesting novelties to the gardens of this country. Of one or two of these latter which have come under my notice, I have appended a brief account:—

*Tritonia Rooperii.**—This is an extremely handsome greenhouse or half-hardy herbaceous plant, in many respects resembling the old, but not common, *T. Burchellii*, from which it differs, however, in its dense spike of flowers, its conspicuous bracts, and its included stamens. Captain Rooper found it in Caffraria, growing in marshy places; and at Brighton, it has been found to be almost hardy, having survived the last winter with the slight protection afforded by a broken hand-light. It flowers in the winter and spring months. The dense heads of tubular flowers are yellow on the lower side, and of the richest orange-scarlet on the upper side, shining as if varnished. The plant has a fleshy rootstock, from which springs a crown of recurved carinate leaves, which are upwards of four feet long, two inches broad at the base, and tapering to a long point. The scape is a foot high, with a few large bracts below the spike, and terminating above the flowers in a crown of crowded smaller bracts, subtending abortive flowers. The flowers are densely arranged into a roundish ovate spike, and have very short stalks, at the base of each of which is an oblong-ovate obtuse scarious three-to-five-nerved bract, which gradually becomes smaller upwards; those of the crown being oblong-acute, or acuminate, one-to-three-nerved, and glandular serrate. The perianth is tubular, slightly curved, narrowed above the base, an inch and three-quarters long, with six greenish nerves;

* *Tritonia Rooperii;* leaves very long, recurved, carinate, taper-pointed, minutely cartilagineo-serrate above; spike roundish-ovate, flowers subsessile, densely crowded in the axils of oblong-obovate scarious bracts, which are obtuse, with 3—5 fuscous nerves, the upper ones acute or acuminate, 1—3-nerved, glandular-serrate, forming a coma above the developed flowers; stamens included.—T. M., in *Gard. Comp.*, i. 113 (with figure).

the segments of the limb are ovate-obtuse, erectish, the three inner slightly recurved, the three outer shorter, their apices incurved. The stamens are unequal and included. The figure referred to, having been drawn from a specimen which blossomed during winter and under cover, does not do justice to the colour which is acquired at a more favourable season.

Hypoxis Rooperii. *—Found by Captain Rooper, near the mouth of the Buffalo river in Caffraria, and introduced in October, 1848. It is a very brilliant plant; but as it produces no side-shoots, nor as yet has shown much disposition to ripen seeds, it is feared that it can never become so common as its merits deserve. It continues in blossom from March until August; and, during that period, under the influence of sunshine, is seen glittering with its golden stars. It has an erect short stout stem, from which the long narrow leaves grow in three ranks, about four in each rank being perfect at one time; they are from nine to eighteen inches long, an inch and a half broad, narrowed to the base where they embrace the stems, the apex being drawn out into a long taper point; on both sides are white stellate hairs, but those on the upper are few and scattered, whilst those below are more dense, and produce a hoary appearance. The scape is about a foot long, and bears four to six flowers, each having a subulate membranous-edged bract, shorter than its pedicel, which latter is about as long as the perianth. The exterior surface of the perianth, as well as the bracts and stalks, are shaggy, with long white hairs. The flowers are green externally, clear bright yellow inside, about an inch and a half in diameter when expanded; the three outer divisions ovate-lanceolate, entirely shaggy outside; the three inner, broader, more obtuse, and hairy only at the very base. This plant would seem to be allied to *H. stellipilis*, but appears to be distinct from it, and a much larger and more showy plant.

Among other plants introduced from the same source, are the *Ipomœa palmata*, and a fine rose-purple-flowered species, which Mr. Henfrey identifies as the *I. oblongata* of E. Meyer.

EXTRACT FROM MR. ROOFER'S LETTER.

"It is not, I believe, generally known, that the fruit of the Cape Gooseberry (*Physalis edulis*), a very old inhabitant of our

* *Hypoxis Rooperii;* pilose; leaves trifarious, elongate, recurved, acutely keeled, narrowed below, tapering into a long point, with scattered stellate hairs above, woolly beneath; scape 4—6-flowered, much shorter

greenhouses, makes an excellent open tart or preserve, but such I find to be the case. The following hints on its cultivation may be useful to those who may feel inclined to give it a trial.

"It may be raised from seeds very early in the year; but I find it far preferable to raise a supply of plants from cuttings in January, as these produce fruit which is much finer and ripens much earlier in the summer, than that borne on plants raised from seeds. The plants should be gradually hardened in March, and should be turned out subsequently, under a south wall, in a favourable soil and position. They will perfect their fruit by the end of July, and will go on bearing abundant crops until the end of October, particularly if the superfluous shoots and leaves are occasionally pruned away, in order to allow the rays of the sun to reach the fruit."

IX.—Pear Mildew. A Note by the Rev. M. J. Berkley.

(Communicated November 11th, 1852).

Many varieties of Pear are affected this autumn with a black mildew, which is extremely injurious to their beauty, and, consequently, to their market value. In the Garden of the Horticultural Society, the Glout Morceau and Easter Beurré are more especially affected, but the disease is not confined to these varieties; in my own district, I have noticed it more particularly on the St. Germain. The disease attacking the fruit is, in point of fact, the same which has of late been observed so frequently both in this country and on the Continent, on the leaves and young shoots of Pears, and of which some account was given in the *Gard. Chron.* of June 17, 1845, as also of a similar disease on the leaves of Cratægus Pyracantha, October 28, of the same year. The fungus, like many others, takes its origin beneath the real cuticle, through which it soon makes its way, and then appears perfectly superficial. In some cases, as in the leaves of the Common Service, and on Apple leaves, the mycelium exhibits a beautifully radiated spot, and, in consequence, it has been named by Persoon, *Actinonema.*

than the leaves, and as well as the bracts, pedicels, and exterior of perianth, shaggy with long hairs; pedicels as long as the perianth, exceeding the subulate membranous-edged bracts.—T. M., in *Gard. Comp.*, i. 65 (with figure).

The shape of the spores is, within certain limits, pretty constant, whether it grows on the Pear or Apple; while those of the plant on Pyracantha are of a totally different form, and smaller. As the patches, when they occur on fruit, especially on Apples, are more neatly defined than when they grow on leaves, and the remains of the white cuticle are very manifest surrounding the smutty spores, they have given rise to a distinct genus (*Spilocæa*), in accordance with that superabundance of useless divisions with which Mycology, more perhaps than any other branch of Botany, abounds. Such productions, though far from uncommon amongst Pears, are far more abundant on Apples, insomuch that the produce of whole orchards is frequently almost valueless. The disease sometimes commences in a very aggravated form when the fruit is no larger than a pea, rendering the whole crop abortive. Such was the case this year in one garden with a young and apparently healthy Downton Nonpareil. The Newtown Pippins, which are transmitted to the southern states, are often disfigured by it, and though, perhaps, those which are exported to this country are more carefully selected, they are by no means free. The species, however, by which they are affected is not always the same. At least, *Spilocæa fructigena,* Schwein, of which I have authentic specimens, is not the same species with that before me.

As regards any remedial measures, I have little or nothing to offer. Such affections are often dependent on causes over which we have no control whatever, and are part of the curse which aggravates all human labour. The best cultivation will sometimes fail where atmospheric agency is principally concerned, and in the present case, where everything has been done to secure a proper condition of soil and a due exposure of the leaves to light and air, immense injury has been produced year after year with every variety of season and treatment. A figure of the little parasite is subjoined.

X.—On the Genus Yucca. By William Wood, Fishergate Nurseries, York.

(Communicated November 20th, 1852.)

No tribe of plants perhaps has received less attention from *planters* than this, and yet it is an undeniable fact, that, whether considered in regard to its suitability for constituting a natural group, or as an individual feature in the mass, it is probably unequalled as far as effect is concerned, on account of its exotic aspect, and imposing appearance when in bloom. It is true that, like many other ornamental shrubs and trees, the species of Yucca generally require from one to three or more years to attain sufficient vigour of growth to be able to form their majestic flower-scapes, or stems, but the lover of Nature's grand and diversified forms receives ample compensation for this in their peculiar habit of growth, standing out, as it were, with Palm-like aspect from amongst surrounding objects. One of the principal reasons which have probably led to the depreciation and comparative neglect of Yuccas is, that, instead of being permitted to form a distinct and separate feature in the arrangement of a garden, they have too often been either crowded amongst other shrubs of a miscellaneous character, or they have been placed in such isolated or obtrusive positions, as to form no essential or desirable relative feature in the general outline.

To convey an accurate idea of the effect which plants of this genus are capable of producing, it may not be improper to remind those who are about to plant, that Yuccas differ from other shrubs in their having remarkably large, terminal, radiating crowns of broad, dark, or glaucous-green, sword-shaped, needle-pointed leaves from one and a half to three feet in length. In the largest kinds these crowns proceed from a common centre situated on the extremity of an unbranched column-like stem, varying in their maturer state of growth from a few inches to three or four feet in height, and each respective crown measures, according to the species, from five to ten or twelve feet in circumference. The outline of the crowns also differs; in Y. gloriosa, the leaves are erect, with a broad, obtusely plaited or grooved surface ; in Y. recurvifolia, they are at first erect, but ultimately obtain a decurved position; whilst in Y. draconis the leaves assume a gracefully curved form. The stately flower-stems issue from the centre of each crown of leaves. In the large-growing kinds they reach an elevation of from six to eight feet, and progressively form densely-flowered pyramidally-ovate racemes containing from 500 to 1000 large conspicuous, creamy-white, pendent perianths or flower-cups, variously shaded with purple or brown.

Yuccas appear to great advantage, when planted in a large detached group, at a due distance from the approach or entrance to a flower-garden, but they should be so situated as to form a permanent feature from the mansion. They are also well fitted for bold and picturesque effect on large masses of natural or artificial rock-work, crowning its summits or irregular slopes with an Aloe-like appearance, and during the summer-months relieving the heavy and massive outline with towering pyramids of bloom. The strongest growing species are equally well adapted for imparting a novel and exotic character to a large richly furnished park or arboretum, as the smaller kinds are to blend their distinct features with the ordinary occupants in the prescribed limits of a villa flower-garden. The whole of the species thrive satisfactorily wherever a firm loamy soil is found in connexion with a tolerably dry substratum. If planted upon a mound, or on rock-work, a strong retentive soil is absolutely necessary.

The most ornamental kind for a small garden is Yucca glaucescens, which may be regarded as an evergreen Autumn-flowering perennial, with numerous stemless crowns of flaccid, decurved, lanceolate, shreddy-margined leaves, from twelve to twenty-four inches in height. Its flower-scapes are formed in July, and matured during the two following months, ultimately attaining a height of from two to four feet. When fully developed they assume the appearance of large open pyramidal racemes of creamy-white, drooping, tulip-like blossoms, each raceme containing from twenty to forty or more individual blooms. At the period just referred to, this species forms a highly interesting feature, more especially when viewed from a distance during the deepening twilight of a summer's eve. It is also admirably adapted for smaller groups, and for picturesque effect in the foreground of shrubberies—multiplying itself by numerous crowns, which readily admit of separation, and attain a sufficient vigour to produce flower-stems in a much shorter time than any other known species.

The following kinds are enumerated with a view to show their adaptation for planting in a large detached group or bed, commencing with the largest (first-named) five species, which are supposed to occupy the centre, the others gradually becoming dwarfer as the margin is approached, viz.:—

Yucca recurvifolia.	Yucca rufo-cincta.
„ gloriosa.	„ filamentosa.
„ superba.	„ „ variegata.
„ draconis.	„ glaucescens.
„ conspicua.	

XI.—On Holly-leaf Tea. By Alex. Forsyth, C.M.H.S., St. Mary's Church, Torquay.

(Communicated December 2nd, 1852.)

In all civilised countries, and particularly in warm climates, a beverage similar to tea must be had, for, although the savage can exist upon dry roots, bark of trees, and things of that description, it has been generally remarked that nations highly civilised use a great deal of liquid along with their food. In warm climates intoxicating drinks would brutalise society, for nature craves compensation for her loss by heat, and strong drink in proportion to that would be unreasonable. I am assured by my schoolfellows now residing in India, that though they abstain from wine and spirits, they could not live without tea or coffee.

Among the commodities exported from Paraguay, conspicuous is the celebrated Paraguay Tea, to which I now beg to direct attention; and lest any one should imagine that this Paraguay Tea-plant is either a novelty or a thing of little note, I must state that in La Plata, Peru, Chili, and Quito, as well as in Paraguay, it has been the staple tea-tree for half a century at least, and rich and poor indulge in this beverage at every meal; and when we look at the vast extent of this territory, which is larger than the whole of Europe, and see its natural advantages of soil and climate producing the finest fruits and grain in the greatest abundance, the wines of France or Portugal, or the ale of England, could easily be had if either of them had been preferred. Only imagine a river so wide that sailing in the centre you could not see the land on either side—such is the Rio de la Plata, which overflows like the Nile, and enriches the land for grain crops, as well as tills it without labour. Here then we have the Jesuits, a society of the most learned men, inhabiting one of the finest countries in the world, and with such a river, a regular "high way of nations" for traffic, choosing a serrated-leaved Ilex to make tea from, for the Paraguay Tea-tree is the Ilex Paraguariensis, the manufacture of which into the beverage in question is extremely simple, and the produce is so good that the Creoles are said to be addicted to it even to excess. It is said to be stimulating to the slothful, and to encourage sleep in those that are restless, and is extolled for many virtues which, no doubt, it never possessed; yet all agree that it is perfectly harmless, being diuretic and aperient. The "*black* drink" of the American Indians is reported to be manufactured from the leaves of Ilex Dahoon, Ilex vomitoria, and Ilex Cassine,

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From the foregoing remarks it will be seen that I had good reasons for suspecting that Ilex aquifolium possessed drinkable qualities, and in order to confirm them, I closely examined Ilex Dahoon, comparing it with various varieties of Ilex aquifolium, and in taste, texture, and appearance they were very much alike. I then manufactured some of the leaves of the common Holly, after the Paraguay fashion, and found that well-roasted Holly leaves are quite as good as five-shilling tea. Paraguay tea is almost charred and then pounded to a coarse powder, and the prickles upon our Holly leaves look as if they had been made on purpose to prop the leaf in roasting, for the hot air gets through the mass of leaves without sweating them or requiring them to be turned or tossed as Chinese teas are The smell is very disagreeable during the process of roasting, but not so when the leaves are dried enough for use, and such is precisely the case with Coffee, whose fumes, when roasting, are anything but pleasant. Paraguay tea is drank with a little lime-juice and sugar, and sucked from the tea-pot (Mate) through a wooden tube (Bambilla); but I used milk and sugar, after the English fashion, and drank it out of a tea-cup, and children, who may surely be considered unbiassed judges, drank it freely.

Failures in the manufacture of Holly-tea must not be taken as conclusive evidence of its worthlessness any more than the want of information upon any other branch of industry, leading to unsatisfactory results, would condemn it; rather let them lead to perseverance in improving, for if the manipulation of tea had been an easy matter, Mr. Fortune's journey to China and his procuring, at great cost and hazard, Chinese manufacturers for our tea plantations in India would have been labour in vain. I beg it to be distinctly understood, that this is no nostrum of mine like "roasted corn," or any other quackery. All the Hollies that will bear the open air in England are here, and I have therefore the best means of comparing their characters. I have shown of what importance Holly-leaves are to millions inhabiting a finer country than ours, and I do believe that the essence of our English Holly-leaf is not inferior to theirs, and if it is in reality as good as Ilex Paraguariensis, its importance to that portion of Europe, where it is indigenous, will be immense. I cannot imagine the Jesuits preferring this beverage and manufacturing the article so extensively in such a country, if it were not a good thing, for, among all the faults laid at their doors, we do not hear that they have been charged, as a body, with dullness as regarded their neighbour's best interests or their own.

What will tea-drinkers, confirmed tippling tea-drinkers, say to this? The very tea itself becomes cheap at last, and abundant, even growing in the garden hedge. A forest of tea-trees in full leaf at our doors! Such a harvest has never before been seen; waste not the Holly any more upon whip-handles, peel it not for Birdlime as formerly, squander it not even at Christmas, but reap it, roast it, and drink it again and again, for the store will be annually renewed and the future foliage will furnish finer tea leaves than those just gathered.

XII.—On the Cultivation of Exotic Fruits. By P. Wallace, Chiswick House.

(Communicated December 4th, 1852.)

When we consider the success which attended the covering in of the large space of ground occupied by the Exhibition building of 1851, there can be little doubt that a new era has commenced in the construction of large glass houses for horticultural purposes, and that in future the erection of such buildings will become a matter of no great difficulty—and, comparatively speaking, of little expense. Such being the case I would therefore direct the attention of gardeners and their employers to a more extensive cultivation of exotic fruits. Although great advances have already been made in this department of gardening, yet, looking at the variety of exotic fruits that have come under my notice both at home and abroad, I feel persuaded that their culture can be carried much farther than it ever yet has been, and at the same time be conducted at much less expense, adding to the dessert a variety of handsome and delicious fruits, which are now only known by reputation, or procured with difficulty from foreign countries.

The fruits I would more especially treat of in this paper are such as can be cultivated in a temperate house or conservatory. A proper and good style of building might be that represented by the flat ridge and furrow-roofed Lily-house at Chatsworth (the house "that gave birth to the Crystal Palace") and a very similar model Greenhouse, erected by Messrs. Hartley in the Society's Garden at Chiswick. In extent it might be from a Crystal Palace down to a nice snug conservatory, according to the desire and wants of the establishment, bearing in mind that all the light and air that can be obtained will be requisite for the production and proper ripening of such fruits as the China, Lisbon, Maltese, and Tangerine Oranges, Sweet Limes, and Lemons, the Loquat, Guavas, the Longan,* the Alligator Pear, the Custard Apple, Pomegranates, and many others of less importance, yet creating interest in a collection of this kind. The different kinds of Granadillas might be trained up the columns and supports of the building, provided they did not interfere with the amount of light required or otherwise incommode more valuable plants.

I have seen all the above-named trees bearing and perfecting their fruit in the temperate Island of St. Michael, whose only advantage in point of climate over that of our own is its mild winter. From this I conclude they might all be grown with the

* The Longan has flowered in a house without artificial heat.

greatest success in a temperate house in England, the house being supplied with sufficient heating apparatus to exclude the chill of winter.

I might here state, by way of inducement to cultivate the more useful Orange-trees, especially the Tangerine, in England, that the trees in the countries from whence we derive our principal supplies are infested by a kind of Coccus, which is annually destroying acres of Orange-gardens and rendering the fruit of others worthless. We have heard of the sad effects of the Vine-blight in France, Spain, Portugal, and the Island of Madeira. The Coccus might as easily extend to the other countries from which the rest of our Oranges come, and thus cause a scarcity of this deservedly much esteemed fruit. Even at the present time I believe that, owing to the small quantity sent to this country, the Tangerine Orange could be produced at a less cost than that for which they can be bought in our markets. I would recommend those who may be desirous of cultivating the fruits I have enumerated to have borders formed for their reception, as the success likely to attend their culture will be greater if planted in the open soil than it would be in tubs or boxes. By tasteful arrangement, too, a house of exotic fruits could be made at once useful and highly enjoyable. The borders must not be too deep; from two to three feet will be ample, and good drainage will be requisite.

A suitable soil for forming borders would be two-thirds strong turfy loam and one-third old and well decayed manure, liberally mixed with a quantity of brickbats and broken sandstone, which would permit superabundant water to pass off and maintain a healthy medium for the roots. It has been customary for Orange-growers to use strong and powerful manures, as garbage and other decayed animal substances. The late Mr. Ayres, a most successful cultivator of Citronworts, employed such stimulants at Shipley Hall in Derbyshire, but then his trees were in tubs, and consequently such applications were necessary. Growing in the natural way, however, in borders, the use of garbage, &c. is not required, and the frequent and troublesome business of re-tubbing is thus done away with. It has also been a long-acknowledged axiom that Orangeries, to grow fine trees, must be heavy, shady, and sombre-looking buildings, inside and out. In the present advanced state of gardening, however, but few illustrations will be required I imagine to subvert this notion. Look, for instance, at the sunny climes and cloudless skies in countries where Orange-trees succeed best. I was in Lisbon a fortnight in May, 1849, and I never once during my stay saw a cloud on the face of the sun. I was informed that the whole summer usually passed away in the same manner, and that the winter there was equally remarkable for its clear and cloudless sky. When Orange-trees were first introduced to the Island of St. Michael it was found absolutely necessary to plant quicker-growing trees around them to shelter them from the rude winds of the Atlantic. To such an extent was this planting of shelter carried and persevered in, that that which was meant for and really would have been a benefit, became an evil. The Orange-trees in the over-sheltered gardens grew fast and luxuriantly, but the produce was inferior in quality and quantity to that of gardens on the sides of mountains, where it was found impossible to exclude sunlight and air. It was in over-sheltered gardens where the hordes of Coccus first found a stronghold, and commenced their attack on the wealth of the Azores; and such was the natural indolence of the proprietors, that they calmly watched the onward progress of the enemy destroying their property, without even making an effort to stop its career. It was with difficulty that English gardeners persuaded them of the cause of the evil by pointing out Orange-trees free from the pest in more exposed situations. So many dear associations were connected with shelters that it almost amounted to sacrilege to cut them down. At length, however, one by one they gave way; an onslaught was made on those least required, and the advantage derived was soon perceptible. In the gardens infested by these destructive insects, their progress was checked, and the fruit of others was so much improved by the free admission of light and air that their value was materially increased. Facts like these, therefore, will surely go far to convince reasonable people that all the light and air that can be had is required to produce Oranges in perfection under artificial treatment in this country.

The operation of planting will require a good deal of attention, as Orange-trees, when deeply planted, are subject to a kind of canker, which originates at the base of the stem, and, though it works its way slowly, eventually destroys the plants. In order to avoid this evil it will be well to raise the soil where the trees are to be planted a little higher than the general level of the border, and this will afterwards admit of top-dressings to renovate the soil when exhausted, without there being any danger of too deeply burying the stems. Another important point will be to select strong, healthy, and well-established plants, particularly of the more tender kinds, for on the choosing strong plants success in a great measure depends. I have seen the bad effects of planting small and weakly trees in large houses. Time after time they have died, and hopes of the desired plant ever doing well despaired of, till at length some well-established specimen having been procured, the object aimed at was attained.

In order to encourage the growth of a house of young trees, so as to have luxuriant and fine-looking specimens, the temperature may be extended a little beyond what will be required when the plants come into a bearing state; yet any additional fire-heat beyond 64° must be applied with a sparing hand, as anything approaching forcing will be injurious.

In a house of this kind the temperature should never be below 50°, and, when rising in winter above 64°, if the external atmosphere be not too cold, admit air. With abundance of ventilation the summer temperature may range from 70° to 90°. Orange-trees, I infer (from their prolificacy and fine growth in the over-drained Island of St. Michael, where, sometimes in summer, rain does not fall for two and three months at a time), are not plants that require much water, especially at the roots; but it must be remembered that from the nightly heavy dews, and surrounding damp atmosphere, the trees are continually receiving an abundant quantity of moisture through the medium of their leaves. This then points out an important feature in the cultivation of exotic fruits. Heavy rains fall in St. Michael's from October to March, but the ground is so full of cracks and crevices that in a short time the water is drained off again, so that the roots may be said to be always in a moderately dry state. It must not, however, be inferred from the above statements, that I would have the exotic house without water; on the contrary, a plentiful supply must be had, and copious showers given to the plants with the engine, or, what would be better still, have the water laid on the house, with taps and hose at short distances, which would be a great saving of time and labour. From May to September the trees should be engined early in the morning, and in the evening; avoiding throwing water on the plants in bloom; also admitting near such plants as much air as possible.

The borders must not be often watered; the best way will be to examine them by digging in different parts, and when they are found to want water, let it be well but gradually given, so that every part may receive nearly an equal quantity.

I need scarcely say that all kinds of fruit-trees require to be carefully pruned. In pruning Orange-trees thin out all superfluous branches so as to admit light and air to the fruit. All the pruning they require should be effected immediately the fruit is gathered (which should be as soon as it is ripe, for the fruit

I have ever eaten were gathered from trees on the side of a hill, where the ground consisted of, at least, two-thirds stones. It would be an admirable plant to introduce into small tropical islands, as it resists the effects of the salt on the very edge of the sea.

The best Guavas for dessert are Psidium Cattleyanum, polycarpum, and pyriferum; the two first are the best flavoured, having a taste somewhat between that of a Strawberry and a Peach. A white variety of Psidium Cattleyanum, much superior to the dark one, was cultivated in St. Michael's.

Psidium pyriferum is a fine-looking yellowish fruit, about the size of an egg. When cut open the inside presents a rich rose-colour, and is most tempting in appearance; its taste is inferior to that of the others, yet it is a desirable fruit. The time of ripening is late in the autumn, but as the fruit seldom all ripens at once, a supply may be kept up by few plants all through the winter. They are all prolific bearers.

The Custard Apple is a dark-looking fruit; when full-sized it is larger than a Kentish Codlin, with something of the shape of that apple; it is full of pulp of a sweet aromatic flavour, and is very much esteemed by some. It ripens in March. The name of Custard Apple is well bestowed, as it conveys an excellent idea of the nature of the fruit.

Pomegranates are not unhandsome fruit; the pulp on the seeds is a very agreeable acid, and in warm weather would be an acquisition to the dessert table.

As the Longan and Alligator Pear had not produced fruit, I cannot speak of their virtues, but it is well known that they are both fine things.

Granadillas were eaten with avidity by the Portuguese and English residents in St. Michael's, but like all new things they require the palate to become accustomed to them before they can be liked.

XIII.—On Ipomopsis elegans By John Saul; Washington, United States.

(Communicated December 4th, 1852.)

Many elaborate articles have been written on the cultivation of this plant in England, yet it is seldom that it is seen really well grown there, although I think all will admit that it is a charming plant when well cultivated. Before glancing at its treatment in England, however, let me notice how it is managed in this country and with what success. The first example of it here came under my observation in the summer of 1851, in a nursery where it was positively almost a weed, having ripened seeds in great plenty, shed them and sprung up in every direction, survived a cold winter, and bloomed magnificently. Subsequent acquaintance with the gardens of this country has proved to me that it is one of the commonest plants, and of the easiest culture. In our warm summers it ripens seed in abundance. In 1851 in a garden in this city some plants produced as usual great quantities of seed; a large portion was shed, and soon came up in the borders, on rockwork, and even on the walks. Such plants as were allowed to remain withstood a long and severe winter, the temperature being occasionally 6° below zero, yet not a plant was killed or even injured: this past summer (1852) they bloomed finely. It is impossible for a person who has only seen the miserable examples of this plant usually grown in England to form any idea of the brilliancy of colouring which the blooms acquire here, or the profusion in which they are produced. If the flower-spike is removed when its beauty begins, so as to prevent seeding, it will throw out laterals which will continue in bloom during the whole summer. It must be recollected too that all this is going on under a bright sun and burning heat,—a sun and heat under which the greater portion of the fine Californian Annuals refuse to grow. Here the Lantanas, Asclepias, Hibiscuses, &c. of English stoves, are the fittest summer occupants of borders, in which they grow luxuriantly and flower as freely as Verbenas do in English gardens.

Reasoning from the above, were I now cultivating this plant in England, I would proceed somewhat as follows:—I would sow the seed out of doors about August on rockwork or a dry border; when the young plants appeared, if too thick, I should thin them and keep them from weeds, which would be all they would require until the following spring. If they were on a dry bottom, where they should be, nothing need be apprehended from cold; should they stand too thickly a portion might be transplanted in April, when they will take to their new quarters as freely as Cabbages, although I know the general opinion to be that they cannot be successfully transplanted. When sown the site should be very dry, very warm, and should receive all the sun possible; the same should be observed in transplanting. If these directions are adhered to, there need be little fear of failure; although the plants may not bloom in that profusion or with such brilliancy as in the warm climate of the United States, yet I have not a doubt that the cultivator will be well repaid for his trouble.

NEW PLANTS, ETC., FROM THE SOCIETY'S GARDEN.

1. Billbergia bifrons.*

Received from M. de Jonghe, of Brussels; understood to be a Brazilian plant.

This plant has the foliage of a Pitcairnia more than a Billbergia. The leaves are long, narrow, fine-pointed, channelled, recurved, quite spineless, and deep clear green on the upper side, although white with meal on the under. The flowers are in oblong heads; in one plant brilliant fiery red and very handsome, in another dirty greenish yellow. There does not, however, appear to be any other difference of moment. In the crimson state the spike is longer, the scape scarcely leafy at the base, and the spathes below the flowers large and blunt; in the white state, the base of the scape bears a few leaves, the spike is not more than half the length, and the spathes are rather more acute. The two seem, however, to be mere varieties of one and the same species.

A dry stove plant, requiring the same treatment and soil as Tillandsias, or others of the Bromeliaceous Order, with plenty of moisture during the growing season. It is increased by offsets. The two varieties are handsome, and if potted together, so as to force the spikes to intermingle, should produce a very gay effect. The flowers will keep six weeks in a sitting-room without wholly losing their beauty.

2. Odontoglossum Insleayi, var. B. macranthum. *Lindley, Folia Orchidacea*, p. 4, No. 8.

This very fine variety of O. Insleayi has flowered in several gardens in England. Although less rich in colour than the original, the size is most remarkable. A specimen from Sir

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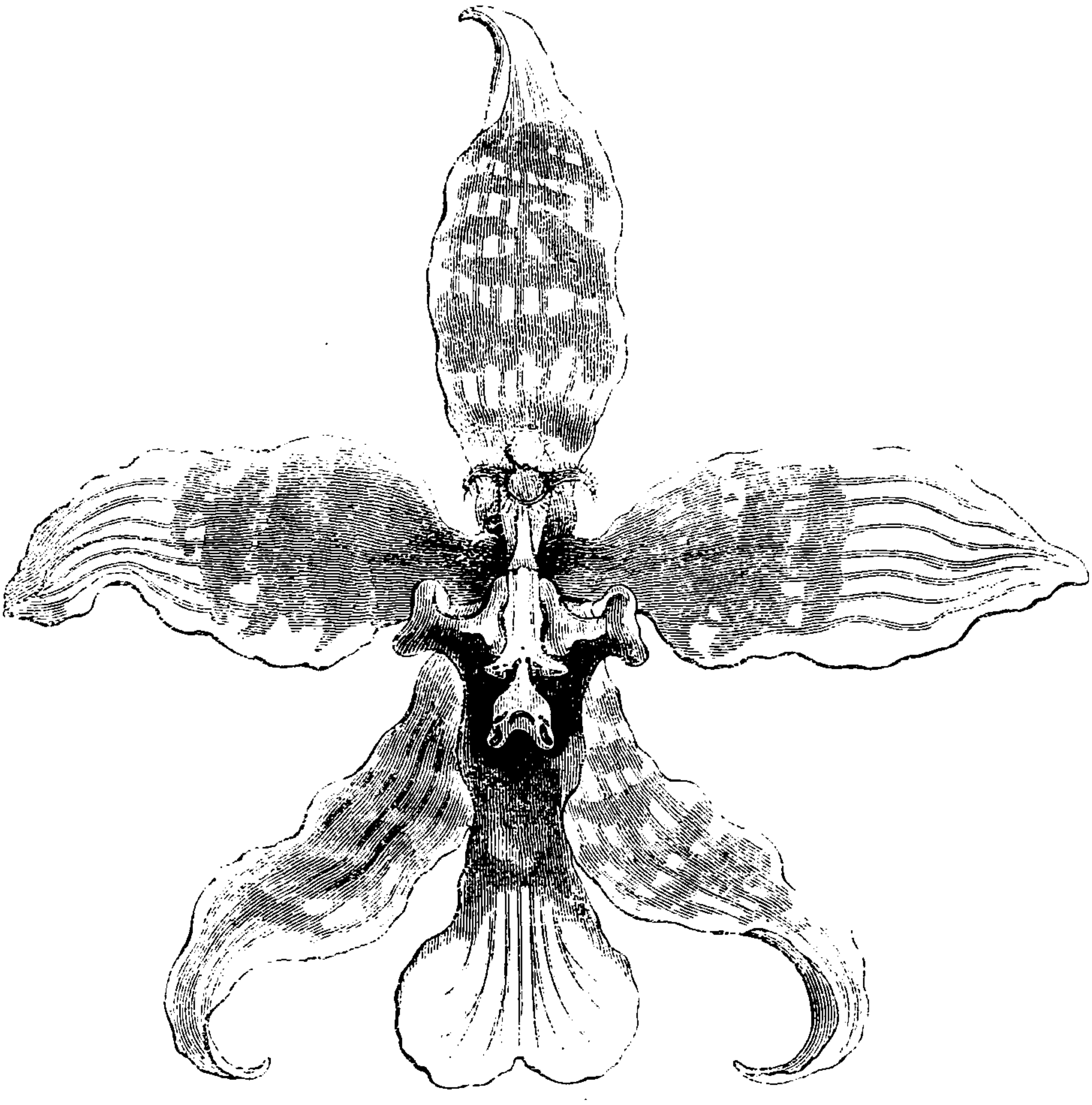
* *B. bifrons;* foliis integerrimis canaliculatis setaceo-acuminatis suprà glabris subtùs albotomentosis, scapo tomentoso nudo vel basi folioso, spathis ante flores concavis acutiusculis, spicâ oblongâ, ovario calycique lævi, squamis faucialibus ovatis obtusis indivisis.

Var. *a.* spicâ oblongâ, floribus flammeis, scapo basi nudo.

Var. *b. albiflora,* spicâ breviore, floribus albidis, scapo basi folioso.—J.L.

Philip Egerton was $2\frac{1}{2}$ inches from tip to tip of the sepals, and another produced with Mrs. Lawrence, and now figured, was even larger. The ground colour is the pale peculiar yellow of O. grande, clouded, especially on the sepals, with broken bands of dull brownish purple. The lip is darker at the base, lighter at the end, with a bright yellow crest, and deep purple wings to the column.



Odontoglossum Insleayi.

The plant is sometimes called O. Lawrenceanum, but it is certainly nothing more than a variety of Insleayi.

3. Malva umbellata. *Cavan. ic.*, t. 95. *De Cand. Prodr.*, I. 435.

Received from the Rev. F. Beadon, F.H.S., August, 1852.

A very handsome soft shrub, covered with dense starry deciduous woolliness. Leaves roundish, cordate, angular, or 3—5-lobed, slightly toothed, sometimes as large as the hand, with tapering stalks about three inches long. The flowers, which are extremely handsome, with five large crimson inversely heart-shaped petals, appear in 3—4-flowered umbels in the axils of the leaves, on peduncles as long as the leaves themselves. They each have three very deciduous bracts, which leave behind an indistinct scar when they fall off; the calyx is hemispherical, with five equal triangular lobes. The ovary is a roundish hairy body, containing about forty cells, in each of which are four ovules placed one over the other.

It is stated that the native country of this plant is New Spain, where it grows on the eastern slopes of the mountains. It was cultivated thirty years ago, at Boyton, by the late Mr. Lambert, but had been supposed to be lost till it reappeared in the garden of the Rev. F. Beadon, at North Stonham.

Although rather coarse-looking, it is useful in the conservatory in winter, and makes a good temporary addition to shrubberies in summer.

4. Sonerila orbiculata.*

Received from, and communicated by Dr. Royle, May 15, 1852, from the Nilgherry Mountains of India.

Stems branched, a foot high, brittle, purplish towards the upper end, clothed with weak scattered hairs. Leaves nearly round, slightly pointed, flat, as long as their footstalks, with fine hair-pointed serratures, seven-ribbed when perfect, but with not more than three ribs on the uppermost pair. Peduncle about three inches long, more than twice as long as the uppermost internodes, quite erect, terminated by a simple cyme consisting of one central flower and a pair of four-flowered arms, Calyx-tube oblong, slightly prismatical, closely covered with stiff white hairs. Petals oval, apiculate, bright rose-colour.

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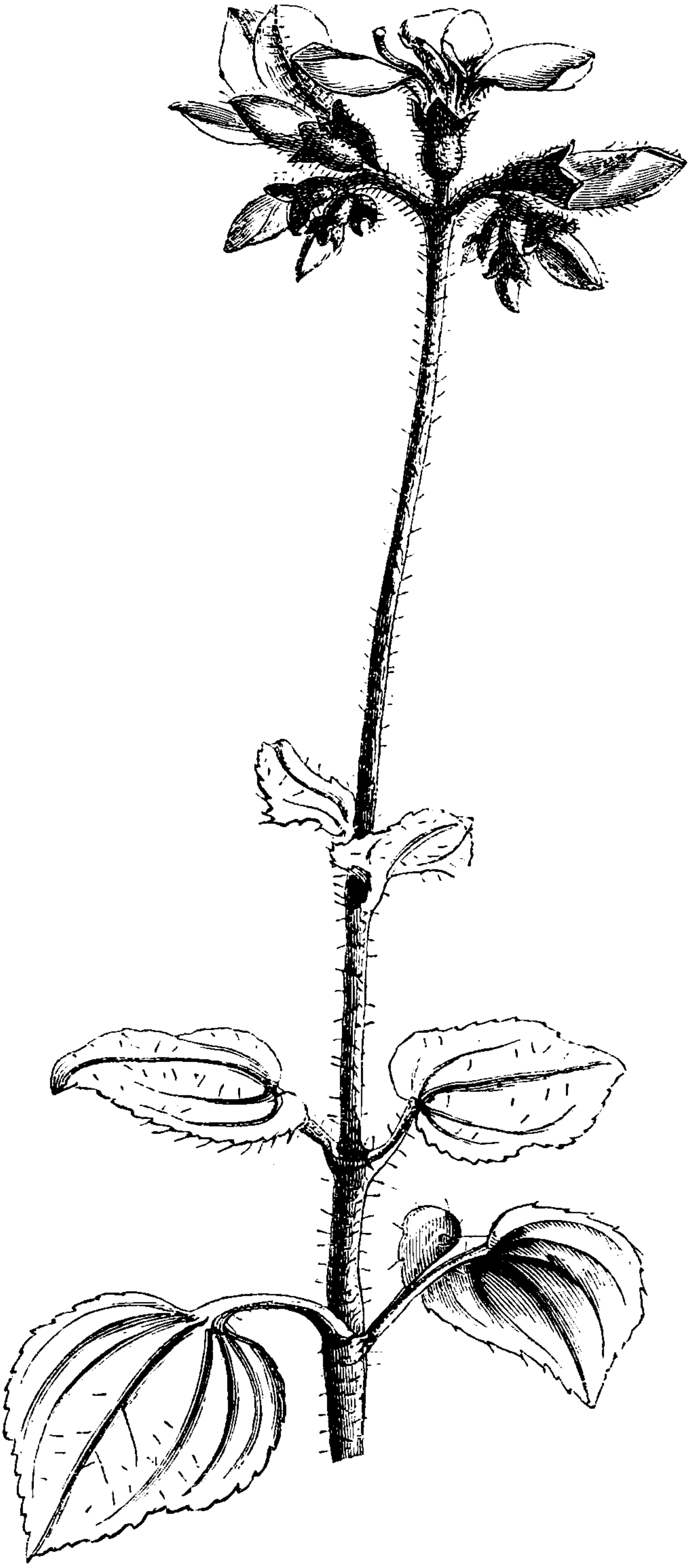
* *S. orbiculata;* carnosa, caulescens, sparsè pilosa, foliis orbiculatis acutis petiolatis argutè serratis 5—7-nerviis, cymâ longè-pedunculatâ 9-florâ, calycis tubo oblongo-prismatico hispido.—J. L.



Sonerila orbiculata.

This very distinct species differs from those previously described in the remarkably circular form of its leaves. From S. Brunonis, to which it comes nearest, it is also distinguished by its flower-stalk being much lengthened out, the calyx shaggy, not smooth, and the flowers rose-coloured, not blue.

It is a small fleshy-rooted perennial, requiring to be treated like Achimenes and similar fleshy-rooted plants—that is to say, to be grown in a mixture of sandy loam, peat, and leaf-mould, in the stove. It is increased by cuttings or pieces of the roots, placed in sand in the usual way. When the plants have done flowering, they should be kept rather dry and rested.

The species forms a very handsome and neat little bush, flowering freely in the stove in November and December.

5. Hibiscus syriacus, *L* var. chinensis.

Raised from seeds, presented to the Society by John Reeves, Esq. F.H.S., in June, 1844, under the name of Koorkun Vellory.

I think there can be no doubt that this, although certainly Chinese, is a mere variety, and not a well marked one, of Hibiscus syriacus. It has large violet flowers, with a crimson eye, and its leaves are larger, thinner, and more smooth than in the shrub out of doors, owing, perhaps, to having been grown in a stove. But the last circumstance is evidently unimportant, for in Mr. Fortune's wild specimens now before us, the leaf-stalks are perfectly shaggy. This traveller found it forming a shrub eight to twelve feet high, with light " blue " flowers, in the hedges and on hill-sides on Poo-too-san, and other islands.

When growing in a stove, with the same kind of treatment as is required by the well-known Hibiscus rosa-sinensis—that is to say, if placed in a mixture of sandy loam, peat, and leaf-mould, it forms a very handsome shrub, flowering in July and August.

6. Colletia serratifolia. *Ventenat choix des plantes*, t. 15. *De Cand. Prodr.* ii. 28.

Received from Dr. Fischer, of St. Petersburgh, on the 27th of August, 1842, under the name of Discaria crenata.

A Peruvian and Chilian shrub, branches bright green, like those of a Broom; leaves opposite, shining, bright green, crenated, obtuse, furnished at the base with a pair of erect brown stipules, which remain upon the stem after the leaves themselves have

fallen. Flowers greenish white, axillary, clustered, with their stalks not longer than those of the leaves, extremely fragrant. When the plant is old and stunted, its branches become spiny; when vigorous, no spines are formed.

In the garden it forms a moderate-sized deciduous shrub, and is nearly hardy, living well out of doors when trained against a south wall. It increases by seeds and cutting, but unwillingly. The flowers appear in May and June in great abundance, and being remarkably sweet-scented, give the plant much value either for growing in pots, or for planting against a conservative wall.

7. Philodendron auritum.*

Found growing out of a mass of roots of Orchids; received from Mr. Skinner in 1851.

A noble-looking climbing plant, with deep green taper stems, emitting great white roots, by which it clings to trees. The leaves are a rich deep green, with a tapering stalk more than two feet long; the blade is deeply divided into three oblong, wavy, acuminate, diverging-veined lobes, of which the middle is a foot, and each of the side lobes nine inches long, placed at right angles to the first, so as to form a hastate figure. The spathe is green, about six inches long, crimson within, but only opening for a short time while the anthers are shedding their pollen.

Although of a quite different genus, this is very similar in foliage to the figure of Syngonium auritum in the *Flora Fluminensis*, vol. ix. t. 113.

It is a *climbing* stove plant, of robust habit, growing vigorously in a damp atmosphere, with its roots freely exposed, and flowers in December. It is a noble ornament in places where there is room to grow, and where a grandeur of effect is alone required.

* *P. auritum;* foliis hastatis 3-partitis sub-cordatis lucidis sinu aperto, lobis oblongis acuminatis undulatis divergenti-venosis, stylo carnoso, stigmate membranaceo radiato, loculis 1-ovulatis (?).—J. L.

ORIGINAL COMMUNICATIONS.

XIV.—On the Periodic Phenomena of Vegetable Life at Different Altitudes in the Alps. Translated from the German of Adolphe Schlagintweit.*

1. *Mode of Observation.*—An enquiry into the periodic phenomena of vegetable life is the more interesting in the Alps from the great differences observable within very short distances. A careful observation of these phenomena often points out changes in climate, which it would be difficult to ascertain by meteorological observations alone. Thus, for instance, the several causes which occasion a variation in the limits of vegetation in respect of altitude become much more apparent. It not unfrequently happens, that it is only in certain seasons that a combination of circumstances occurs unfavourable to the growth of a given plant; the disturbances thus produced in the periods of development of such a plant will call our attention to the causes of its lower limit in altitude.

The great disturbances which the diversity of seasons in different years occasions in the development of vegetation make it often difficult to obtain positive results, easily comparable with each other. In many special cases, on points either very low or on the summits of the Alps, I have been able to make use of observations already published and extending over a long term of years; I have also procured detailed notes on many points for the years 1848 and 1849. They are in general taken at the same places for which I have already communicated meteorological observations for the same years.

It was a great object to me to extend these stations to the limits of growth of Cerealia. Yet it is difficult to obtain authentic observations of this nature for any lengthened period of time, or for any considerable number of points in the Alps, because they depend entirely on the individual care and attention bestowed by the observer.

* This constitutes the 19th chapter of the *Researches on the Physical Geography of the Alps,* by Hermann and Adolphe Schlagintweit, Leipzig, 1850.

In order to compare these phenomena on as large a number of stations as possible, I have endeavoured to procure mean terms, for the commencement of the most important periods of vegetation, by an attentive study of data furnished by the country people, and of notes consigned in old almanacs by attentive cultivators, often extending over periods of from six to sixteen years, and by my own observations in the different places where I have resided in different years. I have only admitted with great caution information communicated verbally; I have generally addressed the same questions to different persons, and I have thus been able the better to test the veracity of verbal communications, which, however, have generally agreed tolerably well with each other. This was a natural consequence of the attention bestowed on the observation of these phenomena.

My own observations comprise only some portions of the year; for great altitudes, where vegetation only commences in June or July, the memoranda taken in summer and autumn are sufficient, and when at other times I was in inhabited valleys, they served me as a check upon the memoranda I had collected. But the number of plants I could admit in my tables was necessarily very limited. In many places, among large leaf-bearing trees, there were only Cherries and Ashes. The species of small plants vary so much with the altitudes, that often the whole of those employed for this purpose and enumerated in the copious catalogues of Quételet were wanting. I could, however, follow the Beech, the Strawberry, the Walnut, the Cherry, the Elder, the Lilac, the Violet, and some others to great altitudes towards the extreme limits of their circumscription. The Cerealia interested me more especially, as with them it was easy to record the periods of sowing, of flowering, and of maturity, in different places, from a great number of observations.

We should not, however, neglect perennial herbaceous plants, which, not being subject to the chances of cultivation, can obey more freely the direct influence of spring, and are better suited to the observation of the early development of vegetable life. In Cereals, on the contrary, although the commencement of vegetation is, even with them, comprised within fixed limits, yet it is not wholly independent of arbitrary circumstances, and all its periods may be changed if the time of sowing be delayed.

Winter Cereals are, however, much freer from this defect, for differences of a week or a fortnight in the time of sowing are compensated during the long continuance of the winter months

Summer Cereals appear to be much more influenced by these extraordinary circumstances, although not so much in the Alps as in large plains. The cultivation of Cereals is restricted within narrow limits by the fall of snow in the spring and autumn. The fear of seeing their corn prevented from ripening by the commencement of a premature winter obliges the inhabitants of the Alps to crop their fields as early and as rapidly as possible.

The period of spring sowing depending therefore so much upon that of the melting of the snows, which is, in general, very characteristic of the re-appearance of vegetation in the Alps, we have taken it into account in the following tables.

In investigating the periods of vegetation in different plants, it is necessary to observe in all cases the same moment of development. Many phenomena, the flowering for instance, often last a long while, and in these cases it is always preferable to choose for comparison the commencement of each phenomenon. Take the flowering of the Cherry for instance; we would not wait till all the branches are quite covered with flowers, but consider the flowering as commenced as soon as it is observed that a considerable number of flowers are open on each of several trees.

The data I make use of are all mean results of phenomena observed during several years.* Annual observations give but very uncertain results, as may be seen by the longer series published by Dove and Quételet.

Among the earlier observations of the commencement of periods of vegetation in a large number of plants, and their relation to changes in climate, may be mentioned those of Linnæus, Cotta,† Sennebier,‡ Schuebler,§ d'Hombres Firmos,‖ Berghaus,¶ L. Schmoeger,** V. Gasparin,†† Boussingault,‡‡ and, more

* All observations made only during short periods are always noted as such.

† *Traité de Météorologie*, Paris, 1774, p. 238.

‡ *Météorologie Pratique*, fourth edition, Paris, 1810, p. 172, &c.

§ *Researches on the period of Flowering of several Plants of the Flora of Germany and the adjoining countries. Ratisbon Journal of Botany*, 1830, p. 351. Several series of observations, more or less detailed, made on the occasion of these researches, by Schuebler, have been published in later volumes of the same Journal. Already in 1822, in the fifth volume of that periodical, Wenderoth, by his remarks on the Spring Flora of the neighbourhood of Marburg, had induced the establishment of a regular course of observation in the gardens of Berlin, Salzburg, Dresden, Ratisbon, &c.

‖ *Recueil de Mémoires et Observations Météorologiques*, 1838, p. 92.

¶ *Almanack for* 1840.

** *Meteorological observations made at Ratisbon, from* 1774 *to* 1834, 8vo. 1835, table xiv.—*Meteorological relations of the Vegetable and Animal Kingdoms*, pp. 78—82.

†† *Cours d'Agriculture.*

‡‡ *Economie rurale*, 2 vols. 1844.

recently those of Quételet,* Dove,† Fritsch,‡ and several others. These last observations, in particular, not only comprise a long series of years, but apply to a considerable number of plants, and thus afford comparable results. I found it very instructive to compare the observations quoted and the results obtained with analogous deductions made in the Alps.

2. *Delays in the development of Vegetation, occasioned by altitude.*—I have endeavoured in the following table to give a mean commencement of different periods of vegetation, according to differences of altitude of 1000 feet each. It is based upon data contained in detailed tables of periods of vegetation in different localities. I have had occasion also to make numerous isolated observations which have assisted in obtaining these means, whilst, at the same time, I composed these data with other isolated observations previously published. It has been my object thus to obtain results as general as possible, to enable me to follow out the influence of altitude and of the consequent climaterio changes. The nature of these phenomena, and the local influences to which they are subject,§ cause the period of their commencement to vacillate over a considerable space around the mean deduced. These data are therefore more extensive than those which might be deduced from other observations, such, for instance, as temperature.||

* *Instructions sur l'Observation des Phénomènes Périodiques*, 1840, in Vol. I., Part I., of the *Bulletin de l'Académie royale de Bruxelles. On the Climate of Belgium, Phénomènes Périodiques des Plantes*, 1846, from the *Annales de l'Observatoire royal de Bruxelles.* The above contains very detailed comparisons of the first parallel observations known, a review of the means of from six to four years, and new series of remarks. The collected observations of several stations are being published annually by Quételet, in the *Nouveaux Mémoires de l'Académie des Sciences et Belles-lettres de Bruxelles.*

† *On the connexion of variations in Atmospheric Temperature with the development of Plants*, 4to. 1846, from the *Memoirs of the Academy of Berlin* for 1844, and from the *Monthly reports of the Academy*, for 1846.

On the relation of Atmospheric Temperature to the development of Plants, after the observations of M. Vogt, at Arys, in East Prussia, from the monthly reports of the royal Academy of Berlin, for 1850.

‡ In the *Annals of the Observatory of Prague*, by Kreil, commenced in 1840, and *On the Periodic Phenomena of Vegetable Life* in the *Annals of the Royal Academy of Sciences of Bohemia*, Prague, 1847.

§ We shall advert farther on to the great deviations from the general means in special seasons and at special stations.

|| Some irregularities in different plants will still be found in the accompanying table; it has not been always possible to separate them from the actual observations made, nor to investigate more attentively their causes. As it is the endeavour in these researches to compare the analogous periods of vegetation in several plants, it would be much to be wished that the mean results obtained could be much freer from similar perturbations.

Indication of Periods.	From 1500 to 2000 feet.	From 2000 to 3000 feet.	From 3000 to 4000 feet.	From 4000 to 5000 feet.	From 5000 to 6000 feet.	From 6000 to 7000 feet.	From 7000 to 8000 feet.
Melting of the snow, and re-appearance of vegetation	17 March	30 March	10 April	21 April	12 May	2 June	28 July
Culture of summer Cereals	25 „	8 April	15 „	24 „	13 „		
Last Falls of Snow:—							
Mean	20 April	30 „	15 May	28 May	15 June		
Extreme	15—25 May	15 June	30 June	15 July			
Foliation:—							
Fagus sylvatica	2 May	11 May					
Fraxinus excelsior	3 „	11 „	22 May	31 May	17 May Growth of meadows.	7 „ Growth of meadows.	1 „ Growth of meadows.
Juglans regia	10 „	19 „	26 „ In very favourable situations.				
Flowering:—							
Viola odorata	4 April	12 April	21 April	4 „	12—15 May First spring flowers, Anemones, Gentianellas, Primroses, &c.	2—5 June First spring flowers.	28—30 June First spring flowers.
Prunus cerasus	5 May	10 May	16 May	28 „	22 June Rhododendron.	11 July Rhododendron.	29 July Rhododendron.
Fragaria vesca	4 „	10 „	16 „				
Syringa vulgaris	9 „	21 „	2 June				
Secale cereale hibernum	4 June	14 June	21 „	28 June	8 July (5200)		
Sambucus nigra	8 „	19 „	29 „				
Hordeum distichum, and hexastichum	11 „	20 „	30 „	11 July	21 July (5200)		
Hay harvest	15—20 June	24 „	25 „	27 June	1 July	3 August	
Ripening of Fruits:—							
Prunus cerasus	25 June	18 July	3 August	20 August			
Secale cereale hibernum	18 July	31 „	8 „	18 „	3 September (5200)		
Hordeum distichum, and hexastichum	25 „	7 August	17 „	29 „	11 September (2500)		
Triticum vulgare æstivum	9 August	21 „	31 „	13 September			
Avena sativa	14 „	27 „	5 September	16 „	29 September (5200)		
Sambucus nigra	9 September	21 September	3 October				

My data comprise altitudes of from 1000 to 8000 feet. They relate, especially as to the periods of vegetation corresponding to great altitudes, to groups of mountains in and near the heart of the Alps, where one meets still at a height of 4000 to 6000 feet with villages, cornfields, and meadows; as to the lower regions, I have made use also of other observations made in the northern portion of the Alps, and at the foot of the mountains. These stations are between the $46\frac{1}{2}^{\circ}$ and 48° of north latitude.*

The melting of the snow and the reappearance of vegetation in spring, as also the commencement of the permanent winter layer of snow, are periods as yet rather uncertain, yet the indications given above will serve to show generally the mean commencement and termination of vegetation at different altitudes.

A very favourable circumstance in the observation of these phenomena is, that the winter is so much longer in the Alps† than in the plains, it commences and terminates in a much more regular manner. In lower regions, and even at the foot of the Alps,‡ especially on their southern side, the commencement and disappearance of snow cannot be taken as the limits of the period of vegetation, because the climate is too mild and the snow too inconsiderable. The recommencement of vegetation must then be determined by observation of the moment at which the sap begins to flow with increased rapidity and the plant appears to revivify. In climates where the winters are mild, as in Belgium, for instance, it not unfrequently happens, as remarked by Quételet,§ that some plants free themselves from their winter sleep and continue partially to develop themselves so long as there do not come on any continuous periods of frost.

There are in the Alps considerable local irregularities in the melting of the snows, according to the direction of the valleys and the aspect of the declivities. Here hot banks exposed to the sun are very much in advance of narrow, low, and shaded valleys; there, in ravines and in the isolated depths of the valleys, large masses of snow are amassed which do not melt for a very long while.

* The southern Alps are not included in the present tables.

† It sometimes happens in the lower regions, up to 3000 feet, that the winters are interrupted by continuous south winds bringing on a general melting of the snow.

‡ In the lower regions, up to 2000 feet, the quantity of snow in some valleys (that of the Inn, for instance, up to 1700 feet), in extreme years, is not sufficient to admit of going in sledges.

§ *Phénomènes Périodiques des Plantes*, p. 23.

come on in the beginning of October; any strikingly early appearances of them cause a considerable deficiency in the harvest.*

We have elsewhere noticed that at the height of 4500 feet, taking the mean of several years, no month is without snow, and that from this height upwards, the number of days of snow rapidly increases, without entirely excluding falls of water even at great heights. In extreme years there are still considerable tracts of snow at between 4000 and 5000 feet in the beginning of May, which, however, then rapidly disappear. In September, and especially in October, falls of snow become frequent at the further limits of Cereals; falls of snow are not unfrequent in all months. In the table of heights, the 15th June is given as the mean of ordinary years at an elevation of 5000 to 6000 feet. The flowering of Cereals often suffers considerably by such falls, and it not unfrequently happens that they are entirely covered with snow for a short time not long before their ripening.

The commencement of winter is usually accompanied by the heavier falls of snow; sometimes, however, the latter take place somewhat after the sinking of the temperature.

The number of days of snow in comparison with that of rainy days increases with the altitude, so also the length of time during which the ground is covered with snow. The latter, however, increases with the altitude more than the former; an increase of one day in the fall of snow corresponds with an increase of several days in its duration on the ground. Thurmann† found that, in the Jura, an increase of three days in the fall of snow entailed an increase of ten days in its duration on the ground. The figures given on this subject show some interesting results as to their relations in elevated regions. They indicate also numerous variations according to the quantity of snow fallen on each snowy day,‡ according to the degree of heat in summer, or to the daily maxima, according to the radiation on isolated summits, &c.

The duration of vegetation, that is, the period intervening between the reappearance of vegetation in spring, and the com-

* As an instance of an early frost, very injurious to Maize at an elevation of 1700 feet, we may state on the authority of private letters, that a very severe one took place at Innspruck in the nights of the 14-15th September, 1850, after a continued east wind.

† *Essai de Phytostatique*, v. i., p. 67.

‡ The quantity of snow which falls in a day diminishes at considerable elevations.

mencement of winter, undergoes considerable changes according to altitude. The comparison of this period in similar climates will afford interesting results as to the degree of development which vegetation may reach during this period. In the north, the duration of vegetation is also very short; at St. Petersburg, for instance, it comprises, according to Grisebach, only four months and ten days.* Yet the high maxima of temperature during this time, and the increased excitement, from the long duration of daylight, occasions a much more active development and a greater richness of vegetation than might have been expected from the short duration of the period of vegetation, when comparing these relations with what takes place in the Alps.

DURATION OF THE PERIODS OF VEGETATION.

Heights.	Days.	Differences.
1500 to 2000	268	
2000 to 3000	245	23
3000 to 4000	224	21
4000 to 5000	203	21
5000 to 6000	169	34
6000 to 7000	125	44
7000 to 8000	95	30

The mean difference is twenty-nine days for every thousand feet, but it would appear from the above figures that the diminution is less rapid at lower elevations than in higher localities. Above the line of snow, and especially towards the furthest limits of phanerogamic vegetation (above 10,000 feet), the period of vegetation is still further shortened; this period is, on an average, not much more than a month in localities not much exposed to the sun, yet still accessible to plants, and is chiefly confined to the month of August. During this short period, there occur, not unfrequently, very considerable changes of temperature and great falls to which the last phanerogamic plants appear to be but little sensitive. These plants continue to flower when the nocturnal temperature sinks very low, even below the freezing point, and when the surrounding rocks, as well as the leaves and flowers of the plants, are covered with rime. After very snowy winters and during cool summers, it happens sometimes that the last phanerogamic plants remain completely covered with snow the

* On the influence of climate on the limitation of natural floras. —*Linnæa*, vol. xii., p. 194.

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whole season; and as to the highest lichens, where the rocks are not too abrupt, that is very frequently the case; they have the power of preservation under the snow for a very long time without losing their vital faculties. *

On account of the great length of the period during which the ground is covered with the winter snows, the relation to each other of the different seasons alters considerably at great altitudes. The winter comprises by far the greatest portion of the year, summer comes next in point of duration, spring becomes very much shorter, and still more so autumn, which is generally very rapidly put an end to by the fall of early snows.

For each individual plant, the time which intervenes between the flowering and fruiting, for instance, shows great differences according to altitude.† It is, in general, long in the elevated regions; for the deficiency of heat necessarily delays the ripening of fruits. As examples, I will mention the Cherry, Winter Rye and Barley, for which the following means are the result of a great number of observations.

NUMBER OF DAYS BETWEEN THE TIMES OF FLOWERING AND OF RIPENING FRUIT.

Heights.	Cherries (Prunus Cerasus).	Winter Rye (Secale cereale).	Barley (Hordeum distichum et hexastichum).
1500 to 2000	51 days	44 days	44 days
2000 to 3000	69 „	47 „	48 „
3000 to 4000	79 „	48 „	48 „
4000 to 5000	84 „	51 „	49 „
5200	„ „	57 „	52 „

For the Cherry, the interval between these phenomena is greater than for Rye and Barley; so the differences according to elevation vary more in the case of the former, than in the two latter: a

* Premature ice is much more injurious to vegetation than snow; when from the oscillation (that is, the variations in length and breadth) of glaciers, spots are left free either on their lower extremity or on their sides, these spots remain for a long time without vegetation, although generally situated below the limit of perpetual snow. The motion of the glacier itself is not however without influence in this respect, as it destroys the roots and germs of previous plants. And new plants, even mosses, establish themselves with great difficulty on the smooth rocks and rocky fragments left on the edge of the glacier.

† There may be some exceptional cases where the length of time from the flowering to maturity is not sensibly increased, but these cases have not as yet been determined with certainty. Those species which will grow up to a great elevation are the best suited for these comparisons.

few observations have indicated to us clearly similar relations for other fruit-trees. For Cereals, account may also be taken of the time which elapses between sowing and reaping. Striking differences are observable in this respect according to geographical latitude, as well as according to elevation. I have here placed in juxtaposition with these phenomena, as recorded in the Alps, some observations which Grisebach* has published after Daum and Parlatore.

Plants.	Places.	Mean time of sowing.	Mean time of reaping.†	Difference in days.
Triticum vulgare hibernum . .	Malta . . .	1st December	13th May	163
	Sicily . . .	1st December	20th May (Palermo)	170
	Naples . . .	16th November	2nd June	198
	Rome . . .	1st November	2nd July	243
	Berlin . . .	—	—	299
	Alps at 3000 ft.	12th September	7th August	329
Secale cereale hibernum . .	Alps at 2000 ft.	20th September	30th July	313
	Alps at 4000 ft.	8th September	14th August	340

The progression from southern Italy to the north of Germany here produces the same effect as a considerable increase in elevation. In both cases there is a great prolongation of the period of vegetation in Cereals. At 5000 to 5200 feet, the extreme limit of Rye, it often remains a whole year in the ground.

These comparisons can only be established in respect of countries whose climates are analogous in the repartition of heat according to seasons. The growth of Cereals near their limits towards the north can no longer be compared with the same phenomena in the Alps, for in the usually excessive climate of the north of Siberia, the period of vegetation of Cereals is on the contrary shortened.

Besides the phenomena of which the periods are solely occasioned by relations of climate, I have, in the table of their mean commencements (above, p. 65,)‡ inserted some others which

* *Report on the progress of Vegetable Geography for the year* 1845. Berlin, 1847.

† I have here taken the period of the harvest in preference to that of maturity, for the purpose of comparison with southern stations, the former being there rather later than the period of maturity strictly speaking. In the variations in the time of sowing, the data given, especially for autumn, can only give the most usual changes in these relations.

‡ In some parts of that table, as, for instance, opposite the foliations of Fraxinus excelsior and the flowering of Viola odorata, at the heights not

depend on the will of man; these are the hay-harvest and the cultivation of summer Cereals. Yet in comparing a number of observations, we find that the differences in the periods of these voluntary acts are still caused by relations of climate. The hay-harvest gives the most irregular results and differences, varying the least according to elevation. It is only from 6000 to 7000 feet that it shows a very considerable delay, which is owing to the manner in which the meadows are turned to use.* Up to 6000 feet the meadows are generally mown twice: it is only in some of the deepest valleys that by irrigation and careful cultivation three hay-crops are sometimes obtained. In more elevated situations they are obliged to commence mowing as soon as the Gramineæ are in seed, in order that the second mowing may be completed before the often premature fall of the first snows of winter. From 6000 to 7000 feet we often meet still with real Alpine meadows, which, however, are only once mown; this takes place from the beginning to the end of August, and even as late as September, whilst some high Alpine meadows, above 7000 feet, are only mown every two years.

In order to show, at one view, the delays occasioned in the development of vegetation according to altitudes in a general manner,† I have inserted in the following table comparative differences in regard to special periods of vegetable life.

We may observe, that in general the delay in the periods of vegetation is less in the spring months than towards the end of the flowering, and thence to the ripening of the fruit. The mean difference in question is of two days and a half, and this phenomenon is more especially observable in different parts of isolated valleys. The cause must be sought for in the more rapid fall of temperature which takes place in those situations in the summer months, as the more elevated parts are thereby colder in proportion, and the development of plants consequently slower than at the commencement of vegetation.

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reached by these plants, I have inserted some data on the vegetation of meadows or on early spring flowers, without intending to indicate any analogy between these latter phenomena and the former.

* This only applies to meadows cultivated in the vicinity of the most elevated habitations. For in some places Alpine meadows are met with much lower down which are only once mown.

† It is only by comparing the means of a great number of observations that any precise estimate of the influence of altitude on the development of plants can be obtained; for isolated stations and particular seasons show very great differences, from which many apparently contradictory results might be obtained.

The mean elevation for every degree (of the centigrade thermometer) of lowering of the temperature is in winter 670 feet, in spring 510 feet, in summer 440, and in autumn 560.

One circumstance seems of importance, which is that the lower temperatures acting on plants at great elevations influence their development more especially after a long lapse of time; the period of ripening the fruit, for instance, is more delayed by this prolonged action than that of flowering.

As a general mean, we find in the Alps a delay of eleven days in the development of vegetation for every 1000 feet; * this result, however, shows many variations in different parts of the Alps of different elevations, configuration, and aspect, on account of the changes occasioned by these circumstances in the repartition and fall of temperature.

A vertical difference of 1000 feet, corresponding to a delay of eleven days, entails generally in the mean temperature, especially during the period when the development of vegetation takes place, a difference of two degrees centigrade.

Schuebler, from his own observations, admits, for every 1000 feet, a delay in vegetation of from ten to fourteen days, and a difference of six days for a mean lowering of temperature of one degree.

Quételet † has confirmed these results. He finds that 100 metres in the climate of central Europe entails a delay of about four days, which corresponds with the action of one degree of latitude.‡

Thurmann has published some observations on the delays in the periods of vegetation in the Jura; he finds that, generally speaking, a delay of seventeen days in the harvest corresponds to a difference of altitude of 1000 feet, or 100 metres = 5·50 days.§

Some special observations, made on several points of the Jura, during the first half of the summer of 1849, up to an elevation of 1045 metres,|| gave, for the time comprised between the com-

* Notwithstanding the variations to which these general means are liable, they nevertheless serve to give an idea of general results, and to facilitate their comparison in different climates.

† *Phénomènes périodiques des Plantes*, p. 69.

‡ These relations vary in different latitudes. Berghaus (*Almanack* for 1840) observed, that between Hamburg and Christiania a much shorter delay corresponds to a degree of latitude, than between South Germany and Smyrna.

§ *Essai de phytostatique*, vol. i. p. 51.

|| *Essai de phytostatique*, vol. ii. pp. 286—293. These observations are continued by Thurmann.

mencement of vegetation in spring and the hay-harvest, thirteen days and a half for every 1000 feet (100 metres = 4·25 days). Although these numbers are the result of only very short observations, they seem to show that in the Jura, as in the mean results in the Alps, there is a greater delay in the development of vegetation at the time of harvest, and especially in autumn, than during the spring months.

I should here mention, that the delay is generally greater in the Jura than in the Alps; this proceeds from the higher stations in the former chain of mountains being in exceedingly exposed situations, where the much more restricted cultivation of Cereals and the want of fruit-trees already indicate a more rigorous climate.

Influence of Climateric Relations.—Amongst the climaterio conditions influencing the periodic development of vegetation, the following appear to be the most important: the mean temperature of the air in the shade and in sunshine; the form of the curves of temperatures during short periods; and the magnitude of isolated extremes in consequence of exposure to sunshine and radiation; the heat of the soil and its variations; the moisture of the air and of the soil; the accumulation of clouds and repartition of rain; the pressure of the air, whether moist or dry; winds, and in some measure, electricity, &c. These groups of influences have all this common character, that they depend essentially on changes in geographical position,—that is, in altitude, latitude, and longitude. Aspect, configuration of the ground, composition, and especially physical properties of the soil, are more local, but also of great importance: add to this many irregularities peculiar to certain plants, which, however, disappear in mean results, obtained from the consideration of different plants.

From the manner in which the phenomena of vegetable life in any given year depend on the conditions of temperature, it will be readily seen how important, among the above-mentioned influences, is that of *temperature.* These phenomena always commence earlier under the action of greater heat, always later when the heat is less, than the ordinary means; although the other climateric conditions should not exercise their influence in the same direction on the temperature. This constant relation of the non-periodic changes of temperature points out to us what the investigations of Dove have proved, that heat is generally the most essential condition for the phenomena of vegetation. The great influence of temperature, which acts directly as well as by promoting the evaporation of leaves, has been frequently demonstrated by direct experiments on the growth of plants. Münter,* Harting,† and others, have proved that the growth of plants is greater by day than by night; that under a decreasing intensity of development, it may be confined to the day-time, and that it is more active in direct sunshine than in the shade.

Nevertheless, the heat which a plant receives is different from the mean temperature obtained by the observation of a thermometer suspended in the shade; for plants have usually their free parts exposed to the action of the sun,‡ whilst their roots partake of the temperature of the soil. In shady situations, the mean temperature of the air is lower, and the extremes are nearer together, than in sunny places; for the maximum is much lower in the shade, and the minimum is also not quite so low, owing to the diminution of nocturnal radiation. This contrast between the shaded and sunny situations is greater during the warmer than during the colder portions of the year, and increases greatly in more elevated situations in comparison with lower ones. Yet, variations even in the mean temperature of the air, as indicated by the thermometer in the shade, exercise great influence on the development and general growth of plants.

In the scale of heights in the Alps, the variations, as we have already observed, diminish with greater elevation, but more because at greater altitudes the heat is less, than because the cold is greater: the decrease in temperature is greater in summer than in winter.

The great influence which the climateric character and mode of repartition of temperature exercise on the development of plants may be readily perceived, if we endeavour to draw synchronistic lines; that is, if we connect those places where certain phenomena of vegetation occur at the same time. These lines, in extensive continents, do not, as observed by Quételet, coincide with mean annual temperatures, and are neither parallel, nor do they show

* *Observationes phytophysiologicæ.* Berlin, 1841. See Schlechtendahl's *Linnæa,* vol. xv. pp. 209—242; Mohl and Schlechtendahl's *Botanische Zeitung,* vol. i. pp. 69, 753, &c.

† In F. Van Hœven and De Vriese's *Journal,* Leyden, 1842, vol. iv. pp. 296—348, extracted in Mohl and Schlechtendahl's *Journal,* vol. i. pp. 99—102. For the relations of the development of plants to external conditions, as well as for the physiological relations of these phenomena, see De Candolle's *Physiologie Végétale,* vol. i. Schleiden's *Principles of Scientific Botany,* second edition, 1845, vol. ii. pp. 494—503.

‡ For the great influence on vegetation of the direct exposure to sunshine, see Von Humboldt's *De Distributione Geographicâ Plantarum,* 1817, p. 163.

any constant differences. They cross each other, on the contrary, repeatedly, and are of very dissimilar forms for different months. In one and the same place there may be a delay in one phenomenon, and a considerable acceleration in another. The vernal phenomena and those of autumn show the greatest differences.; which depend, more especially, on whether it is a continental or a maritime climate which prevails, as in the latter case, besides the lower degree of summer heat, the frequent cloudiness, and the consequent deficiency of sunshine, delay much the ripening of fruits. For the Alps, these synchronistic lines take somewhat more regular forms, and the enclosed spaces indicate, in general, more uniform variations; although here, also, very considerable divergences occur, according to the configuration of the ground in particular stations, according to geographical longitude and latitude, and according to the form of the groups of mountains.

For the daily periods, the variations of temperature depend chiefly on aspect; for the periods of the year, positions in the bottom of a valley, as we have already seen, act favourably, as in their case, with the same mean annual temperature, the differences between particular months are generally greater than on the sides of the mountains. It is not all plants that are equally affected by these conditions;—they relate chiefly to plants generally cultivated in freer aspects and on sunny slopes, and where long stalks enable them to take a greater part in the temperature of the air. The temperature to which forests are exposed is very nearly that of the thermometer in the shade; they are, moreover, affected by that of the deeper strata of the soil. For larger plants, also, the aërial temperature is not everywhere the same; for their lower parts are exposed to greater heat in the sunshine, and to greater cold by nocturnal radiation* in calm, cold weather, than their upper portions.

Together with the greater heat under sunshine, there arises also greater excitement from light, which, it is known, has so important an influence on the functions of vegetable life, and on the assimilation of nutritive matter. The intensity of this excitement, depending on the transparency of the air, increases with elevation, and is certainly not without influence on the periods of vegetation, and on the lower limits of Alpine plants. Grisebach has also shown that the southern limits of northern plants in North-west Germany,† depend very essentially on the excitement from light,

* See Glaisher, *Transactions of the Royal Society of London,* 1847, vol. ii.

† Grisebach, *The Lines of Vegetation in North-west Germany. Gottinger, Studien,* 1847, p. 476.

on the duration of daylight, which here corresponds with intensity, whilst there is little probability that there the southern limits are fixed by any excess of summer temperature, which is, moreover, inconsiderable.

Exposure to sunshine depends on the state of the sky as to cloudiness; this varies in different groups of Alps, in a manner analogous to the repartition of rain; but it also acts unequally on the periods of vegetable life, at different elevations. As the greater clouds do not generally reach the highest summits, and isolated mists especially remain long in the valleys, so the highest plants are thereby exposed to much greater excitement from light.

The temperature of the soil produces great variations, as well in the quantity as in the distribution of the heat which a plant receives. As plants of the higher Alpine regions are mostly perennial, and their roots generally have a great extent in comparison with their green parts, so is their connexion with the temperature of the soil much increased. This temperature, in the upper strata, is exposed to greater variations from sunshine by day, and radiation by night, than the temperature of the air; and in these cases, the colouring, the degree of looseness, &c., of the surface have considerable influence. But at some depth the temperature of the soil is much less extreme, and the minima of cold and maxima of heat occur later than in the atmosphere; the degree and the rapidity of these changes is much promoted by the degree of conductibility of heat which the soil possesses.* Plants with deep, especially tap-roots, experience therefore, in their subterraneous parts, a cooler temperature in summer, and a warmer degree in winter, than that of the atmosphere. For larger plants, where roots are small in proportion to their green parts, the total heat they receive is greater than the mean annual temperature in the shade. For smaller plants, with roots lying near the surface, these conditions are still more favourable. In winter they are entirely covered with snow, which, being so bad a conductor, protects them from the chilling effects of radiation.† In summer, their roots are but little colder than the temperature of the air; they even sometimes, in their whole extent, partake of the heating of the upper strata by exposure to sunshine.‡

* See the numerous experiments of Forbes in the neighbourhood of Edinburgh.

† See Boussingault's experiments, *Economie rurale*, vol. ii. p. 454.

‡ A fine example of the conditions of growth of this class of plants is afforded by Cereals, which depend so much on the temperature of the air and of the upper strata of the soil; thus, for example, rye and barley ripen

Under all the above influences, the periodic phenomena are not less varied than the limits of plants.

We should here point out that influences, which appear most favourable on considering only the periodic phenomena of vegetation, do not always promote equally the general growth of the plant, or any important rise in the upper limits of its range. This appears more clearly in regard to vernal phenomena, and by a comparison of smaller plants with larger ones, as trees for example. The effect of an open aspect, the influence of violent storms, the steep declivity of the ground, &c., which are so prejudicial to the growth of the latter, disappear, for the most part, in the case of smaller plants. In the steeper parts of a declivity, the snow melts in spring more rapidly than in flatter situations; and the re-appearance of vegetation takes place earlier, although these very declivities are unfavourable for the formation of close masses of vegetation, and still more so for the establishment of trees. So also dry, even stony localities, which are rapidly heated by sunshine, hasten the development of spring vegetation, and the commencement of flowering, far beyond what is seen in moist rich soils under the same aspect; whilst, later in the season, the plants in the former case become very stunted. Also, an early commencement of vegetation, and a rapid formation of shoots and flowers, become very injurious to the plants on the occurrence of frequent night-frosts; whilst those which grow in situations where, owing to less sunshine, to the composition of the soil, or other circumstances, these periods are delayed, succeed far better, and in greater numbers.*

The consideration of the degree of humidity is more important than that of the repartition of rain, because it depresses the temperature much more in summer than in the other seasons, and thereby often disturbs considerably certain stages of development. Great droughts, which sometimes oppose as great hindrances to vegetation as cold, are rather scarce in the Alps, as the absolute quantity of rain is so great, that even a considerable diminution of it is but little injurious; much more frequently do moist summers affect considerably by their cold the ripening of fruits.

Amongst the local influences, must here be mentioned the

in Siberia near Nerehinsk, where the soil is constantly frozen at a certain depth; in the middle of August, this is the case at seven feet below the surface. See Kupffer in the *Bulletins de l'Académie de St. Petersbourg, Classe Phys. Math.* vol. iv. p. 67.

* We shall farther on have the opportunity of giving some examples of these relations in the case of the Cherry.

configuration of the ground. In very narrow valleys and ravines, the duration of sunshine is much shortened, or, in a few rare instances, almost entirely cut off. This diminution occurs chiefly in winter; partially, also, in spring and autumn. Under the high steep mountains which often rise by the side of such valleys, many points are entirely deprived of the direct rays of the sun for several weeks in winter; whilst in the others the duration of sunshine is exceedingly short. Even in summer, it lasts in most valleys of the Alps, except in the broader basins, some hours less than in plains.* Many periods of vegetable life, the ripening of fruit for example, is thus remarkably delayed in shady valleys. The same circumstances may be readily observed under northern aspects, in comparison with southern declivities.

Considerable accidental variations may be observed on comparing isolated phenomena and years, in consequence of irregularities in certain plants. Age, or artificial transplantation, bring out great differences; single individuals are earlier than others without our being able to attribute it to any external causes; also a degree of development given to a plant by the temperature of the preceding year, especially of autumn, is often perceptible in its effects the following year.† Differences in the degree of consistency or in the composition of the soil, slight variations in moisture or irrigation, will also produce rather striking differences in the period of development, in plants growing in close proximity to each other.

Although the influence of the temperature of the air in the shade on the periodic phenomena of vegetable life is not extensive, we may, nevertheless, make use of it for some general comparisons; partly because its influence is always great; partly because it depends so essentially upon many of the other modifications of climate, that, within certain limits, it gives a fair estimate of their mean variations. The points to be ascertained in this respect are, at what degree of temperature a given phenomenon takes place at different altitudes, and what is the temperature which prevails during the whole period of development.

The mean temperature by day, at which a given phenomenon takes place in spring, remains generally nearly the same; ‡ although

* The influence of the shade is also perceptible in the curves of daily temperature.

† See Quételet, *Climat de la Belgique*, p. 35.

‡ This is shown also by Quételet's comparison of Brussels, *Climat de la Belgique*, p. 19, with the carefully chosen means collected by Gasparin for Western Europe, in his *Cours d' Agriculture*, vol. ii. p. 94.

case, but later during the period of decreasing temperature. As a fine example, we may take the case of the Cherry and of the Winter Rye.

The *Cherry* ripens

In Western Europe, in general, according to Gasparin,* at a mean temperature by day of	17°, 8 cent.
In East Prussia, according to Dove,† at a temperature by day of	17°, 5 cent.
At the foot of the Alps, to the height of about 2000 feet, it appears likewise to range between	17° and 18°
Towards the upper limits of the tree in the central Alps, at 4500 feet, where the ripening only begins on 20th August the temperature during the period does not exceed	11° to 12°

The *Winter Rye* ripens

In East Prussia, according to Dove, at	17°, 9 cent.
At the foot of the Alps, the temperature is nearly the same. At the upper limits of its cultivation in the higher chains of the Alps, at an elevation of 5200 feet, the temperature at the time of ripening on 3rd September is barely	10°
Whilst a considerable diminution is apparent at lower altitudes of 4000 to 4500 feet.	

In the case of the Grape-vine, also, the ripening takes place at a much lower temperature towards its northern limits, as well as towards its limits in altitude, than in more favourable situations.

In considering the total temperature during the whole period of vegetation of a plant, or during particular periods of development, we must distinguish those temperatures which are directly promotive of vegetation, and those which occasion their growth to remain stationary. In mean temperatures, as they are usually taken, these considerations cannot be completely comparable, as the temperatures below the freezing point have in the averages the same value as those above it; that is not, however, the case with plants, as growth only takes place with the higher temperature. The lowering of the temperature may, indeed, produce a stoppage in growth, or even the death of the plant; but there is never any retrograde step in the only sense in which it can be compared to temperatures below freezing point, and to the manner in which they are taken account of in striking the monthly and annual means.

The temperature at which the development commences, as

* *Cours d' Agriculture*, vol. ii. p. 94.
† *Reports of the Berlin Academy*, 1850, Table 2, at p. 214.

well as, the disturbance produced by a fall in temperature during growth, is not the same for every plant; we have already observed that high Alpine plants suffer less from a sudden cooling than those which grow lower down, and especially cultivated plants. The commencement of vegetation takes place with more or less heat according to the peculiar constitution of any given species; but it is also generally affected by the temperature of the preceding winters; a mild season, for instance, may have so far prepared the commencement of vegetation, that its development in spring may take place at a lower temperature than usual. Great heats may also act prejudicially on vegetation. Therefore, the temperatures to be taken into account in respect of the development of vegetation are included between higher and lower limits, which vary according to the species of plant, and to the stage of development at which it has arrived.* Temperatures which have a direct influence on the development of plants appear to be always above freezing point, but in many cases a temperature of from $+ 1°$ to $+ 3°$ centigrade will remain without any perceptible effect, if after a short time it be interrupted by greater cold. This is particularly evident from the little alteration which winter Cereals show before the advent of the warmer spring months, although higher midday temperatures may have commenced earlier, and the snow may have partially disappeared. Similar phenomena are observable, according to Alph. de Candolle,† towards the northern limits of plants. On the other hand, in many larger plants, trees for instance, there is no absolute stagnation‡ even during winter. It becomes, therefore, extremely difficult to judge of the real amount of heat which a plant experiences, either during its whole period of vegetation, or during specific portions of it. It is not even expressed by the sum total of all temperatures above freezing point, for sunshine, distribution of temperature, and especially isolated extreme heats,

* We may mention here, as an instance of a great range of temperature, the process of germination, which will take place from 3° or 4° centigrade to 40° or 50°. See Boussingault, *Economie rurale*, German edition, vol. ii. p. 420.

† *Sur les Limites polaires des Espèces: Bibliothèque Universelle de Génève*, 1848.

‡ By the interesting experiments of Boucherie on the colouring of woods by infiltration, it appears that winter is indeed the season of rest for the sap, but that there is, nevertheless, no absolute stagnation. This is especially the case with evergreen Coniferæ. *Annales de Chimie*, Second series, vol. liv. p. 134.

are items of great importance.* It appears, nevertheless, that in considering the influences of different latitudes and altitudes, the sums of temperatures, or, as Quételet proposed, the sums of the squares of temperatures † give very fair general points of comparison.

If we investigate these conditions according to either of these modes of computation, we shall find that many plants, at their highest limits in the Alps, notwithstanding a considerable retardation of their periods of vegetation, experience a less total heat for the same stages of development than in plains.‡ In this respect, we might especially have made use of meteorological observations taken in the years 1848-49 at Vent, Heiligenblut, and Sagritz, in connexion with memoranda on the development of plants. But the period of time appeared to us to have been too short to give specifically the figures which resulted from them, as differences in different years are so important, according to the interesting communications of Dove.§ The diminished total heat

* A. de Candolle attempted to make use of the development of single plants, in conjunction with the temperature in sunshine and in shade, for the appreciation of the development of vegetation in general, and at different seasons of the year. *Bibl. de Génève*, 1850. *Sciences Physiques*, pp. 177—192.

† Hess of Stettin has shown that relative moisture may also be taken in account by dividing the product of heat and time by the relative humidity. Lamont (*Annals of the Observatory of Munich*, 1849, p. 171) remarks, that a more correct result will be obtained by combining higher powers of the mean temperatures with the squares of the extremes. The farther removed the phenomena considered are from the commencement of vegetation in spring, the more concordant will be the results obtained by different methods, because during the longer periods single variations compensate each other more and more.

‡ That vacillations in the total heat are not uninfluenced by the nature of the plants themselves, is shown by A. de Candolle's observations. It appeared that, even with the most careful experiments with seeds of the same kind, the total temperature under apparently similar outward circumstances was never precisely the same; single plants were developed, some more rapidly, others more slowly. *Bibl. Universelle*, 1850, p. 179.

§ According to Vogt's observations at Arys, in East Prussia, comprising the years 1836 to 1849 (*Reports of the Berlin Academy*, 1850, p. 213), the differences in different years, that is, the non-periodic variations in temperature, become, as shown by Dove, important in another way. There frequently occurs a succession of favourable or unfavourable years; if the first development of a plant occurs during a series of favourable years, it may reach such a size that its existence is secured, also, for succeeding years; this is an important point for acclimatising and other experiments in cultivation. These conditions may also have been of great importance in the case of isolated trees at great elevations, which may be often found at considerable distances from all others. If once they have been able to towards their highest limits is most conspicuous in Cereals; a consequence is, that the corn in such situations always gives a smaller produce, and an inferior quality, which confirms the statement made by Dove, that in one and the same locality an increased total heat from the flowering to the ripening has a favourable effect on the quality of the grain. In some other plants, fruit-trees for instance, we could not, from the series of observations given, deduce with any certainty the conditions as to the total heat experienced, or the sum of the squares. These relations depend so much on the vital functions of plants, on the physiological and chemical conditions of the formation of their sap and ripening their fruit, that it is as yet impossible to trace out the causes of many variations.

4. *Observations made at separate stations.*—(Under this head the original contains eight tables of observations of periodic phenomena of vegetable life made at twenty-nine different stations varying in elevation from 1250 feet to 8400 feet. These separate observations, which form the bases of the general results given in the former part of this article, together with the careful indication of the sources from whence the data they furnish were derived, occupy too much space to be here repeated. It may suffice to give a few general observations which follow.)

Differences in geographical situation, in exposure, in the direction and form of the valleys, alter so much the period of commencement of the various stages of vegetation, that by a comparison of single stations, whose difference of altitude is not considerable, very great irregularities may be observed. The great local inflections of the isothermal lines, which strike one more especially in the lower parts of the Alps, have been adverted to in a former part of the work. Valleys which are thus warmer than others, of the same or of lower altitudes, have also a corresponding advance in the development of vegetation. The observations given have enabled us also to follow up the great influence exercised on the periods of commencement of vegetation

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attain a certain age, they are enabled to continue their development for some time, and will at last remain long after they are reduced to half dried up trunks.

Von Humboldt published, as early as 1817, observations on the conditions of temperature during the period of vegetation of Cereals (*Sur les Lignes isothermes; Mémoires d'Arcueil*, iii.) G. Lucas communicated observations on the periods of vegetation of winter rye and barley, and the conditions of temperature prevailing at the time at Arnstadt from 1838 to 1848, to Mohl and Schlechtendahl's *Botanische Zeitung*, 1849, p. 300.

by the different repartition of warmth where the mean temperature of the year remains the same. For instance, Heiligenblut in the Möllthal, and Innichen in the Pusterthal, are at the same elevation of about 4000 feet; they have nearly the same mean annual temperature, but the repartition of the temperature in the different seasons is very different, and this difference is plainly indicated, also, in the period of vegetation, as the following comparative table will show :—

TEMPERATURE. (*By the centigrade thermometer.*)			PERIODS OF VEGETATION.		
1848-1849.	Innichen 3999′.	Heiligenblut 4004′.	Mean.	Innichen 3999′.	Heiligenblut 4004′.
			Leafing :—		
Winter . .	— 4,8	— 2,1	Fraxinus excelsior .	27 May	29 May
			Flowering :—		
Spring . .	+ 4,7	+ 3,9	Prunus Cerasus . .	20 May	26 May
Summer .	15,1	13,0	Secale cereale hib. .	11 June	17 June
			Fruiting :—		
Autumn .	+ 5,8	5,6	Prunus Cerasus . .	26 July	17 August
			Secale cereale hib. .	2 August	10 August
Year . . .	5,2	5,1	Hordeum distichum et hexastichum.	13 August	22 August

Similar results, in different degrees, are not unfrequent in the Alps.

5. *Remarks on the growth of Cerealia at different elevations.*—With a greater altitude not only are the periods of vegetation delayed, but the general development and successful growth of Cerealia is very much impeded.

The number of grains, the size and number of haulms, and the product altogether gradually decrease as we approach the limits of the growth of corn. In order to judge of the amount of this product, we may take either the proportion which the harvest bears to the seed, or the whole quantity harvested from a given surface under the most appropriate treatment. We have often had opportunities of estimating these quantities by a comparison of long continued lists of observations of great cultivators with other more isolated data.

The produce compared with the seed varies (taking the mean of Wheat, Rye, and Barley) in the high plains at the northern foot of the Alps, and in the deep longitudinal valleys, from sevenfold to eightfold.* At an elevation of 3000 feet it is reduced to five or sixfold; at 4000 feet, and a little above, the produce diminishes very much, particularly in respect of Wheat, which meets here with its limits, whilst at the upper limits of all grain cultivation the produce of Winter Rye and Barley, even in a mean of favourable years, sinks down to two or three and a half-fold. It there happens in the worst years that the corn either does not ripen at all, or barely produces the quantity sown. The produce of Maize shows very great variations. At 2000 feet it amounts to about eighty-five times the seed; at its mean limits of 2500 to 2700, it still produces from fifty to sixty-fold; whilst at the highest isolated points where it is cultivated (3500 feet), it not unfrequently happens, that from a deficiency of autumn heat, or the early occurrence of night frosts, it does not ripen at all.†

Besides the climaterio changes, especially the diminution of temperature, the mode of cultivation, at great elevations, affects considerably the produce of Cereals. In the lower parts of the Alps a rotation of crops can be carried out with advantage, and in the broad flat valleys and their neighbourhood may be found a regular and tolerably extensive course of agriculture. But in the more elevated spots the inclination and inequalities of the soil give room only for very small fields, which are worked with the hoe. By a rich supply of dung,‡ however, it is endeavoured to form a very favourable soil.

In the more elevated cultivated spots, the results are still far more unfavourable, when we calculate them by a comparison of the produce of a given surface, as in these situations, in consequence of the inclination of the soil and the abundance of weeds, the crops are very much thinner on the ground.

The inclination of the soil is very considerable, and in many

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* The produce, however, under the most favourable external circumstances may, for the ordinary kinds of grain, rise to twenty-five times the seed, as, for instance, in the case of wheat in Mexico. See Humboldt, *Essai sur la Nouvelle Espagne*, vol. ii. p. 429.

† Such attempts at cultivation may be seen, for instance, at Sagritz, at an elevation of 3500 feet; mean temperature, 6,2° centigrade, in summer 14,4° centigrade, in autumn 6,2° centigrade. In the tropics where maize is grown at an elevation of 2800 feet in South America (mean annual temperature 27,5° to 14° centigrade), it produces, according to Codazzo, 238-fold; in Alsatia sometimes 190-fold. Boussingault, *Economie rurale*, vol. ii.

‡ For the highest fields an abundant supply of dung can generally be obtained from the adjoining chalets; in the deep valleys, on the contrary, where the greater portion of the cattle is usually sent during the summer to the Alpine pastures, there is often a considerable scarcity of dung.

elevated fields reaches an angle of 30° to 35°; the soil is thus washed down by rains, and has to be carried back with great labour to the upper parts. At the same time the projection becomes smaller as the inclination increases. This projection is for every 100 square metres (or yards).*

With a slope of 10°	. . .	98·5 square metres.
„ „ 20°	. . .	90·6 „
„ „ 30°	. . .	86·6 „
„ „ 45°	. . .	70·7 „

The loss of cultivation is not indeed, as shown by Corrard, quite so great,† as the pulverisation and exposure of the soil to the atmosphere somewhat increases; nevertheless it is very perceptible in steeply inclined fields.

Still more prejudicial to the crops are the great number of grasses and other weeds which grow amongst the corn. They are specially favoured by the humidity of the air and soil. Already at an elevation of 3000 feet, must they be weeded out of Wheat, and at great elevations even from Rye and Barley. The haulms are generally very thinly scattered, and often a half or a whole square foot entirely covered with weeds. Yet a too thick sowing of the corn would also be prejudicial, for the passing snow-storms, which occur at great heights, especially in autumn, would easily lay and break down the haulms where they are too crowded.

The quality of the grain diminishes also with altitude; the Cereals grown in elevated spots, even in favourable years, are much lighter and yield less flour. The straw, near the limits of the corn cultivation, is much stronger in proportion to the grain; it amounts to from four to five times the latter in weight, whilst lower down the proportion may be valued at from 40 to 60 parts of grain to 100 of straw in weight.‡

The quantity of produce and quality of the grain in different years corresponds, even in plains, with the variations in temperature during the term of vegetation, although in this case considerable aberrations may be occasioned by too much rain or by prolonged droughts according to the nature of the soil; but in

* According to Boussingault, *Economie rurale.*

† *Transactions of the Haarlem Society,* vol. xv. p. 308. For larger plants, as trees for instance, which in plains also are placed far apart, the loss of space by inclination is much less than for herbaceous crops.

‡ The different kinds of grain show great differences in this respect, the proportions, according to Boussingault, *Economie rurale,* are as follows: Wheat 41, Rye 47, Barley 50, Oats 60 to 100 of straw. See also Zierl, *On the State of Agriculture in Bavaria,* Part 2, 1840, Appendix 3.

period of vegetation to a mean of eleven days. The mean temperature for the same difference in height, especially during that season when the development of vegetation takes place, experiences a diminution of 2° centigrade.

4. The temperature at which a given phenomenon commences, appears generally in spring to remain nearly the same at different elevations; the melting of snow, however, and the first awakening of vegetation take place at great heights, at a somewhat higher temperature. For the periods of fruit ripening, on the contrary, it is clearly observable that it takes place at great heights at a lower mean temperature. The differences for many plants are considerable. It amounts, for instance, in the case of the Cherry, to 5° or 6° centigrade, in that of Winter Rye to near 8°, on a comparison of the highest points where it is grown, with the foot of the Alps or the plains of Germany.

5. Whether we take the sum of the temperatures or the sum of the squares of temperatures between the different periods of vegetation, it will appear by either method, that many plants at their highest limits in the Alps experience a lower aggregate temperature for the same stages of development than in the plains; this is more especially apparent in the case of Cereals.

6. By a comparison of separate stations in the Alps, it appears that many aberrations in the periods of vegetation are occasioned by the repartition of the temperature in the several months or in shorter periods. Between points which have the same altitude and mean temperature, those whose climate is more extreme are always more forward in their vegetation than those where the variations of temperature are less.

7. The product in grain of Cereals, as well as the quality and the proportion in weight to that of the straw, diminishes with altitude; the former in the case of Winter Rye and Barley, at their outer limits of cultivation from 5000 to 5200 feet, sinks, even taking the mean of the most favourable year, to from twice to three and a half times the seed. An increase of temperature during the period of vegetation at great heights increases the produce with great regularity; and in such situations, fruitful years generally coincide with those in which the ripening of the fruit is in advance of the mean period.

XV.—Notes on the Development of Bulbs and Tubers.
By Thilo Irmisch.

(Abridged from the German original.)

[In the year 1850 an elaborate work on this subject appeared in Berlin, from the pen of Mr. Thilo Irmisch, of Sondershausen, under the title of "Zur Morphologie der monocotylischen Knollen- und Zwiebelgewächse." In two hundred and eighty-six 8vo pages of letter-press and ten 4to plates crowded with figures, the author explained in great detail the manner in which about eighty European plants form their bulbs, or tubers, giving a complete history of the development of such parts. The manner in which the task was executed was so complete, as to throw the clearest light upon the history of such subterranean formations; and thus demonstrated to the intelligent reader the principles upon which tuberous and bulbous plants should be cultivated and propagated. The great length of the original renders it improbable that it will be completely translated, nor is it necessary, in a horticultural point of view, that it should be, for many details required to illustrate points of abstract science have little bearing upon horticulture, or merely confirm the general conclusions at which Mr. Irmisch has arrived. It would, however, be a real loss to English Horticulturists if they were altogether deprived of the valuable information contained in the author's pages, and it has appeared desirable to introduce into the Society's Journal such an abridgment of his observations as will enable the gardener to profit by what among them is most essential to his art. The following pages are therefore not to be regarded as a translation of the German original, but as a condensation of certain portions of it. The woodcuts are copies of some of the engravings employed by Mr. Irmisch to explain his descriptions.]

I. LILIACEOUS PLANTS.

Allium ursinum, L.

The slender bulb of this plant, when the fruit is ripe, presents the following structure:—At its base is the axal portion of the last year's plant, which is now very short, and which like the few fibres which still adhere to it is quite dead (Fig. 1, a). Very rarely two new bulbs adhere to the old axis. The young filiform roots, which are but slightly branched, and are sprinkled with delicate hairs, spring from the base of this year's axis, perforating the lower part of the bulb.

The bulb is surrounded by a single row of bristle-shaped short threads (Fig. 1, c) without any dry skins. The outer portion is at this time formed of the white membranaceous transparent sheaths of the outer or lower leaf (Fig. 1, d), which is of some height, and from whose contracted orifice the flower-stem (e) and the petiole of the second leaf (f) protrude. If the position of the lamina of this outer leaf with respect to its sheath be accurately examined, it appears that that surface (β), which on account of the brightness of its cuticle and its peculiar form is to all appearance the upper surface, is turned from the aperture of the sheath while in other plants it is turned towards it; whereas the surface, which, to judge from the dull aspect of the cuticle, the keel-like projection of the midrib, as well as the margins which are somewhat rolled back toward the tip, and the arching back of the tip itself, is the under surface, forms apparently the continuation of the inner surface of the sheath produced by the petiole.* This irregularity, however, vanishes on closer inspection; for then it appears that the true upper surface has assumed all the peculiarities of the lower surface, the dull aspect of the cuticle, &c., while the real lower surface has the usual brilliancy, &c. of the upper surface; and this takes place with various modifications, sometimes merely from a bending forward of the leaf so as to expose the under surface to the influence of light, and sometimes from various degrees of torsion of the petiole.

The second leaf (f), which projects from the sheath of the first, exhibits the same phenomena. It does not, however, by any means surround the flower-stem with its sheath, but it stands in the axil which the first leaf makes with it, and is turned with its external surface (Figs. 2, 3) to the peduncle, and with the other side (δ) to the medial line of the first leaf. It belongs therefore to a lateral axis; the back of its sheath, which is far shorter than that of the first leaf, is thick and fleshy (Fig. 3): the front is far less so. The bore of the sheath is extremely narrow, since the dorsal and frontal portion rest on each other, and it appears in a

* On this side there are abundant stomata, whereas those on the other side are few in number. There the walls of the cells are undulated, here quite straight.

surrounded the bud equally perishes. The following is the result of the foregoing remarks :—

I.—The two leaves, which exist at the time of flowering and some time later, belong to two different axes; the outer to this year's basal axis which is terminated by the flower-stem, the inner to the lateral axis which proceeds from the angle which the outer leaf forms with the peduncle, and which in the following year is terminated by it.

II.—The leaves on the lateral axis (which next year becomes with reference to the new bud the primary axis) are arranged as follows :—

1. The inner leaf (f), whose sheath forms the true bulb or reservoir of nutriment when the lamina dies. It is the outermost or lowest of its own axis.

2. One (seldom two) membranaceous sheaths.

3. Another leaf (d) which surrounds the flower-stem with its sheath, and, after fruit is formed, entirely vanishes, and with which the outer leaf of the involucre alternates. This leaf is highest and innermost of its axis. It becomes external, however, by the previous destruction of the one or two outer sheaths.

III.—It is remarkable, that the first or lowest leaf in this lateral axis is a perfect leaf, and that its evolution takes place at a different period of vegetation from that of the other leaf of the same axis.

In plants which do not blossom there is normally but one leaf, whose sheath equally becomes a reservoir, while the lamina withers, and with it a sheath alternates: this is followed next year by a leaf with a fleshy sheath. Whereas the principal bud in the flowering plant is axillary, it is terminal in non-flowering individuals, and the leaves formed at their summit always belong to one and the same axis.

A bud is rarely found in the axil of the sheath. The multiplication of the plant by bulbs is rare, and seeds are therefore produced the more abundantly. It begins to sprout in the beginning of April. The seedling plant consists of the cotyledonal leaf, which is firmly fixed by the process answering to the lamina within the seed; a membranaceous sheath, a leaf which incloses a little bud in its fleshy sheath, and which is, with the exception of the cotyledon, in whose place we find in older examples the sheathing base, constructed exactly like the older but not yet

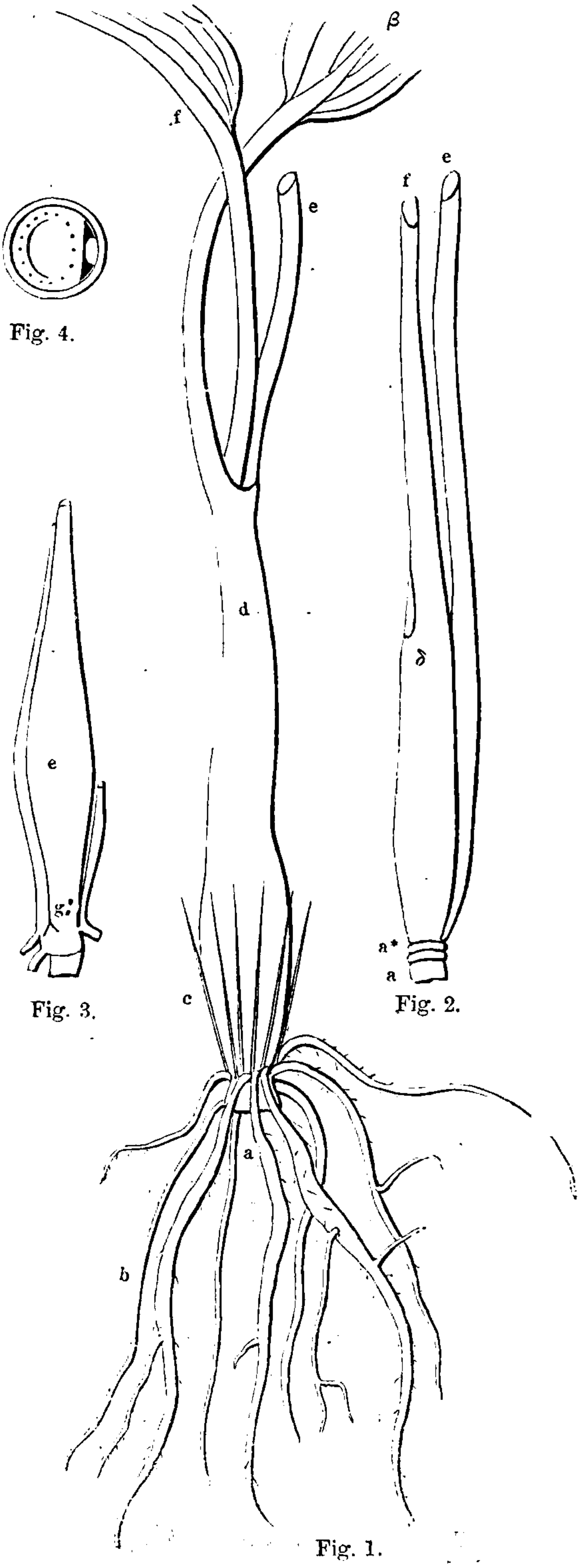


Fig. 4.

Fig. 3.

Fig. 2.

Fig. 1.

Allium ursinum

flowering specimens. The cotyledon and sheath, as well as the lamina of the leaf, soon die and vanish.

ALLIUM URSINUM.

Fig. 1. Perfect plant when the fruit is ripe.
a. old withered axis.
b. dead roots.
c. bristles at the base of bulb.
d. sheath of first leaf.
e. peduncle.
f. second leaf.
β. real lower surface of first leaf.
Fig. 2. The same with the sheath of the first leaf removed.
a. old axis.
a*. new axis.
e. peduncle.
f. petiole of second leaf.
δ. orifice of its sheath.
Fig. 3. Vertical section of fig. 2.
e. bore of petiole.
g. bud at its base.
Fig. 4. Transverse section of (d) in Fig. 1.

Tulipa Gesneriana, L. (Garden Tulip.)

When a fertile bulb is examined towards the end of autumn, the following appearances are presented. It is generally surrounded by a thin brown skin, on the removal of which the dry brown peduncle of the past season appears, furnished at its base with the withered roots (Fig. 1, a). Between it and the fresh bulb a thin dry brown skin (b) is found, which is frequently lacerated both at its base and at the upper margin. This is clothed with long shining hairs on its inner surface, especially at the base, where it is connected with that of the dry peduncle.

At the base of the new bulb on the side which is turned away from the old flower-stem, the first rudiments of the roots appear in the shape of little swellings disposed in a semicircle, whose open side is towards the stem. In most species of Allium the roots form a circle on the bulb.

The fresh bulb is commonly formed of four (Fig. 2, c), or more rarely of five, fleshy sheaths, with a rather narrow orifice. They are disposed spirally, the innermost being the shortest. In the axil of the inmost sheath which incloses the base of the flower-stem (g) is situated the minute new principal bulb (Fig. 2, h), the back of whose outer leaf is next to the flower-stem. In a vertical section through all the parts of the bulb we see that the young roots (Fig. 2, i) are formed on the same side as that on which the young bulb is seated, and that this is on the side of the fresh flower-stem which is turned away from the dried peduncle (a) of the former year. Therefore, as in Gagea lutea, each successive plant is behind that of the previous season. The evolution of

sheaths, the lowest dried, the inmost serving as magazines of nutriment. The bulbs of Tulips differ from those of most species of Allium and the genus Gagea, in that sheaths only spring from the basal axis, and not leaves. It agrees with many species of Allium, as, for instance, A. Scorodoprasum, in that the outermost sheath is soon dried up, but no such membranaceous sheath is found in the Garden Tulip, as follows the thickened sheaths in the above-mentioned species.

TULIPA GESNERIANA.

Fig. 1. Bulb at the end of autumn.
a. old peduncle.
b. dry brown skin.

Fig. 2. Section of ripe bulb.
a. old peduncle.
b. dry skin.
c. c. sheaths of which the bulb is composed.
g. base of flower-stem.
h. new principal bud which produces the bulb of the following year.
i. roots still inclosed.

Fig. 3. Young bulb in spring; all the coats, c c, in fig. 2 having been removed.
e. roots.
g. flower-stem.
h. new bulb.

Fritillaria imperialis, L. (Crown Imperial.)

The well-known thick, somewhat depressed, bulbs of this plant possess, at the time of flowering, strong, generally branched, roots. The broad scales of which the bulb is formed are few in number, and very fleshy and juicy; they are more or less confluent below, but they are not soldered together into a solid mass. Their free upper margin is, in contradistinction to the lower fleshy part, originally very thin. This, however, soon withers and leaves a scar. In the axis of the uppermost scale in front of the flower-stem, stands the young primary bulb (c). It is formed of from five to seven scales, at present distinct from one another. The first of these on the dorsal side, which is turned towards the peduncle, is tolerably flat, with two angles.

There is generally in autumn the short dry stump of the last spring's flower-stem in the centre of the bulb; which is easily drawn out, and frequently carries with it a part of the base of the axis, so that the bulb appears perforated. On the contrary, the scales of the old bulb, which belong to the same axis with the old peduncle, remain in organic connexion with those of the young bulb, which they inclose. Fresh roots spring at this time from the basal axis of this young bulb, perforate the scales of the old bulb and form a circle round their lower half (Fig. 1). The roots of the past spring which belonged to the same axis with the withered flower-stem are entirely dead. The young bulb (Fig. 1, c ; Fig. 2) contains in autumn all the parts of the plant which is to blow in the following spring : the scales of its basal axis have become stronger ; they inclose in their centre the still short and thick peduncle, which is naked at its base, but plentifully furnished above with leaves and flower-buds. There is also, already, in the axil which is formed by the uppermost scale of the axis with the peduncle, the bud of the primary bulb which is to

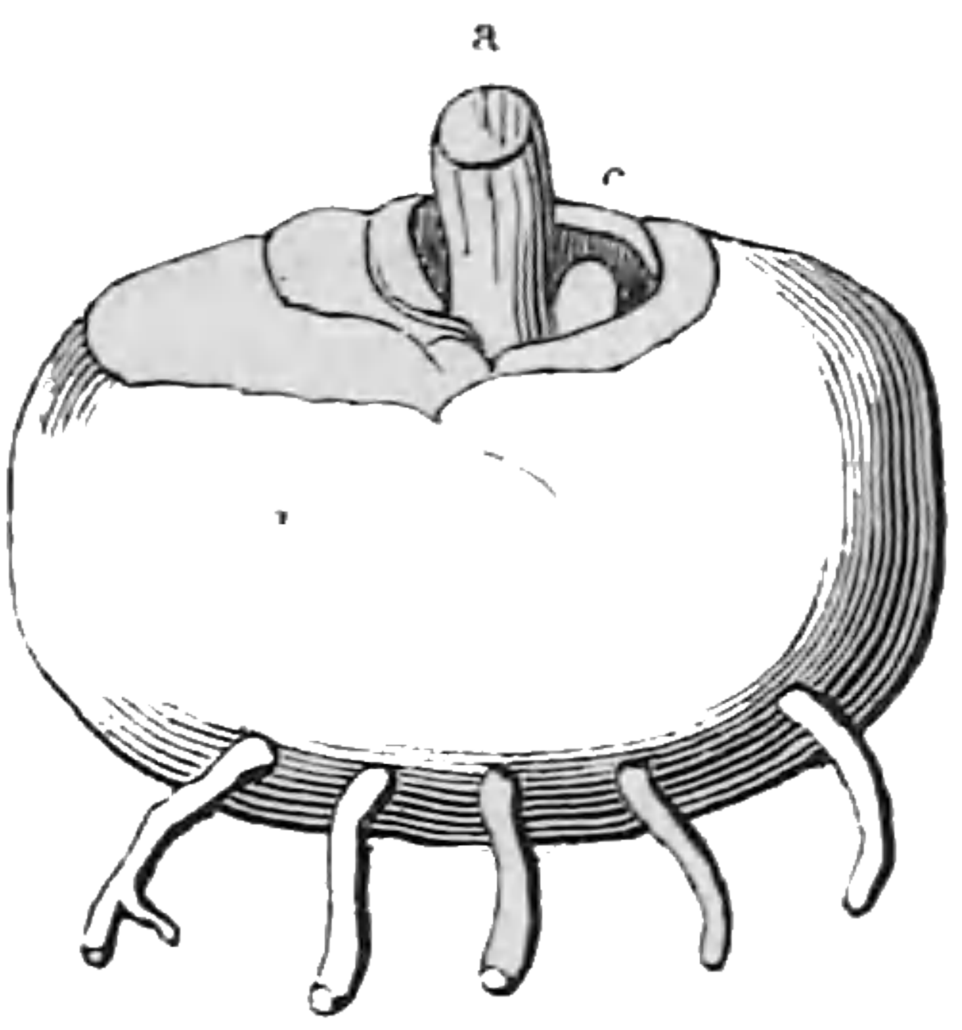


Fig. 1.

Fig 3.

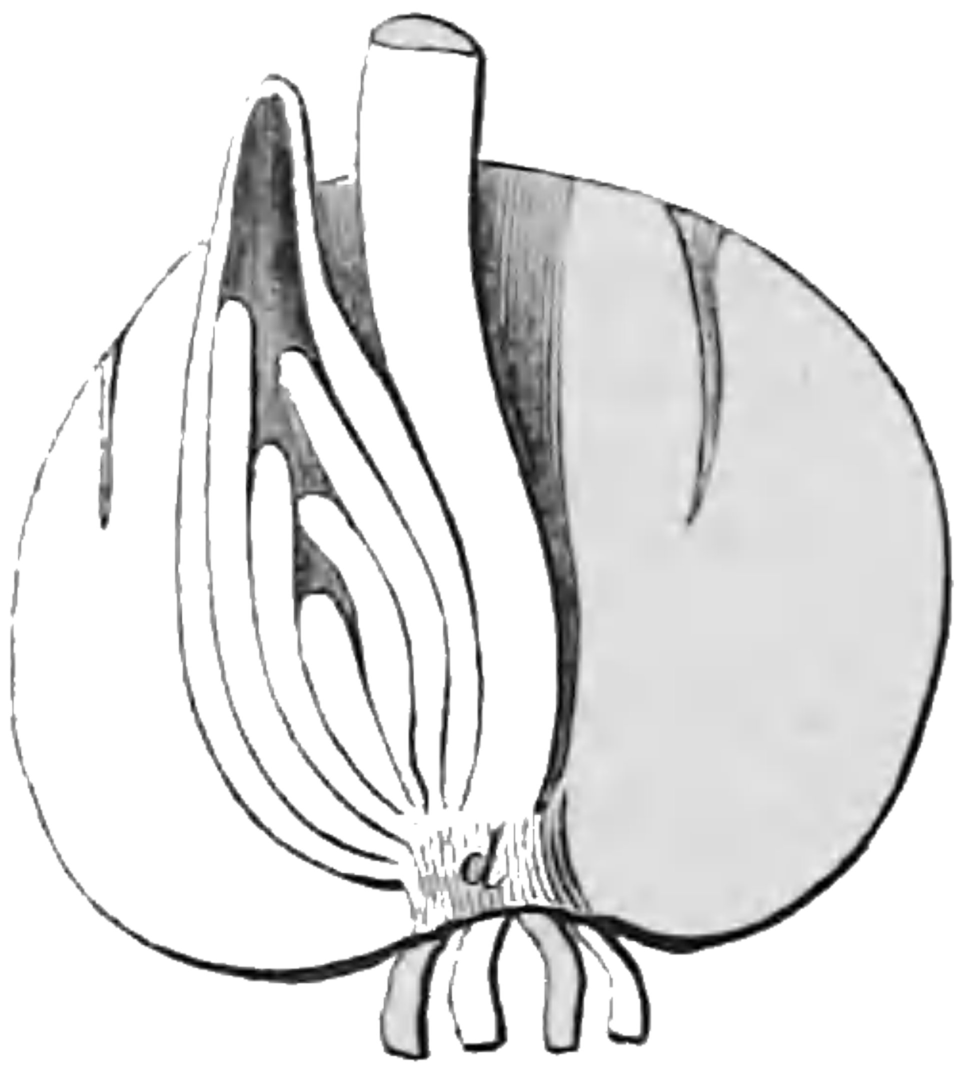


Fig. 2.

Fritillaria imperialis

blossom in the second following spring ; and there is frequently another in the axil formed by the penultimate scale in the flower-stem. It flowers occasionally at the same time with the first bud, so that there are two flower-stems in one plant. Many years, however, sometimes pass before it flowers, and it becomes consequently, when the axis which originally united the two buds is withered, entirely separated from the principal bud.

The composition of the whole bulb is most easily ascertained. A short time before flowering at the end of March, the fleshy scales belonging to last year's axis are still present, and the parts on the main axis of this year's flower-stem are as follows; the rather fleshy primary scale (Fig. 3, b), one alternating with it, and then about six short membranous scales (d). All these, which are distinct from one another, vanish almost entirely after the flowering is over. After these follow from four to six leaves (e) whose basal portion is fleshy, and the lamina membranaceous and white. The lamina is shorter in the outer leaves, in the inner gradually longer, being often five to six inches long. The basal portions are already confluent, at least in the lower leaves. After flowering the laminæ wither very rapidly, and leave a scar on the upper margin of the surviving base. The Crown Imperial grows so rapidly in spring that the nutriment stored up in the scales of last year's bulb is soon exhausted, and in consequence of the very delicate texture of their cuticle, they vanish almost entirely after flowering, and do not form, as in many other bulbs, a dry skin. During and soon after flowering the scales of the active bud attain their full growth, and the bulb is then again in the same condition in which it was before, since the bud at the base of the flower-stem is already more developed.

FRITILLARIA IMPERIALIS.

Fig. 1. Bulb in autumn about half the real size.
a. old peduncle.
b. scaly coats of bulb.
c. bud which is to flower in spring.

Fig. 2. Vertical section of do., with the bulb c, Fig. 1, more advanced.
d. basal axis.

Fig. 3. Main bud a short time before flowering.
b. primary fleshy scale.
c. second do.
d, d. short membranous scales.
e, e. leaves with fleshy bases which form the bulb destined to nourish the young bud during the autumn and winter.

Hyacinthus orientalis, L. (The Garden Hyacinth.)

The following description applies to the plant at the time of flowering. The bulb is formed of numerous very broad concentric sheaths, which exhibit a scar in consequence of the decay of their margin. Of those also (Fig. 1, a) which are seated below the short remnant of the last year's flower-stem, many are still unexhansted, and firm and juicy. Remains even of the two-year-old flower-stem are found between the sheaths, and single sheaths

tuft close to each other; it will then be generally found that the second, which expands later, stands together with the young main bud in the axil of the uppermost leaf.

After the time of flowering the basal portions of this year's leaves extend and become broader and more fleshy, and the lamina dies off at a definite point. This year's roots, also, and the lower part of the main axis perish, and separate easily from the still vegetating portions of the bulb. By autumn the young bulb has nearly attained its full growth, and the new flower-stem is visible; new roots also are sent forth at this period.

On the main axis of a bulb which has blown several years in succession, we find, in general, without reckoning the dead and dying sheaths, the formations of two previous years (I. and II.), of this year (III.), and the commencement of that of the year following (IV.). This year's plant (III.) at the time of flowering has not absorbed the contents of the leaves destined for nutriment, situated on the two-year-old portion of the axis (L), not to mention that of the previous year (II.). In this it differs from the bulb of Ornithogalum nutans, where, at the time of flowering, the scales of the two-year-old portion of the axis are exhausted. In every year's growth of the main axis, many new sheaths are formed (which serve as reservoirs of nutriment, and at a later period, when the tips are dead, cannot be distinguished from the sheaths which have arisen from the basal portion of the leaves), and then numerous leaves; whereas in Ornithogalum nutans there are only leaves, in which respect the Hyacinths have more resemblance to Orn. umbellatum, where at least the first leaf of a new axis assumes the form of a scale. The main axis of II. is the lateral axis of I.; III. the lateral axis of II., and IV. of III. The simple roots do not spring from the axis of the blooming plant as in Gagea, Fritillaria, &c. but from an older part of the main axis. The offsets are found especially in the axils of the lower sheaths, and consist equally with the primary bulb of one or more sheaths, which inclose one or more leaves.

HYACINTHUS ORIENTALIS.

Fig. 1. Bulb with the outer sheaths removed, just after flowering.
a. base of sheaths whose upper margin has perished, leaving a scar.
c. leaves cut across.
d. peduncle.

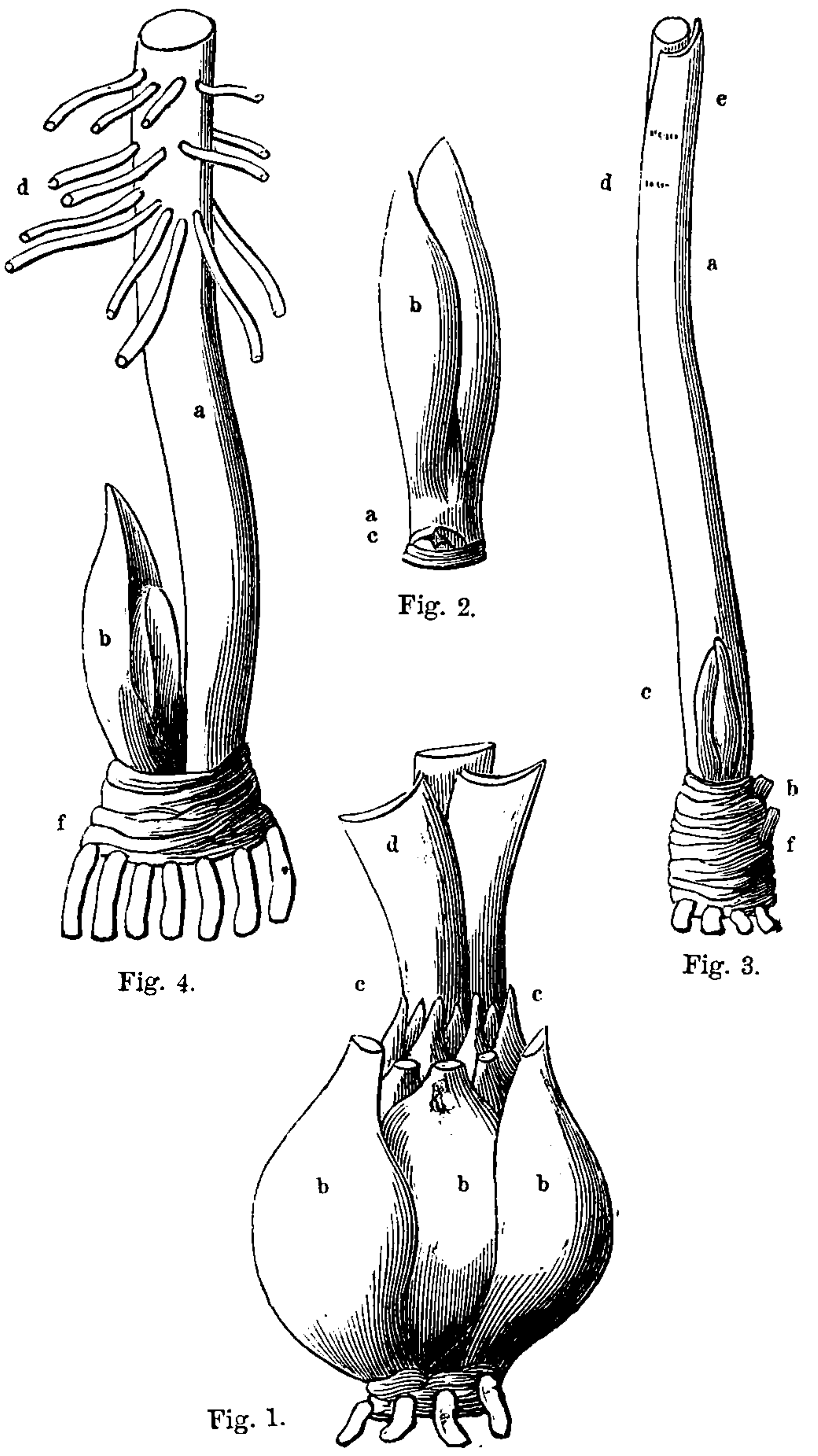
Fig. 2. All the sheaths are removed below the last year's peduncle.
b. scales above peduncle.
e. last year's peduncle.

Lilium candidum, L. *L. Martagon* and L. *bulbiferum*, L.

If the bulb of L. candidum be examined in autumn, the following structure is found. On the outside we observe ovate rather fleshy scales which have a scar at their apex (Fig. 1, b). The number of these varies from six to sixteen. The front of the uppermost of these scales, in strong bulbs, is the withered stump of the peduncle of the past summer. These scales are succeeded by numerous perfectly fresh-pointed scales, varying from six to twenty, without however presenting any intermediate forms. These, again, without any transition, are succeeded by from six to sixteen leaves, which, like the scales, are spirally arranged. These inclose in their centre the undeveloped peduncle, richly furnished with leaves (Fig. 2, a); in weak examples no flowers appear, whereas in stronger roots the flower-buds are visible. In the axil formed by the innermost leaf of the basal axis and the peduncle, there is the rudiment of a bud in the shape of small fleshy scales or cones (c), in which a spiral arrangement is manifest. The larger and outermost of these are next to the flower-stem, without however inclosing the smaller. The leaves of the basal axis give rise to the scarred scales of the following year by reason of the decay of their lamina. Exactly as in the Hyacinth there is an annual succession of scales and leaves, only in the one case the scales, and more especially the basal portion of the leaves, are very broad, in the other far narrower; the outer scales, or sheaths, therefore, of the Hyacinth involve the inner completely, and consequently form a tolerably firm bulb ; in the Lily, on the contrary, the outer scales merely imbricate the inner, and being fixed to the axis by a small point only, easily separate from one another. In the Hyacinth the produce of several years is combined in one bulb; but in the White Lily, as also in the Crown Imperial, that of two only, not, however, including the bud. It is not indeed asserted that this is constantly the case. The Lily bulb differs from that of the Hyacinth surprisingly in the evolution of its component parts ; in the former the leaves are already formed in autumn, and stand on the part of the axis which in the next year is terminated by the flower-stem, while in the Hyacinth the leaves are first developed in spring at the same time with the peduncles.

The branched roots break forth from the lower and older part of the basal axis.

The bulbs of L. Martagon and bulbiferum agree, on the whole, with one another; the scales of the first are smaller and longer than in the last, and therefore the whole bulb assumes a more



Lilium candidum, Martagon, and bulbiferum

slender form in one than in the other. Both are distinguished from L. candidum by the circumstance that merely scales are found on their rather long main axis, and no leaves.

In moderately-sized bulbs of L. Martagon there are about fifty

LILIUM MARTAGON.

Fig. 3. a. peduncle.
c. principal bud.
d. first traces of roots.
e. base of first leaf of peduncle.
f, f. scars or remains of old peduncles.

LILIUM BULBIFERUM.

Fig. 4. a. peduncle.
b. uppermost scale, with bud in its axil.
d. roots on peduncle.
f. scar of old peduncle.

Colchicum autumnale, L.

Our examination of this plant applies to its condition at the time of flowering, which takes place from the middle of August to October.

The flowering plant is connected at its base by a small round spot (Fig. 2, a) with the corm. The filiform simple and smooth roots forming a close fascicle, and by no means disposed, as in most bulbs, in the periphery of a circle while the area is free, burst through a short thin fugacious membrane which surrounds the base of the flowering plant. Scattered roots also arise externally from between the old dead organs.

The foliaceous appendages are as follows:—

1. A thin delicate, and consequently, fugacious sheath, scarce half an inch long (h). This surrounds entirely the base of the inner leaves.
2 A second white sheath (i), often four or five inches long, projects beyond this. Between its point of attachment and that of the outer sheath, the axis is undeveloped. It is turned with its back to the bulb, and presents a proportionally narrow tube. The fissure in its upper margin is not deep; it is rather thick, and the cuticle of its inner and upper surface easily peels off, so that on a superficial examination it is easy to imagine that there are two superincumbent membranes. From its orifice the blossoms (q) protrude, sometimes singly, sometimes two, three, or four. If this sheath be opened we find that its lower portion incloses (3) the still undeveloped leaves. Between the second sheath and the outermost or lowest leaf, the axis is undeveloped. The leaf alternates with the above-mentioned sheath, and has its back turned away from the bulb. It incloses

the inner leaves and the lower part of the narrow tube of the corolla, with its somewhat involute lamina; at its base it forms a short tubular sheath. If this be removed neatly at its point of attachment, we perceive that between it and the second leaf there is an internode one to two lines high and proportionally thick (Fig. 1, n). On the side of this portion of the axis, which is clothed with a shining cuticle, near the medial nerve of the first leaf, yet not close above its line of attachment, but somewhat higher, a very compressed bud, swollen below but drawn out above into a bluntish point, is seated in a shallow depression (o). Above this axillary bud there projects slightly a small still rudimentary swollen border formed by the internode, from which the bud springs beneath the line of attachment of the second leaf.

This second leaf alternates slightly with the first, the angle of divergence being from 140° to 150°. On the first glance, one fancies that this second leaf has as well developed a sheath as the first, since the fissure formed by the lateral margins does not run down to its line of attachment, the annular upper margin of the first visible internode. If, however, we try to tear it off from the axis at the point where the sheath seems to commence, the attempt does not succeed, because the leaf below the above-mentioned fissure is united with the axis. This union does not, however, extend for a small distance only. If we examine the dorsal portion of the second leaf, we find that its medial nerve runs down to the swollen upper margin of the first internode; far deeper, that is, than the fissure formed by the margins of the leaf, and that when it ceases, the back of the leaf is slightly distended. Now if the leaf is split down the medial nerve to the point of distension, we find that this is caused by a little bud (Fig. 3, δ) which is seated in the axil of the second leaf. Under the nerve there is a small narrow canal, since at this point the inner surface of the leaf is not united with the subjacent stem which is clothed with a shining cuticle. This canal calls to mind a similar structure in Gagea pratensis, and the bud which is found at the base of the canal is imprisoned in an organically closed space, but a free communication is left above with the outer air. The bud is constructed like that in the axil of the first leaf, and behind it the axil is somewhat swollen and forms a little oval cushion (Fig. 3, δ), on or in front of which the bud rests. This cushion answers to the swelling of the axis between the first and second leaf.

In the axil of the third leaf there is occasionally, though rarely, a third bud, formed exactly as the second, on a still smaller cushion and in a much shorter canal: far more frequently there is in the axil of this third leaf (in which case there is no canal) the lowest and first expanding flower which is borne by a short but rather strong peduncle. The same is the case with the fourth, fifth, and sixth leaves. More than four blossoms are rarely present, and frequently only one. Each blossom stands in the axil of a leaf. The internodes between the leaves in whose axils the blossoms are seated are very short. The leaves below the uppermost flower are often contracted into short scales. The axis is stunted above the highest blossom, and is here frequently covered with small leaves and little blossoms (Fig. 1, p). Barren plants agree in essentials with those which flower, except that about two leaves only are in general present, and that the axis ceases above the second. After the parts which appeared above the ground in autumn have withered, no remarkable change takes place in those vegetative organs with which we are concerned. In spring the parts of the axis and leaves are gradually extended.

Towards the end of May, when the fruit appears above ground, the leaves having already come forth in the beginning of April, the corm of the previous year is quite wrinkled, though still rather tough. In the young sterile plant the second tall sheath (i) is already withered above, and only a small portion remains below, above the lowest leaf, in the form of a thin brown skin;—the outer and shorter (h), as well as the sheath (f), which at first inclosed the roots, had already decayed just after flowering. This sheath has, however, no part in the formation of the brown coats. The lowest leaf (k) covers with its sheath, which is greatly elongated (from four to ten inches), all the inner parts. The lowest developed internode (Fig. 1, n) is much elongated and thickened, and has assumed the size which is attained in large full-grown corms in autumn. The portion of this internode (Fig. 1, g), between the point of insertion of the first leaf and the little bud, is also somewhat elongated, and since descending obliquely it pushes forward beneath the bud, it forms the part which is called by some authors the lateral appendage. The upper margin protrudes as a strong raised border, since the internode is not remarkably thickened above the point of insertion of the second leaf. The border rises obliquely in front, towards the medial nerve of the first leaf, and forms there, above the young bud, a blunt projecting point. The young bud (o) is at present dormant.

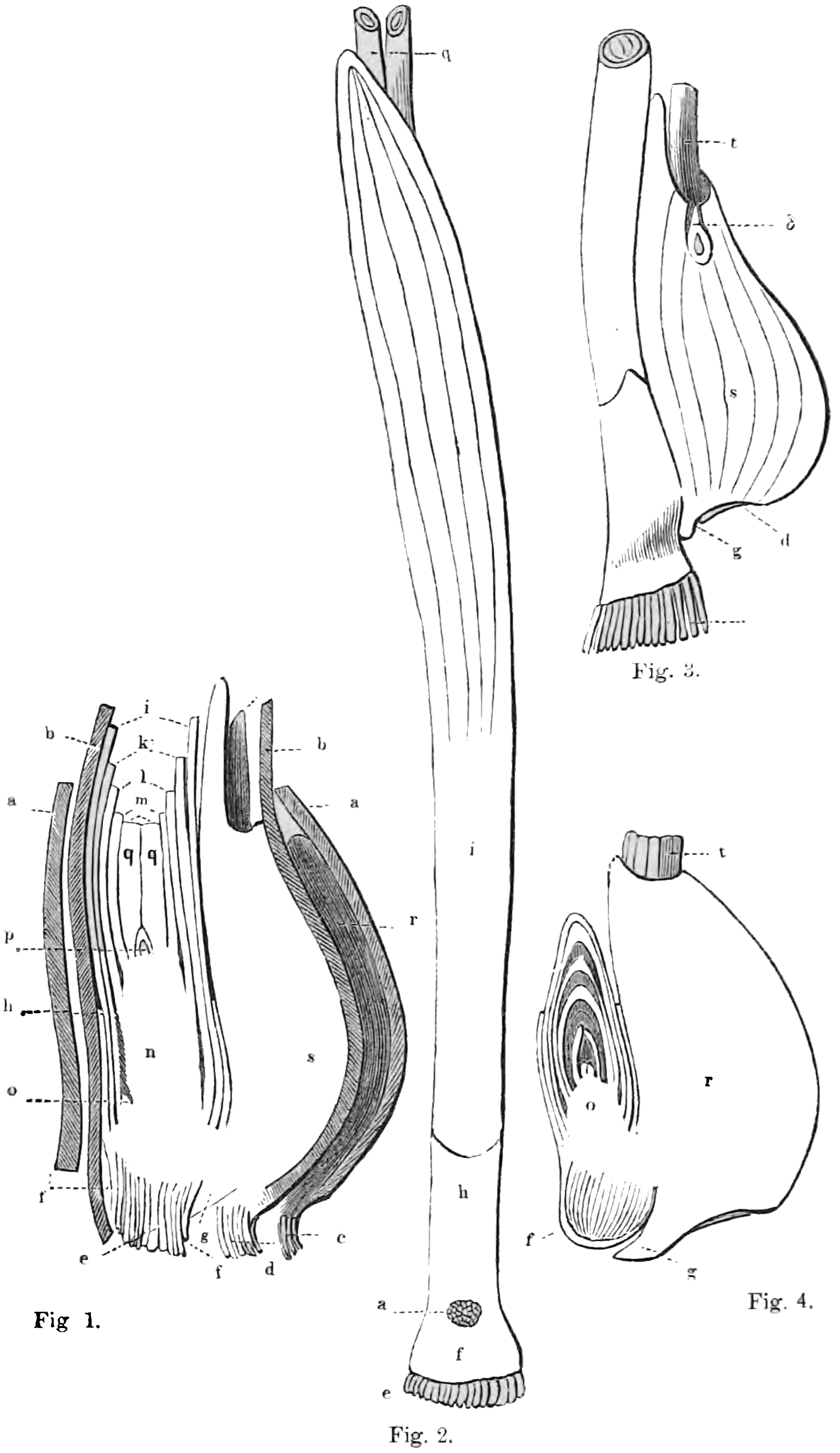
connexion with the plant which was developed at the base of the corm from the bud in the axil of the lowest leaf, and becomes perfectly free. The time of each phenomenon cannot be exactly marked, as it is subject to great variation.

When we examine then the plant in autumn, we have parts belonging to at least three different years; first, the flowering plant; then the fleshy corm which produced the flowers in the previous year, the dry brown envelope and a bunch of dead roots; and lastly, the bud which is to produce the blossoms the next year. Very frequently, however, the remains of earlier corms and their investing coats are present. Three such coats may sometimes be counted, investing one another; the older being outermost, and the youngest immediately inclosing the new corm.

Since the number of leaves which precede the formation of the primary bud is always the same, the bud being constantly in the axil of the third leafy appendage (or first leaf), and the position of these appendages is constant, it follows that the addition of each new annual period in one and the same plant has always the same direction. It is clear then that the addition of new parts in the plants which spring from the bud in the axil of the second leaf must be in a different direction from that of the primary bud. It appears, however, that no remarkable change of place is combined with this arrangement; from the fact that the brown coats envelope the produce of several years, having a narrow passage only, through which the blossoms of one cycle, which is often three or four years later than that to which the outer coat belongs, protrude without any marked direction from a straight line.

The circumstance that I have uniformly spoken of a corm and not of a bulb requires no explanation, since it is a portion of the axis, and no part of the leaves which assumes the office of storing up the nutriment for the new plant.

In conclusion, I must draw attention to a deviation from the usual position of the leaves which I do not quite understand. The second sheath in the young plant stands with its back to the corm or axis of the last year's plant. What then is the position of the first or shorter sheath with respect to this second sheath? It seems, judging from their earliest condition, as if it also stood with its back to the axis of the last year's plant. In this case the second sheath must stand before the first, and not alternating with it; if, however, we assume that the first stands on the side of the young plant which is turned away from last year's axis, it maintains its position before the leaf from whose axil the young plant springs. Both cases must be considered as abnormal, but the latter more so than the first.



Colchicum autumnale.

COLCHICUM AUTUMNALE.

Fig. 1. Imaginary section of a full-grown plant.
a, b. outer dead skins.
c. dead roots of two-year-old corm.
d. ditto of last year's corm.
e. roots of present year.
f. their common sheath.
g. basal appendage of old corm.
h. basal sheath of young plant.
i. second sheath.
k, l, m. successive leaves.
n. internode between first and second leaves.
o. primary bud.
p. termination of axis.
q. peduncles.
r. remains of two-year-old corm.
s. ditto of last year's corm.

Fig. 2. Young plant, with the envelopes and old corm removed.
a. point of attachment with old corm.
e. roots.
f. their common sheath.
h. sheathing leaf.
i. second sheath.
q. peduncle.

Fig. 3. Young plant still connected with last year's corm, the envelopes having been removed.
d. scar of old roots.
g. basal appendage of old corm.
s. old corm.
t. dead upper portion of last year's axis.
δ. second bud.

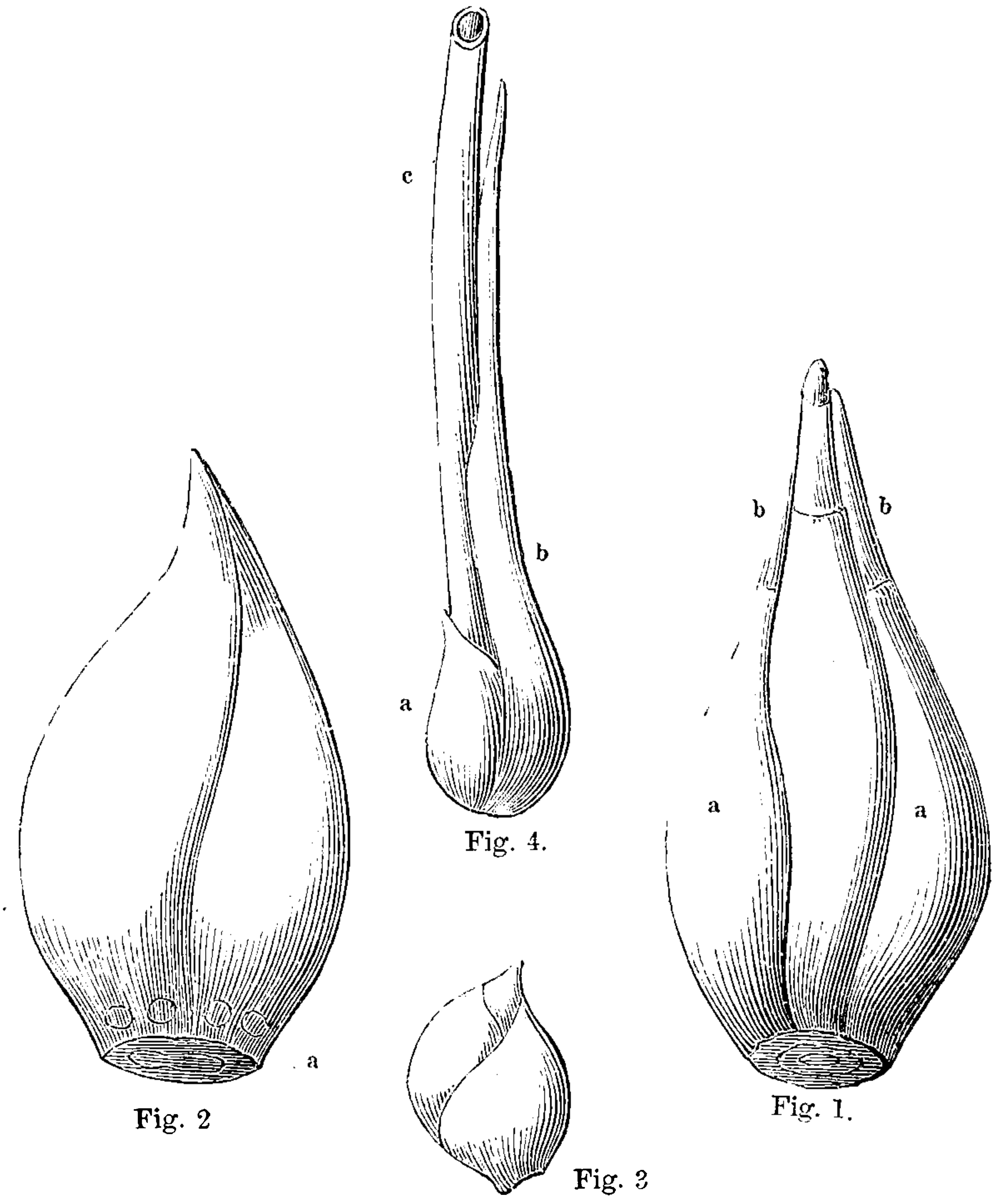
Fig. 4. Section of old corm and swelling bud.
g. basal appendage.
n. old corm.
t. dead upper portion of axis.
f. membrane inclosing young roots.
o. common axis.

Iris persica, L. *Iris Xiphium*, L.

The flowering bulb, which possesses at its base a small dry stump, the remains of the last year's peduncle, is clothed externally with numerous very thin dry skins. These are followed from their base to the height of from one to one-and-a-half inch by about five scales (Fig. 1, a), which are already quite dry as far as the upper margin, where they are marked by a scar. Then follow from seven to nine broad fleshy scales, whose tips are yet perfect.

As regards the height of these, it may be remarked that the lower decrease gradually in length, and this decrease extends from the first to the fourth or fifth; then they increase again in a higher ratio, so that the uppermost is the largest; the upper ones, however, are thinner and more membranaceous. Buds occur in the axils of the lower of these leaves whose tips are still perfect (and, indeed, though not so regularly, in the axils of the lower scales), and the size of the buds is in an inverse ratio with that of the mother leaves, the largest bud being found in the axil of the smallest scale (the third, fourth, or fifth). A rather small bud occurs also in the axil of the next somewhat larger scale; the axils of the three or four upper scales are barren.

The bulbs of Iris persica differ from those of the Tulip in that their main axis produces leaves (No. 2), from that of the Hyacinth and Lily in the short duration of its parts, and from that of Tigridia pavonia in that the main bulb is not seated immediately at the base of the peduncle, but in its stead many other leaves.



Iris persica and I. Xiphium.

Iris Xiphium bears a great resemblance to I. persica in the structure of its bulbs. In a state of rest (at the end of summer or in autumn) the outermost scales are dry and membranaceous, followed by fleshy scales which have no closed sheath, and which are still perfect at their tips (Fig. 2); their margins also are not separated from one another, but that of the one is wrapped for a short distance over that of the other, by which character the bulb of this species may be distinguished from that of I. persica, with which it agrees in size.

In spring from about eight to ten leaves arched backwards grow above the sheaths, which extend a little so that the uppermost of them is the longest, and which, like the next below it, is far more membranous than the others which contain the nutriment that is gradually absorbed. A few of the leaves grow at the base of the peduncle, but the others, separated by tolerably large internodes, are disposed on the peduncle, which is about a foot high, and is terminated by a flower near which another breaks forth. Buds occur only in the axils of the scales, and not in those of the leaves; the lower are smaller, the upper larger. Two modifications of the buds or young bulbs occur in cultivated specimens. The larger (Fig. 3), which are seated in the axil of the highest scale, are formed at the time of the flowering of the parent bulb, in June, merely of sheathing scales. The first, in the usual position, is quite membranaceous, and becomes at a later period a brown skin. The second is of the same nature, while the third and those which follow are very fleshy. No leaves are at present visible. The bulbs in the axils of the second and third scales, reckoning from above (Fig. 4), are formed of one or two thin sheathing scales (a and b) which are followed by from one to three leaves (c) whose cylindrical blade, like that of the leaf of a non-flowering bulb of Ornithogalum nutans, is fully developed at the time of the flowering of the parent bulb; these leaves are followed by some short sheathing scales, a structure near to that of the buds of Iris persica.

The lower buds seldom come to perfection. Here also the whole of the parent bulb perishes after flowering.

IRIS PERSICA.

Fig. 1. Bulb in a state of rest.
a. fleshy portion of its scales.
b. dried portion of scales of bulb.

IRIS XIPHIUM.

Fig. 2. Bulb from which the dry coats have been removed.
a. rudiments of filiform roots.
Fig. 3. Young bulb in axil of highest scale, showing the successive scales.
Fig. 4. Young bulb in axil of second and third scale.
a, b. their sheathing scales.
c. leaf.

Crocus vernus, L.

When the corm begins to vegetate in autumn, numerous simple smooth fibrous roots penetrate the outer or lower dried sheaths,

I 2

and form a circle round its base. The bud or buds destined to flower in the spring are seated on the crown of the corm, which is slightly depressed. Near these the dry flower-stalk of the preceding season frequently retains its place (Fig. 2, b) at the back of the lower extremely short sheath (a) of the new bud. If this bud be examined in autumn, when it just begins to project beyond the dry lacerated coats of the corm, it is found to consist of about five white membranous sheaths. The innermost of these incloses the still extremely short leaves, which are from three to five in number. There are no intermediate stages between the sheaths and leaves, in which the middle never projects strongly on the under side, not keel-shaped but with two angles; the lateral margins being rolled back. They have a very low almost annular closed sheath of equal height all round. The leaves are not strictly alternate, for their angle of divergence is less than 180°. The axis on which the new leaves are seated is slightly swollen, but their internodes are not yet developed. The innermost leaf surrounds with its short sheath the base of the blossom, which is still extremely small, and is immediately enveloped by two highly membranaceous sheaths, of which the outer springs from the base of the flower-stem; the second is separated by a short articulation above it and close under the ovary. The principal bud for the year following is visible in the axil formed between the innermost leaf and the peduncle, the first sheath of which turns its outer side to the peduncle, and the inner to the mother leaf. A tolerably large bud is also not unfrequently found in the axil of the last leaf but one, which is equally capable of producing a blossom the next year; and buds, though smaller, are also found in the axils of the lower or outer leaves.

As vegetation proceeds, while the roots are elongated, the parts of the buds are extended; the outermost sheath (Fig. 2, a) remains very short, and indeed soon disappears altogether. The same is the case with the second sooner or later. The rest are elongated in such a manner that the inner always extend beyond the outer. The leaves project from the orifice of the fifth and longest sheath, and the blossoms from within the leaves. The young bud in the axil of the uppermost leaf alters very little; it increases only slightly in circumference. The new common axis gradually becomes thicker, and while the three or four sheaths which remain after the time of flowering stand close together one above the other as regards their point of insertion, we find now between the uppermost sheath and the lowest leaf a marked

Arum they vanish altogether. In this respect the Crocus corms resemble the analogous bodies in Sturmia and Colchicum, though in other respects very different. Colchicum and Arum, however, differ from Crocus in that their roots do not spring from the last

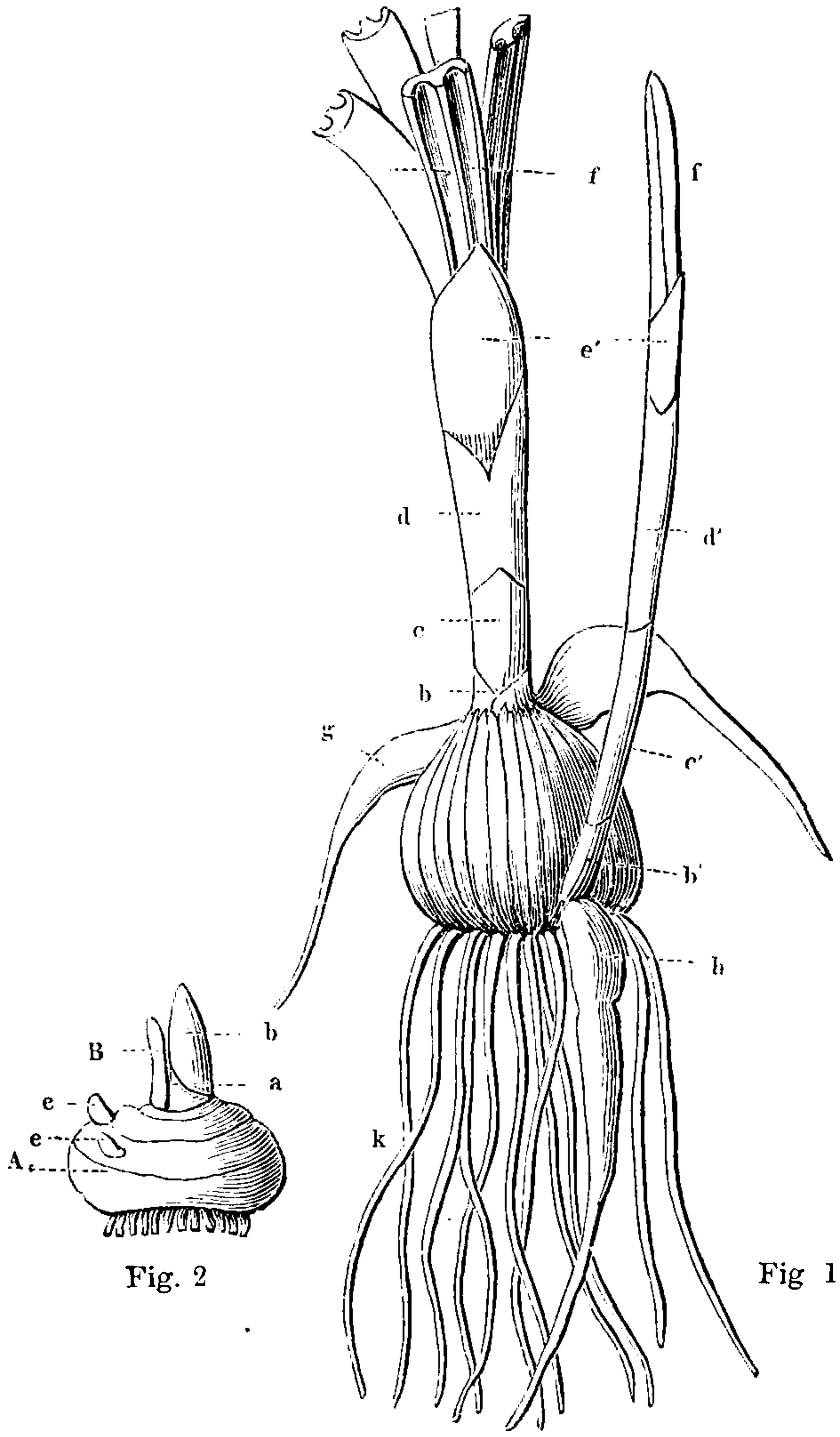


Fig. 2

Fig 1.

Crocus vernus.

year's corm as in the genus before us, but from the base of this year's plant, the base of whose axis is to contain the nutriment for the ensuing year. If it be objected that this difference does not exist where tuberiform roots spring from the base of this year's axis, it must be remembered that at the same time roots are present at the base of last year's corm, and derive their principal nutriment from it, and that the base of the axis which this year sends out transitory tuberiform roots, will next year produce the normal fibres.

CROCUS VERNUS.

Fig. 1. Base of plant in spring.
b. lowest sheath.
c, d, e. 2nd, 3rd, and 4th sheaths.
f. leaves.
g, h, i. tuberiform roots.
k. filiform roots.
b′, c′, d′, e′, f′. analogous organs in lateral accessory bud.

Fig. 2. Corm deprived of its coats in autumn.
A. corm.
B. remains of old peduncle.
a. lowest sheath of principal bud.
b. second do.
e, e. accessory buds in axils of lower leaves of last year.

Convallaria majalis, L. (Lily of the Valley.)

The dried leaves of the previous year are still visible in spring, and involve the base of this year's plant. Next to these follow from four to six sheaths closed in front, of which the inner constantly project beyond the outer. Then follows a small membranous sheath, in front of which is the peduncle, which produces no leafy appendage below, but the first bract above bears in its axil the first flower. No bud is found in the axil formed by the above-mentioned scale and the peduncle. On the other side of the peduncle the two or three new leaves are seated, of which the first or outermost does not stand with its back to the peduncle, but obliquely. Occasionally the leaves do not stand immediately close to the peduncle, but are involved in a long sheath, which then is turned with its back towards the peduncle.

The leaves are furnished with long closed sheaths. At the base of the sheath of the innermost there is already in spring a little bud. If this is examined again in autumn, it shows completely the same organisation as the plant in spring above described, only everything is undeveloped; it is then especially clear, that the scale immediately before the peduncle involves with its borders not merely the peduncle, but also the still rudimentary leaves which stand upon the other side of it.

Besides the main bud, another far smaller is found normally in the sheath of the inner leaf near the main bud where the margins of the first sheath are united to each other. Even in spring this is still very small when the main bud is ready to flower; it is formed of many sheaths, and generally remains undeveloped.

Besides these buds with undeveloped internodes, there are formed on the knots of the underground creeping axis, lateral axes, whose first internodes which produce sheaths are strongly developed. At the tip of these runners the above-mentioned organisation is repeated with undeveloped internodes.

The order of the parts in the basal axis agrees in essentials with that in the Amaryllideæ; for there, as here, the peduncle is lateral, while the primary bud is terminal. The disposition of the leaves on the basal axis is, however, different, as for instance in Amaryllis formosissima. In this only leaves occur, whereas in Convallaria majalis a number of sheaths stand immediately below the peduncle, and below and on the outside of these the two or three leaves, which are developed a year before the evolution of the peduncle which those sheaths surround, and which at the time of flowering are dried up. The new leaves, which a short time before the appearance of the flowers of Am. formosissima come out near the peduncle, may be compared with the new leaves of C. majalis, so far as they stand in either case on the basal axis above the peduncle, and belong therefore properly to the next peduncle. In the case in which a sheath appears first above the peduncle in C. majalis this has the same position with respect to the peduncle, which the long-sheathed leaf which answers to it has in Am. formosissima. C. majalis agrees with Leucojum in the circumstance that both sheaths and leaves occur on the basal axis; but they disagree in their mode of arrangement.

Galanthus nivalis, L. (Snowdrop.)

The bulb at the time of flowering is constructed as follows:— On the outside are found a few very thin and dry brown coats. After these are removed, a white fresh sheathing scale appears, with the margins united; rather fleshy, but of a looser texture on the inner side, about half an inch long (Fig. 1, a). The upper margin is marked all round by a scar. The new roots form a circle at the base. From the orifice of this fleshy coat projects a long sheathing scale (e) which involves the peduncle (h) and two leaves (f, g), and generally, but not always, a second shorter scale (m) of a lateral bulb, from whose mouth projects the tip of one or two leaves (n), but no flower-stem. The withered tips of two scales (b, c) also peep forth from the same common orifice. If the fleshy coat is now removed, besides the lateral bulb we perceive two scales also closed in front (Fig. 2), but having

and alternates with the parent leaf. Such a position is the more surprising in the Snowdrop, since the lateral bulb has quite the normal position with respect to its parent leaf. It appears, however, that a border, though extremely small, proceeds from the lowest lateral margin of the upper leaf which encircles the bud, indicating that the bud cannot belong to the axil of the lower leaf; indeed, the upper leaf often encircles the bud with the lowest portion of its margin, though only slightly. On the whole, then, we come to the conclusion that the first leaf of the bud must be regarded as next in succession to the upper leaf (g), with which it alternates; that the bud is terminal; and that the peduncle is in the axil of the upper leaf (g).

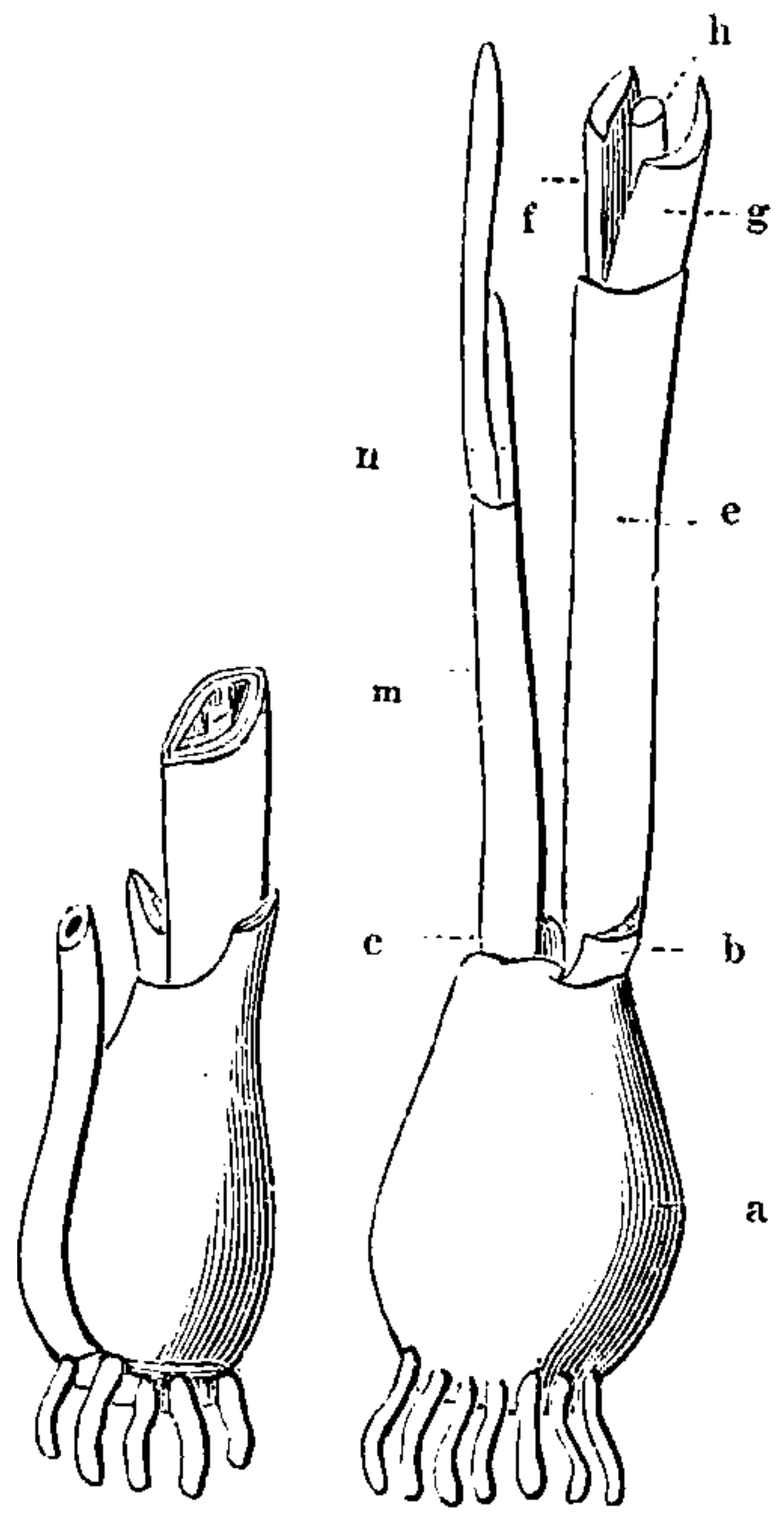


Fig. 2. Fig. 1.

Galanthus nivalis.

If we now examine further the structure of the bulb, we find that the upper portion of the sheath (e) of this year's plant dies and disappears, while the lower remains as a reservoir of nutriment. It then becomes the outer coat of the bulb (a), closed all round, and showing a scar, above and from whose axil the lateral bulb is developed. The first leaf loses only its lamina, and becomes the sheathing scale (b), which has a scar at one point only of its upper margin; the blade of the second leaf likewise perishes, but its base remains, and forms the fleshy scale (c). The corresponding parts of the former year's bulb are entirely exhausted, and are reduced to dry skins.

The composition of the Snowdrop bulb is so far quite simple, that at the time of flowering only the basal parts of the last year's growth are fresh, but those of the former year completely perished. In this respect it is like the bulb of Ornithogalum umbellatum. It however deviates remarkably from this and the other Liliaceæ and Irideæ, which have been described in the position of the main bud and other points. Sterile plants have also generally two leaves, which are contained in a sheath. The second leaf has also a closed sheath in which the young bud is inclosed, whose first leaf alternates with the second leaf.

The spathe, out of which the blossom bursts, is originally formed of two leaves, which, however, at length become confluent.

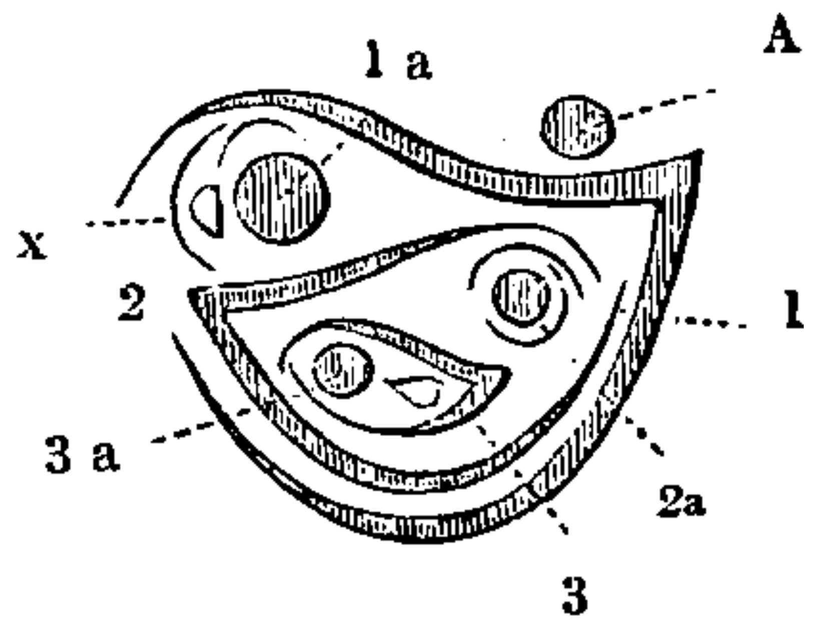
GALANTHUS NIVALIS.

Fig. 1. Bulb at the time of flowering.
a. outer coat of bulb.
b, c. first and second scale.
e. long sheathing scale.
f, g. leaves.
h. peduncle.
m. sheath of lateral bulb.
n. leaf of ditto.
Fig. 2. The same with the outer coat removed.

Alstrœmeria Peleyrina, L.

In contradistinction to all those Liliaceæ which have been submitted to examination, the Amaryllideæ exhibit lateral peduncles and terminal primary buds. It becomes then matter of interest to examine such Amaryllideæ as are not bulbiferous, and which Endlicher calls Anomalæ, to see whether they, like the true Amaryllideæ and Narcisseæ, have lateral peduncles. For this end I have studied Alstrœmeria Pelegrina, and have arrived at the following result:—

The horizontal axis from which the more or less tuberiform incrassated roots spring forth, and which are branched at their tips, is clothed with short broad scales or a rather white and thin substance. One of these scales (Fig. 1) incloses with its margins the young peduncle (1 a), which it is well known is frequently sterile, and in the axil formed by the scale with the peduncle there is a bud. The outer leaf (2) of this is placed with its back towards the peduncle, though rather obliquely, and incloses again with its margin a peduncle (2 a), as also another bud (3) in the axil formed with it, which again repeats the same structure. The peduncle then is terminal, the primary bud axillary, and the plant presents entirely in this respect the phenomena of Aloe margaritifera, only in the latter everything is plainer on account of the vertical axis and perfect leaves. The above results can be obtained only in Alstrœmeria from the young axis.



Alstrœmeria Pelegrina.

In the axil of the second leaf (x)—the leaf which incloses the primary bud reckoned as the first—at the base of the peduncle, we frequently observe a second smaller bud. If this is developed the main axis becomes branched.

ALSTRŒMERIA PELEGRINA.

Fig. Imaginary horizontal section to explain the position of the leaves, peduncles, &c.

A, 1 a, 2 a, 3 a. peduncles.
1, 2, 3. scales.
x. second leaf.

(To be continued.)

with five styles, said to be a branched shrub two to four feet high, inhabiting wet places in the valleys, may possibly be this.

Hypericum oblongifolium.

In general appearance the plant resembles H. elatum ; but it has very large rich reddish-yellow flowers, and firm sessile ovate acute coriaceous leaves, slightly marked with transparent dots, some of which are minute and circular, others larger, long, and linear. The flowers appear at the ends of the branches in forked cymes, having oval leafy bracts recurved at the point. The sepals are large, roundish ovate, very blunt, and slightly toothletted at the edge; the stamens are scarcely polyadelphous; the pistil has five distinct recurving styles rather shorter than the ovary.

CRYPTOPHRAGMIUM CANESCENS *Nees v. Esenbeck in D.C. Prodr.*, XI. 95.

A soft-wooded stove Acanthaceous plant, raised from seeds sent from Ceylon by G. U. Thwaites, Esq. It is a perennial, growing about two feet high, and covered all over with a fine soft down. The leaves are opposite, thin, wavy, acute, somewhat decurrent upon the petiole, and so forming a wedge-shaped base; in length they vary from four to six inches. The flowers are pure yellow, and appear in one-sided spikes, partly axillary, partly terminal, covered all over with long straight hairs, among which a few glands are intermixed; hence the name of canescens, or hoary, applied to the plant in Botany. The sepals and subtending bracts are linear-subulate, rather obtuse, and as long as the corolla, which has a nearly straight tube, and a two-lipped limb, the upper half of which is erect and emarginate, the latter divided into three oblong blunt lobes, of which the intermediate is the broadest. There are only two stamens, which arise from the base of the lower lip of the corolla; the anthers are beardless, unequally two-celled, with the larger cell mucronate at the base. The stigma is an oblique oval blunt terminal area, with a furrow along the middle. The ovary is many-seeded, glandular near the point, and seated upon a fleshy cushion-shaped base.

This plant cannot be called showy; yet there is considerable minute beauty in its shaggy calyxes and pure yellow corollas. It requires a hot damp stove, in which it grows freely in a mixture of sandy loam, peat, and leaf-mould, striking readily from cuttings. Mr. Thwaites reports that his seeds were gathered in Ceylon at an elevation of 6000 feet above the sea.

CALCEOLARIA ERICOIDES. *Vahl. enum.*, I. 190. *D.C. Prodr.*, X. 221.

Although this plant, when in the state in which it is here represented, straggling upon the open border, does not hold out much promise of beauty, yet in its natural condition, upon its own mountains, it would seem to be really handsome. A dried specimen now before us, collected by Hartweg, in Colombia, is a branch of a stiff erect shrub, terminated by a dense naked panicle nine inches long. Mr. Anderson of Edinburgh, from whom this

Calceolaria ericoides.

was received, raised it from seeds communicated to him by Dr. Jamieson of Quito, and describes it as a wiry woody shrub, partly upright and partly procumbent; when the wood is ripe, very like Erica odore-rosæ. Its seeds were gathered at the height of 12,000 feet above the sea. The whole plant is covered with a short coarse felt. The leaves are linear, with the edges rolled back till they meet. The inflorescence is also covered

delicate abortive stamens having been overlooked by the former author. Like many Acanthads, the foliage of this plant is rather coarse and weedy, but the flowers are striking objects. It is, however, very tender, and requires all that a hot damp stove can give it.

VIBURNUM SUSPENSUM.* *Of Belgian Gardens.*

Under this name the Society received from Mr. Van Houtte, of Ghent, an evergreen shrub nearly related to V. dahuricum, from which it is readily distinguished by its large smooth leaves, and drooping compact cymes of greenish white flowers, a little tinged with yellow. Its manner of growth is that of a Laurustinus, but the leaves are thinner, strongly veined on the under side, crenate, and rounded at the point, and of a bright uniform green. The tube of the corolla is rather more than a quarter of an inch long, and cylindrical; the limb is divided into five blunt lobes shorter than the tube. The ovary is one-celled.

The plant flowered in a glass wall, last February. It grows freely in any good garden soil, and is increased by cuttings of the half-ripened wood. Should it prove hardy it will be valuable. Concerning its native country no information has been gained.

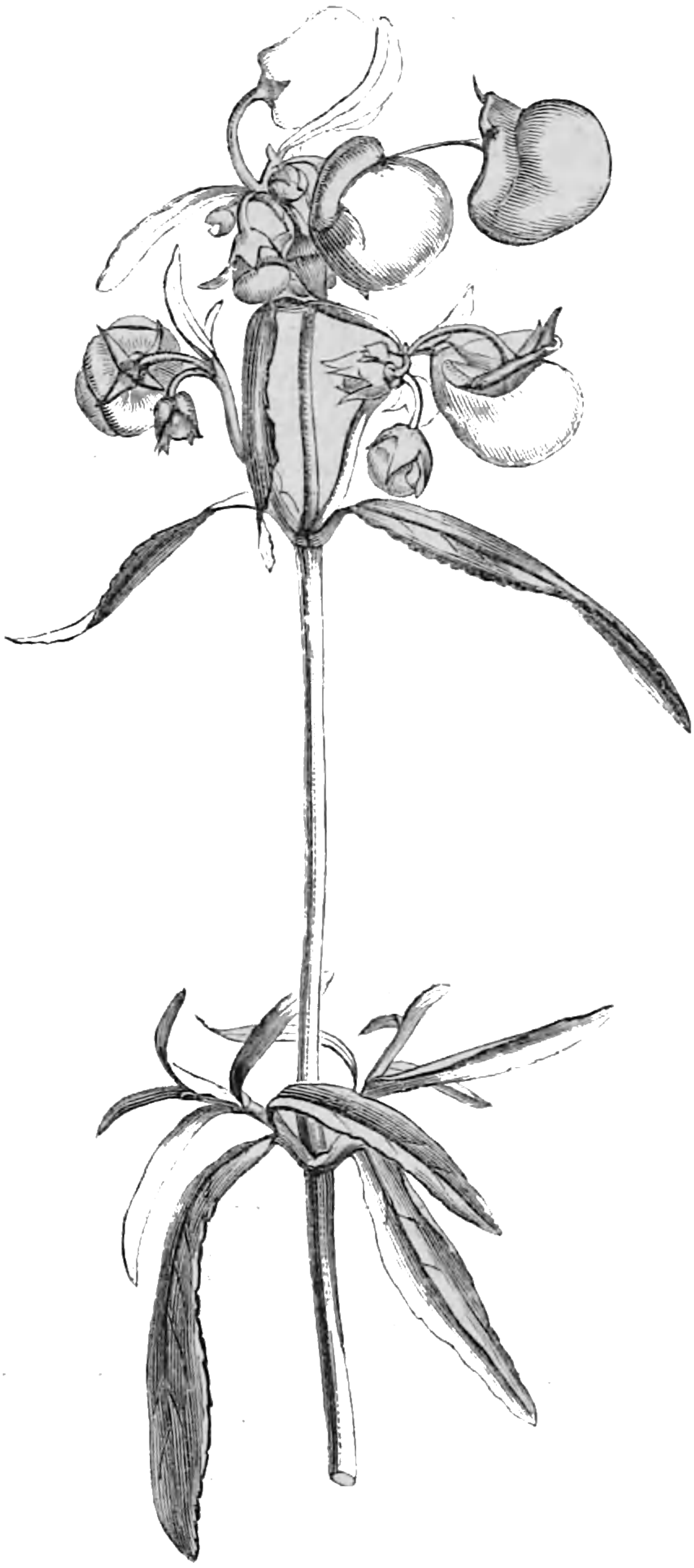
CALCEOLARIA HYSSOPIFOLIA. *Humb. B. & Kunth nov. gen. et sp.*, II. 386. *D. C. Prodr.*, X. 222.

A specimen of this species was sent by J. Anderson, Esq., of Maryfield, under the name of C. lavandulifolia (which is a different plant), with the following memorandum :—

"Dr. Jamieson describes this as perhaps the handsomest we have. It grows on pastures above the level of Quito, say at 10,000 feet. It is truly an elegant shrub, about two feet high, and throws its panicles of bloom all over and around the plant, so that it looks as if adorned with a canopy of white and golden balls: the blooms partake of both colours, which greatly heightens the effect. The spike sent is from a plant put out all summer on the border, where it luxuriates more than in the greenhouse." —*August* 16, 1852.

* *V. suspensum* (Solenotinus) foliis oblongis obtusis crenatis glabris basi acutis petiolatis, cymis densis pedunculatis nutantibus stellato-pubescentibus, corollæ tubo cylindraceo limbo obtuso longiore.—*J. L.*

It is certainly an acquisition, on account of the novelty as well as beauty of its appearance. The stem is erect, stiff, polished,



Calceolaria hyssopifolia.

and dark purple. The opposite leaves are linear-lanceolate, flat, minutely serrated, with a decided tendency to droop; they are not at all hoary on the under side, by which circumstance they are known from C. lavandulifolia. The annexed cut represents a lateral branch only, but gives the characteristic peculiarities of the plant.

Maxillaria hirtilabia.*

This species, which has appeared in several collections in this country, is strikingly different from any other cultivated species except M. setigera. It has flat round pseudobulbs, and leaves broadly strap-shaped, with a long channeled footstalk, and of a most beautiful green. The flower-stalks grow from the base of the pseudobulb, as in M. punctata; they are completely covered by loose inflated sheaths of an olive-brown colour, tipped with green; the point of the uppermost often rises above the top of the ovary, and always covers that organ partially. The sepals are broad, oblong, erect, of a rich Crocus yellow, tinged with red at the back. The petals are much narrower, of the same length, nearly white, and, when the flower is in perfection, diverge abruptly near the points. The lip is much shorter than the petals, more yellow, stained at the edges with dull purple, and thickly clothed with hairs on the upper side.

The introduction of this plant is forgotten by those who possess it. It is a native of New Grenada, where it was found by Schlim, one of the collectors employed by Mr. Linden, near San Pedro in the province of Ocaña, at the elevation of 4800 feet above the sea, blossoming in February. A beautiful specimen has been received from the garden of the Lord Bishop of Winchester at Farnham Castle.

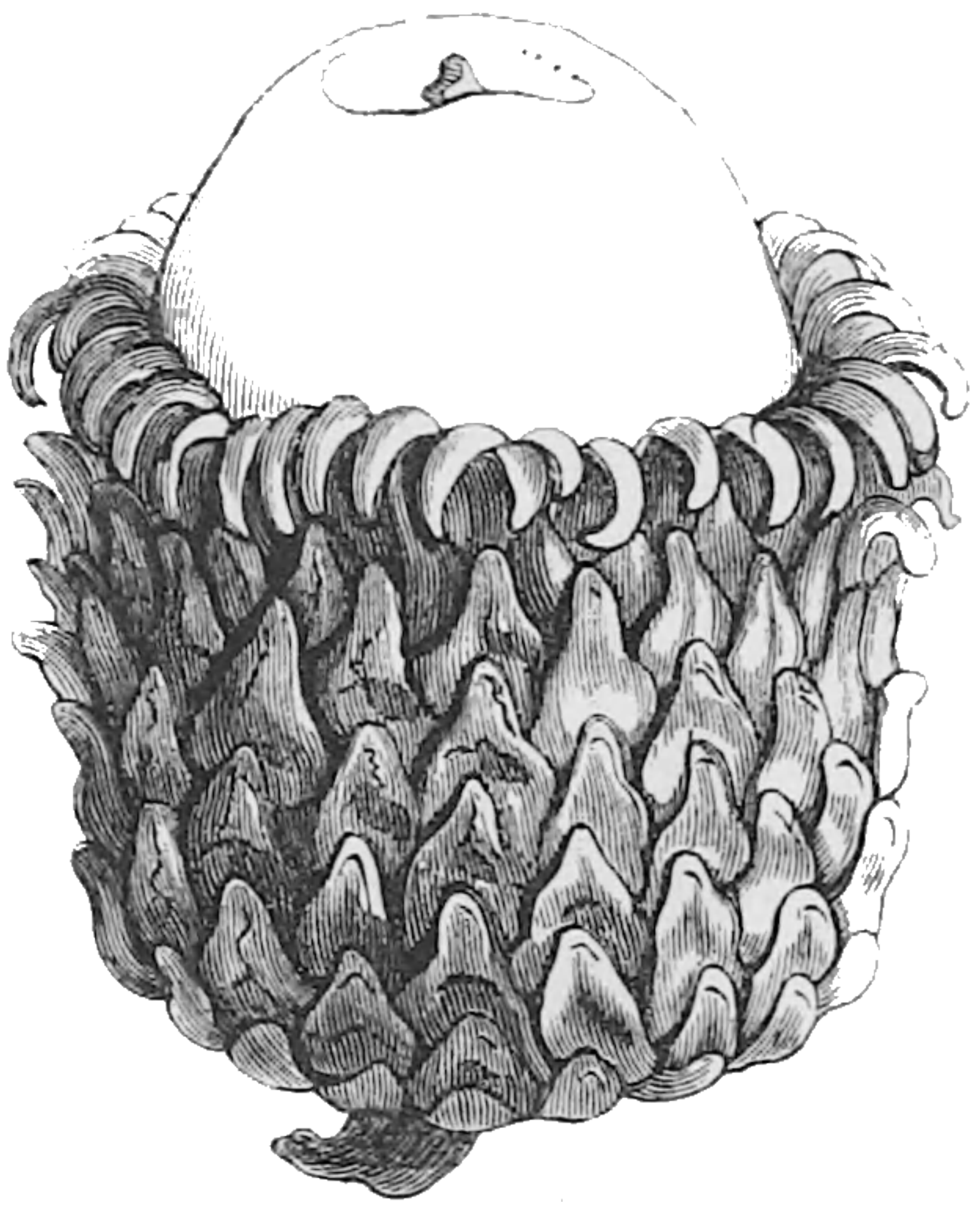
Quercus infectoria. *Olivier in Willd. sp. pl.*, IV. 436. *Voyage dans l' Empire Ottom.* I. 253, t. 14, 15. *Loudon's Arboretum Britannicum*, 3, p. 1928.

Although it is stated in Catalogues that this Oak, which produces the Nutgalls of commerce, was introduced to cultivation in this country in 1822, it is extremely doubtful whether the statement means anything more than that acorns had then been

* *M. hirtilabia;* (acaulis, uniflora,) pseudobulbis ancipitibus rotundatis, folio oblongo-ligulato longè petiolato, vaginis pedunculi imbricatis cucullatis supremâ ovario longiore, sepalis oblongis erectis, petalis angustioribus labello longioribus, labelli trilobi secus medium hirsuti laciniis oblongis lateralibus brevioribus rotundatis intermediâ margine undulatâ, callo oblongo indiviso, columnâ elongatâ glabrâ, antherâ acutè cristatâ.—*J. L.*

QUERCUS BRANTII. *Lindley in Bot. Reg. misc.* 1840. p. 41.
Q. persica. *Jaubert and Spach.*

When in the year 1839 (?) James Brant, Esq., H. M. Consul at Erzeroum, visited Kurdistan, he was accompanied by Dr. Edward Dickson, who prepared for the herbarium a considerable number of the more remarkable plants met with during the journey.



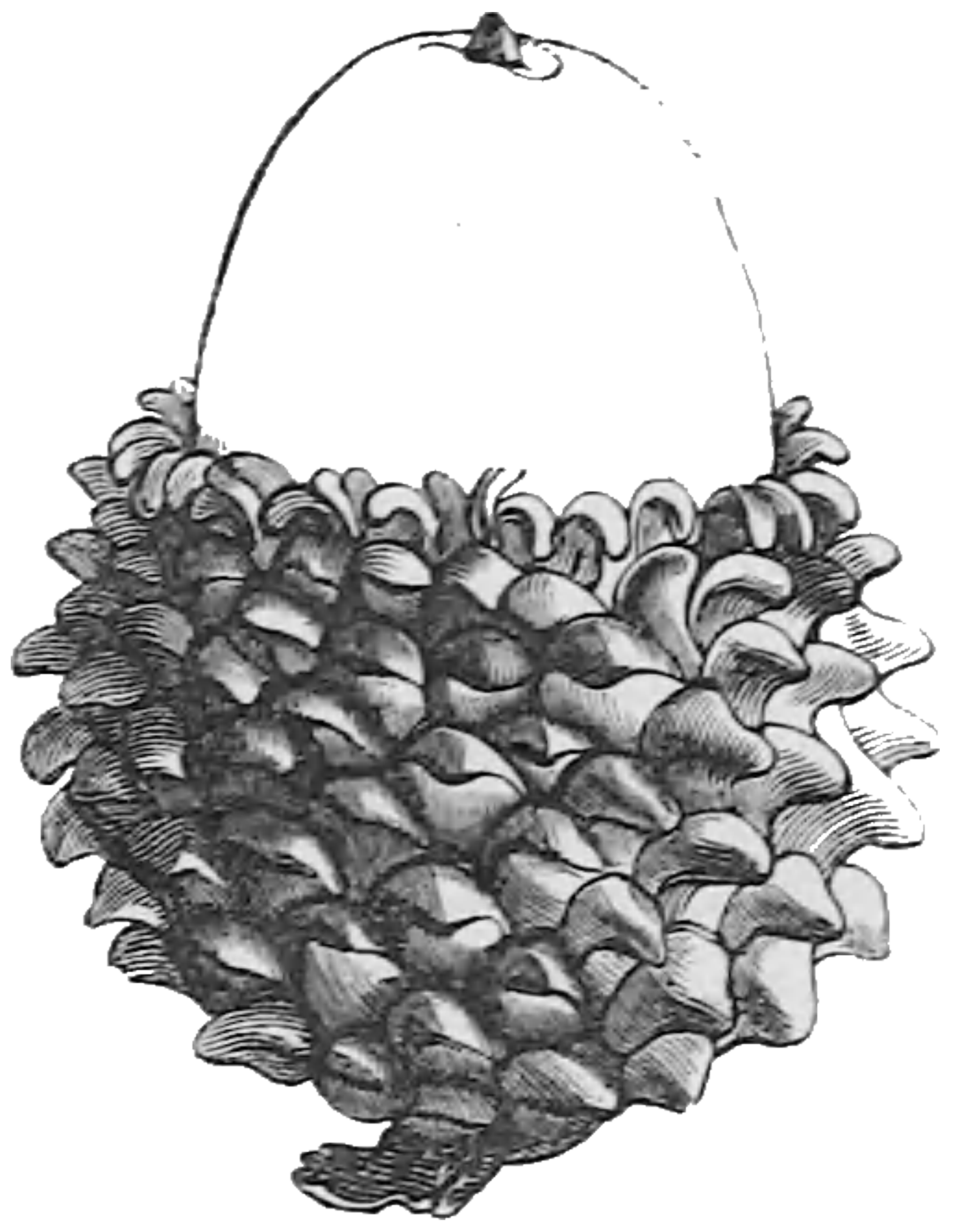
Acorn of Quercus Brantii

The collection having been afterwards presented by Mr. Brant to the Hon. Wm. Fox Strangways, was given by the latter gentleman to the writer of this notice, who published in the Botanical Register for 1840 an account of the remarkable Oaks which formed a part of Dr. Dickson's* herbarium. Among them was a very remarkable species, named after Mr. Brant, the great heart-shaped, bristle-toothed, leathery, woolly leaves of which, measuring as much as six inches by four, especially attracted attention, as of a plant likely to be ornamental in this country. Many attempts were made to procure acorns of the species, but in vain, until Mr. Layard took such measures as resulted in the despatch of a box of them, which arrived safely in the year 1850. Among these acorns there were some of remarkable size, one of

* It is right to state that the author of the notice in the *Botanical Register* was not aware till long after 1840 that the collection had been formed by Dr. Dickson. This explains why that gentleman's name was not mentioned.

which was afterwards identified with Q. Brantii, when the young Oaks were old enough to be determined. The strong coarse erect woody scales of the cup, bordered by a row of recurved hooks, and more than half as long as the blunt-ended acorn, offer a ready means of recognition. After growing the plant for two years it has been ascertained that the species is deciduous, not evergreen as had been supposed; and this renders it almost certain that another name of it is Quercus persica, of Jaubert and Spach, as appears from specimens (No. 115) collected by Kotschy in March, 1842, between Abuschir and Schiras, where it is represented to be a common tree. All the plants that were raised from Mr. Layard's acorns have been distributed among Fellows of the Society fond of arboriculture.

At the same time another Oak was raised very like Q. Brantii, and supposed to be a variety of it, of which there is reason to believe that the annexed cut represents the acorn.



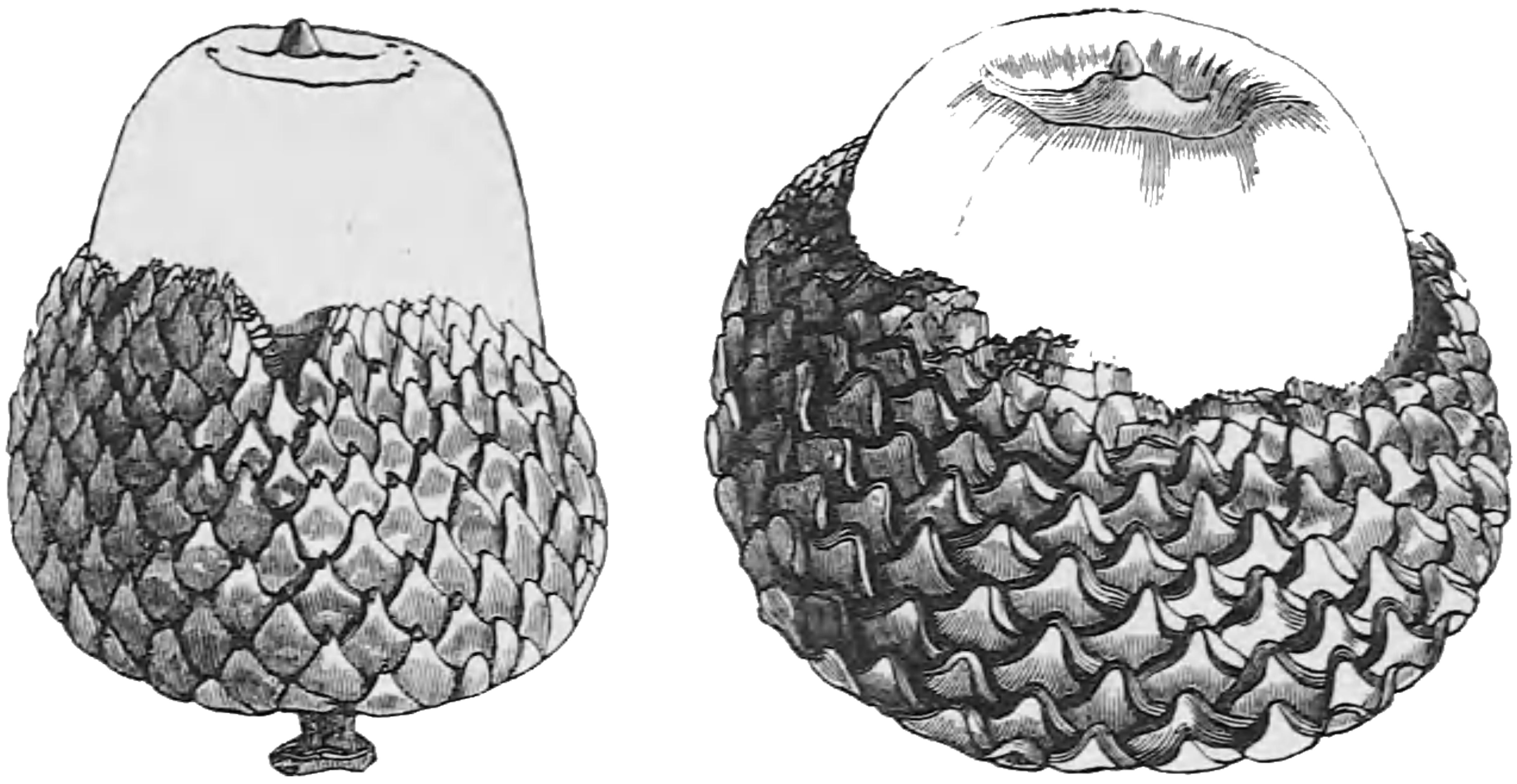
Acorn of Quercus Brantii var.?

The size and form of the acorns of Q. Brantii are so remarkable as to justify a conjecture that it was this very species which was occasionally employed by the Assyrians to decorate their sacred tree, before which King Sennacherib is represented standing, on a Royal cylinder figured by Mr. Layard. (*Discoveries in the ruins of Nineveh and Babylon*, p. 160.)

The hardiness of the species is not yet absolutely proved, but there is also no reason to doubt it.

Two other acorns, with erect scales on the cups and wanting the inner row of recurved hooks, were also received from

Mr. Layard, but having been packed in honey they were dead, and it is not known to what species they belong. They seem to differ from each other as well as from Q. Brantii.



Acorns from Kurdistan, the species of which is unknown.

making fresh shoots which require a constant and judicious superintendence, if we wish to manage properly, and this greatly depends on stopping in time those growths which are not likely to suit our purpose.

2. As soon as the genial influence of spring is felt, the buds swell, and very soon the flowers come out: whilst the leaves, more backward, are yet within their envelopes. Afterwards the leaf-buds open their scales, and the shoots burst forth, to become, the following year, branches of greater or less length.

3. From May to August, the leaves, coming successively to maturity, acquire a more compact structure, and consequently absorb less sap. This, continuing to flow, seeks fresh outlets, and produces, at the axil of the leaves, buds which remain as such, or break into laterals according to the time of their formation, the continuance of fine weather, and the vigour of the tree.

4. These new productions, all formed in the course of the growing season, are easily seen at the fall of the leaf. They are the source from which our hopes of future crops arise; and as it is necessary to know them well, I therefore proceed to explain them in detail.

5, A. *Eyes or Buds.* These are envelopes containing the rudiments of shoots, leaves, flowers, and fruit. They are conical, and covered with little imbricated scales, more or less coriaceous, and which are merely abortive leaves dried by the air, so as to protect the tender parts which they inclose from the severities of the winter. They continue in this state as long as the flow of sap is arrested by the cold; and they commence growing when the weather becomes sufficiently warm to put the sap in motion.

6. If the eye does not receive proper nourishment it may remain a long time inactive; it is then called a *latent bud* (œil expectant). It is generally roused from this dormant state by pruning, performed with the view of calling it into action: or naturally, by an increased flow of sap which acts as a stimulus to it: otherwise, it may become completely extinct.

7. Buds become either *Wood-buds,* or *Fruit-buds;* and it is important for the operations of pruning to distinguish well these two conditions. I may, however, remark, that with reference to the Peach-tree, the nature of the bud is never doubtful to an experienced person. In fact, its form, its place, the age of the wood on which it appears, all help to show the function which it is destined to perform; but for those little acquainted with this tree, it is necessary to enter more into detail.

8. *The Wood-bud* (Figs. 1, 2, 3, 4, 5, *a*) is an embryo shoot, covered with imbricated scales of a reddish-brown. Its form is usually that of a little cone, more or less pointed; when in the axil of a leaf it is always slightly compressed. The wood-bud, which is also called at Montreuil *œil de pousse* (pushing-eye), comes on all parts of the Peach-tree, upon the young as well as upon the older wood; and pruning can make it push from very old wood.

9. *Fruit-bud* (Figs. 1, *b*; 2, *c*; 3, *d*; 4, 5, *g*). This contains the rudiments of the flower. It is also covered with scales: but its form is always rounder than that of the wood-bud. Fruit-buds are only found on one-year-old wood.

10. There are upon the Peach-tree buds which are single, double, triple, or more numerous.

11. The single bud is in general a wood-bud, from which a shoot proceeds. We however see flower-buds by themselves; such are those marked *b*, Fig. 1.

Most commonly the fruit-branch that bears them is terminated by a wood-bud, or growing-point, the use of which is to draw into this branch the sap necessary for the nourishment of the flowers and fruits; but it may happen, that by accident, or abortion, this eye does not exist; yet the loss of the fruit may not result. In 1844, I observed numerous instances of this, and farther on I shall have to refer to them.

12. Double buds generally consist of a wood-bud, and a flower-bud. Fig. 2 shows this kind of buds; *a*, wood-buds; *c*, flower-buds.

13. In the triple buds, such as are seen at *d*, fig. 3, two are flower-buds, the other a wood-bud. There are also triple buds, which consist of three wood-buds. But this sort does not show itself except on the shoots of young Peach trees, or on those that are very vigorous. It is always the middle eye that is the strongest; sometimes those at each side die off. I shall state, further on, the procedure adopted in pruning them.

14. Quadruple buds, although they appear as such, have always in the midst of them a pushing-eye that is at first hardly visible, which leads one to believe that it is absent. The four prominent ones are all flower-buds; but the wood-bud that develops a little later has the same functions as the *œil de pousse*, or growing-point (11); and from its presence these ought to be called quintuple. They are rare, and always at the end of a little branch or spur (Fig. 4). They are sometimes more numerous, and disposed in the same manner with a growing-point in the

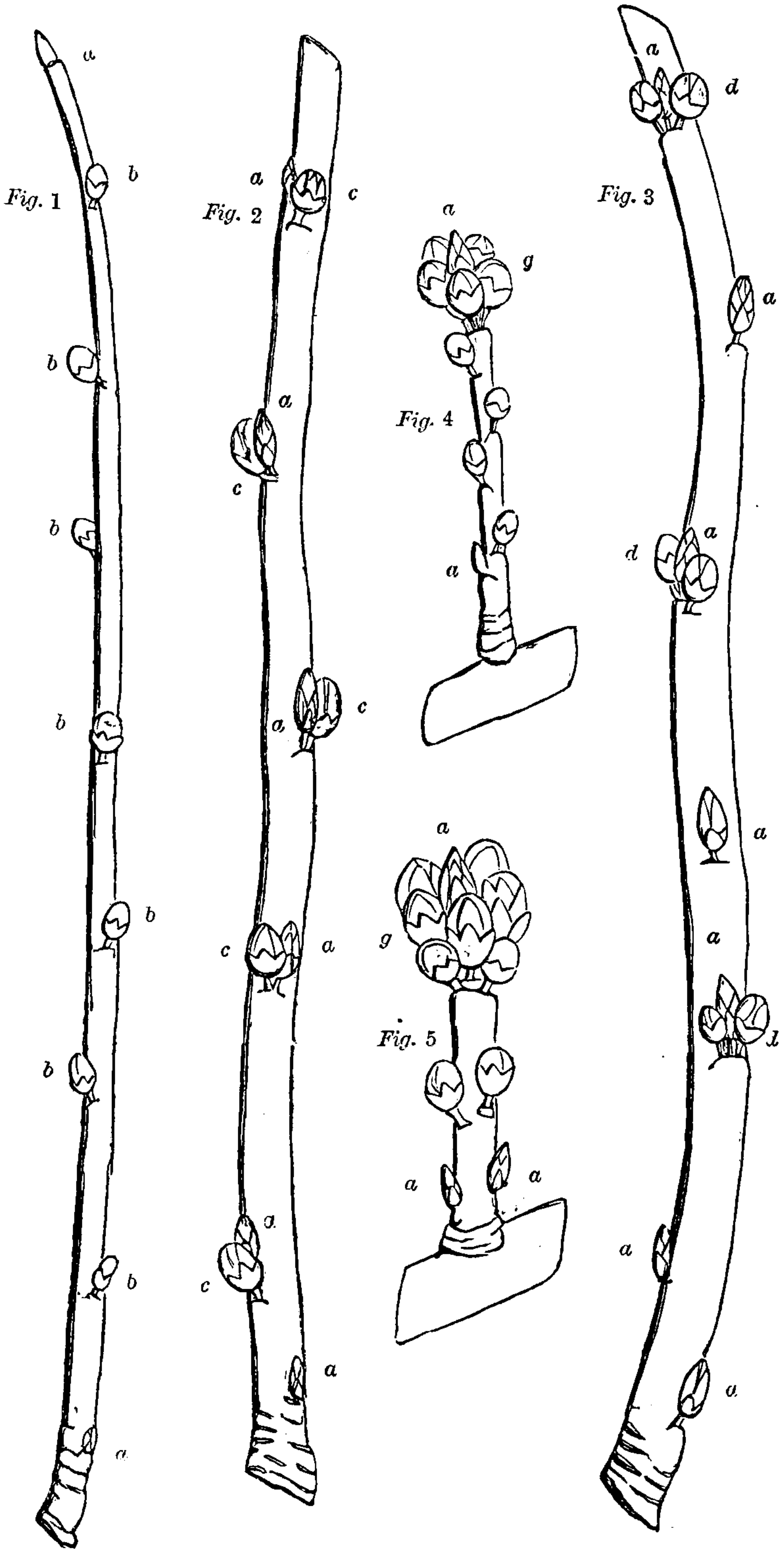


Fig. 1
Fig. 2
Fig. 3
Fig. 4
Fig. 5
a
b
c
d
g

of wood and leaves only. Its vigour is equally distributed, and the eyes with which it is furnished are of nearly the same size. It abounds in young trees, and occasionally the terminal shoots of older trees are of this description.

The over-luxuriant (*gourmand*), which is a strong shoot of the sort just mentioned, differs from it in its broad base, in its disproportionate growth, in its length, in its thickness, in its greyish bark speckled with brown, and in the distance of its eyes from each other, the lower ones of which are nearly obliterated, whilst those at the top are large, drawing all the sap to themselves, and inclined to push out laterals. The over-luxuriant shoot shows a bad circulation of the sap; and is seldom found on any but very young Peach-trees, or on those that are badly managed. It is most frequently taken off; but this should be done before it has attained too great a size; still there are circumstances, which I will point out, where it can be made useful by pruning.

24. *Second sort.* The mixed shoot, as previously observed, is that on which both wood and flower-buds exist.

25, D. *Of the Branch.* It is now understood that every shoot is, in general, the origin of a branch, on which, by the influence of pruning and the continuance of growth, the buds with which it is furnished break forth. Some of these buds give rise to young shoots only; others to both young shoots and flowers.

26. Hence it follows that, as I only allow of two sorts of shoots (22), I recognise but two sorts of branches, namely: 1st, the wood-branch; 2nd, the fruit-branch. I make use of the latter expression because it is usually adopted, although improperly so, as branches bearing fruit only rarely exist on the Peach-tree.

27. *First sort.* The wood-branch is the second state of the shoot, of which all the buds are wood-buds. The first branches that a young Peach-tree makes are of this sort, because, being nourished by a strong-flowing and as yet imperfectly elaborated sap, they cannot, during the first year of their existence, give rise to anything but wood-buds, which become successively young shoots, mature shoots, and branches. They afterwards remain wood-branches during the life of the tree; and they preserve the power of producing wood-buds at any age, whatever may have been said to the contrary.

I dwell so much upon this fact, because it is hardly admitted; and many persons yet maintain that the Peach-tree never forms shoots from the old wood.

Whatever be the mode of training, the wood-branches form the framework of the tree. They receive different names according to their place ; but I will speak of this in treating on pruning, having only to consider here the Peach-tree, and the nature of its productions.

28. *Second sort.* The fruit-branch follows the mixed shoot (24), as has been seen, and is always borne by the wood-branches. It is of the greatest importance ; for on it all hopes of a crop depend. We also call it at Montreuil the *small branch* (*la petite branche*), from the difference between its size and that of the wood-branch. In fact, its thickness rarely exceeds that of a large quill ; after having borne fruit it becomes a wood-branch, if not removed by pruning, in order to replace it by another of an age to bear.

29. The fruit-branches, besides their use of producing fine and good fruit, have another that is not without its interest, that of shading from the excessive heat of the sun both the fruit which they nourish and the bark of the wood-branches which bear them, and to which the nearer they are the better they protect.

30. Such is the account that I have deemed necessary to make of the manner in which the vegetation of the Peach-tree is carried on. I have thought this necessary, in order to render more intelligible the explanations which I have to give on its pruning.

In recapitulating what has been said, we recognise that all growths in this kind of tree commence by an eye or bud ; that this eye is either a wood-bud or a fruit-bud ; that the wood-bud may be produced on all parts of the tree, even upon those that are oldest ; that it successively becomes a young shoot, a shoot, and a wood or fruit-branch ; that the flower-bud is not produced on any other than wood of one year old ; and that to have fruit for any length of time, we must know how to produce a succession of this young wood.

Lastly, it is doubtless understood, that each wing of a Peach-tree trained against a wall is the product of an eye of the original tree that has undergone all the changes spoken of.

Section II.—Propagation of the Peach by Budding.

31. It is by budding that the Peach-tree is propagated. The proper stocks for it are the Almond, the Saint Julien and Damask Plums, and the Peach itself. Lately the Myrobalan Plum has been budded on, and is said to produce excellent stocks for this purpose, but I have not tried it.

32. The finest trees are produced on the Almond-stock, especially on the hard-shelled variety. It succeeds well everywhere except on very wet soils, or those subject to be flooded, because the roots of the Almond almost invariably perish when under water. It has the advantage of late growth; consequently, it is indispensable for the late varieties of Peaches.

33. The Plum is better fitted than the Almond for moist soils. Except in this case, I prefer the Almond-stock because it imparts a greater vigour to the tree. This is the opinion of the growers also. Nevertheless the following example does not appear to corroborate this:—For ten years I have cultivated a wall covered with a hundred Peach-trees, of which fifty were on Almond and fifty on Plum-stocks, planted alternately. The soil was very unsuitable for the culture of the Peach, being gravelly, stony, clayey, &c. All the trees have, notwithstanding, grown well; Almond and Plum-stocks have made an equal growth, so much so that, even after most scrupulous examination, I have found it impossible to say on which stock the tree succeeded best. The produce from both has also been in every respect equal. I still, however, prefer the Almond-stock, although I have given this case as an exception in favour of the Plum.

34. The Peach-tree itself is the least employed as a stock on which to bud its different varieties. They grow on it vigorously, but do not fruit so readily. They are also liable to gumming. I have budded the Peach on its own stock, and have been disappointed with the crop of fruit. I have remarked that by budding a second time, the growth was moderated, and the crop was abundant. But this proceeding delays production; it must therefore be abandoned for the use of the Almond and Plum-stocks. Besides, thus worked, the Peach is but short-lived.

35. If we desire to plant our own Almond-stocks, we must choose hard-shelled almonds, and put them in layers. In the first fortnight of January, we must put in a box or basket, alternately, a bed of sand of the thickness of the hand and a layer of Almonds until the box be full, or till all the Almonds are used, and place the box or basket in a cellar, or in the earth, so as to be moist and protected from the frost. As soon as there is no fear of frost, that is to say about the end of April, the Almonds are planted in a soil, manured and trenched to the depth of sixteen inches at least. Holes are then made from six to seven inches deep, and about a foot apart, in each of which an Almond is placed, after breaking off about one-third of its tap-root in

last are always budded with a single eye, the shoot from which is pruned in the following spring. When budded in their position against a wall, a bud can be placed on each side of the stock; this gives two eyes regularly placed for the formation of the two main branches. A year is gained by this, for in the following spring, instead of pruning the shoot from the bud to allow of the growth of the two lower eyes, destined to form the two main branches, these already exist, and can receive their first pruning. But for that to take place, both buds must have taken well, and both must be equally strong. Yet it is true that if one of them die, we find ourselves, by straightening and pruning, in the same position as if we had inserted one bud only,

41. Nurserymen often commit the error of propagating, for too long a time, a variety that they know to be good by taking shoots for the supply of buds from the plants of that sort that were worked the year before. It is better to renew these buds by taking shoots from full-grown trees. This is the reason that I bud myself the stocks which I have chosen in the nurseries; by this I am also more sure of the varieties; I, however, take the precaution of not nailing to the wall some shoots on the upper part of the tree which is to be propagated from, so that the sap may still be in flow at the time of budding. The necessity of having shoots of good growth for this purpose is the reason of nurserymen taking them from the open ground rather than from the walls.

42. By means of budding, several varieties of Peaches can be grown on the same tree. This gives no great advantage, except in a case where it is desirable to have, in a short time, a greater variety of fruits than we should otherwise possess. Some buds are worked on the strongest shoots of the middle of the tree. Often these buds make shoots of five feet and more; the eyes burst and form fruit-branches; and sometimes the following year ten or twelve Peaches are gathered from the first shoot of the bud.

43. By the same means it is possible to change the nature of the fruit of a Peach-tree. A person had planted double-flowering Peaches; when he saw them his first impulse was to order them to be destroyed. I persuaded him to do nothing of the sort, hoping to make his trees productive in a short time. In the beginning of August, I put ten or twelve buds on each tree, on the young wood as well as on the main branches. The success was complete, and in two years afterwards he gathered splendid fruit.

SECTION III.—ON PLANTING THE PEACH TREE.

I. *On the Choice of Trees for Planting.*

44. Those who are unable or unwilling to bud their own trees, should be careful properly to select, or cause to be selected, in the nurseries, the sorts budded on the stocks best suited to their soil. As I have already said, the preference is usually given to those budded on Almond stocks, with the previously-mentioned exception.

45. After having chosen the sorts we require, we must pick out healthy and vigorous trees, with a clear and lively bark, and with a straight stem, properly furnished with eyes at its base. The size of the tree must not be too much regarded, for there are certain much esteemed kinds, which, though appearing less vigorous, are, notwithstanding, equally advantageous.

46. It is necessary to apply to a nurseryman worthy of confidence, whom we can trust in regard to the taking up of the young trees so as to preserve their roots, this being so important to their success. It is better to pay a trifle more per plant rather than run the risk of having trees with roots cut short and mutilated. We should also take care to have the trees planted as soon as possible after they are taken up; and if they have to come from a distance, it is necessary that they should be well packed, especially the roots, so that they may not be dried by the contact of the air.

47. Before giving the precautions which it is necessary to take in planting, it will be well to point out the aspects most suitable for the Peach. Although those I determine are specially applicable to the climate of Paris, it will be easy to modify them according as the locality may be more to the south or to the north, though the culture of the Peach extends but little to the north of the latitude of the capital. I shall also say a few words respecting the wall against which the Peach is trained, and, after having treated on these two subjects, I will return to the planting.

II. *Aspects and Soils most suitable to the Peach.*

48. The Peach-tree equally dislikes an aspect that is too hot or too cold; and, although it may be cultivated against a south, and likewise against a north aspect, it is preferable to plant it against an east or west. In this way, the same wall gives support to trees of which the produce on both sides is nearly equal. This is

not the case with walls running east and west; on these the trees facing the south have too much heat, whilst those on the opposite side scarcely see the sun, and either ripen their fruit badly, or not at all. This consideration has determined the greater part of the inhabitants of Montreuil, Bagnolet, and other places, where the cultivation of the Peach is the principal source of employment, to build their walls to run nearly north and south, in order that the trees planted on the east side may enjoy the influence of the sun from his rising till 1 p.m.; and those on the west for the rest of the day. However, we plant the Peach against aspects less favourable than those just mentioned; for the ground does not always admit of placing the walls so as to afford the aspect we would wish. Walls are occasionally to be seen which do not receive any sun till 10 a.m.; we, however, cover them with Peach-trees, which become very fine; but they give great trouble in pruning, because their wood or pushing-eyes are frequently at the ends only of the fruit-branches, which must therefore be preserved entire if we wish to obtain fruit.

49. As regards the nature of the soil, the Peach is not so particular as some imagine. When well managed it grows anywhere, if the soil is only deep enough. Nevertheless its growth is much greater and more regular when planted in a light soil resting on a bottom of silicious pebbles amongst which the roots of the Almond find their way; it must also be one that does not retain the water so long as to prove hurtful to the roots when the summer is wet.

III. *Of Walls and Protection.*

50. When we have a garden the walls of which are already built, the aspects that they have must be made the best of. But when a new garden is made, it is well to bear in mind what I have said with regard to aspect, and consequently to lay out the kitchen-garden in the most suitable manner for building walls in the best direction for the trees.

51. When a Peach-wall is built at Montreuil, it is $15\frac{3}{4}$ inches thick at its base, tapering to $11\frac{3}{4}$ at the top; and about ten feet high. This height is the most convenient for the square mode of training, that which I recommend. There is no objection to the walls being of a greater height. But experience has shown us that the height I have stated is sufficient; and it is prudent not to make an outlay too great in proportion to the produce which

and I advise no one else to do so. The season for planting is commonly attended with sudden cold rains, which sometimes fill the holes, rendering the earth so wet and cold as to prove injurious to the roots; but such is not the case when the holes are made at the time of planting.

IV. *Planting the Tree.*

55. Everything being prepared we plant in the course of November. The soil of the border having been newly worked, it is sufficient in good light soils to make holes one foot square [better two feet square] and two feet deep ; but when the soil is of a clayey or damp nature, the holes must be two feet square and three feet deep, and the earth before being filled in must be rendered light by mixture with good garden mould. This method is to be preferred to that of planting in March, which has the great inconvenience of causing a loss of valuable time to the tree, which, when planted in November, is ready to vegetate the first fine weather in spring; but when planting is deferred till March the vegetation of the tree is often retarded by the drying winds so prevalent at that season. The plants called *eighteen-months* are preferred for planting. They are so called from having been eighteen months budded, or nearly so long. Trees which have been thirty months budded, and which have been cut back upon a lower eye, and of which the roots are much larger and less fibrous than the former, are not so good ; still, in some particular cases, they are not to be rejected ; for instance, they often take root better in new ground.

56. Whilst the holes are being dug, the roots are trimmed, that is, their bruised extremities are cut with a sharp pruning-knife, and so as that the cut surfaces may rest upon the earth when the tree is planted. At the same time, its head is taken off at from eight to nine inches above the bud to allow of planting it with a sufficient inclination, so that the stem may touch the wall; whilst the roots are so far from the foot of the latter as not to be cramped in growing by the foundations. See Fig. 6, which represents the tree before being planted. It is headed back at the point A.

57. The tree is fixed in its place at six and a quarter inches from the wall, and not deeper in the earth than it was before. It is so placed that the eyes *a* and *b* of the bud may be at each side, and not before and behind, without heeding the position of the original bud. It is of little moment whether the latter

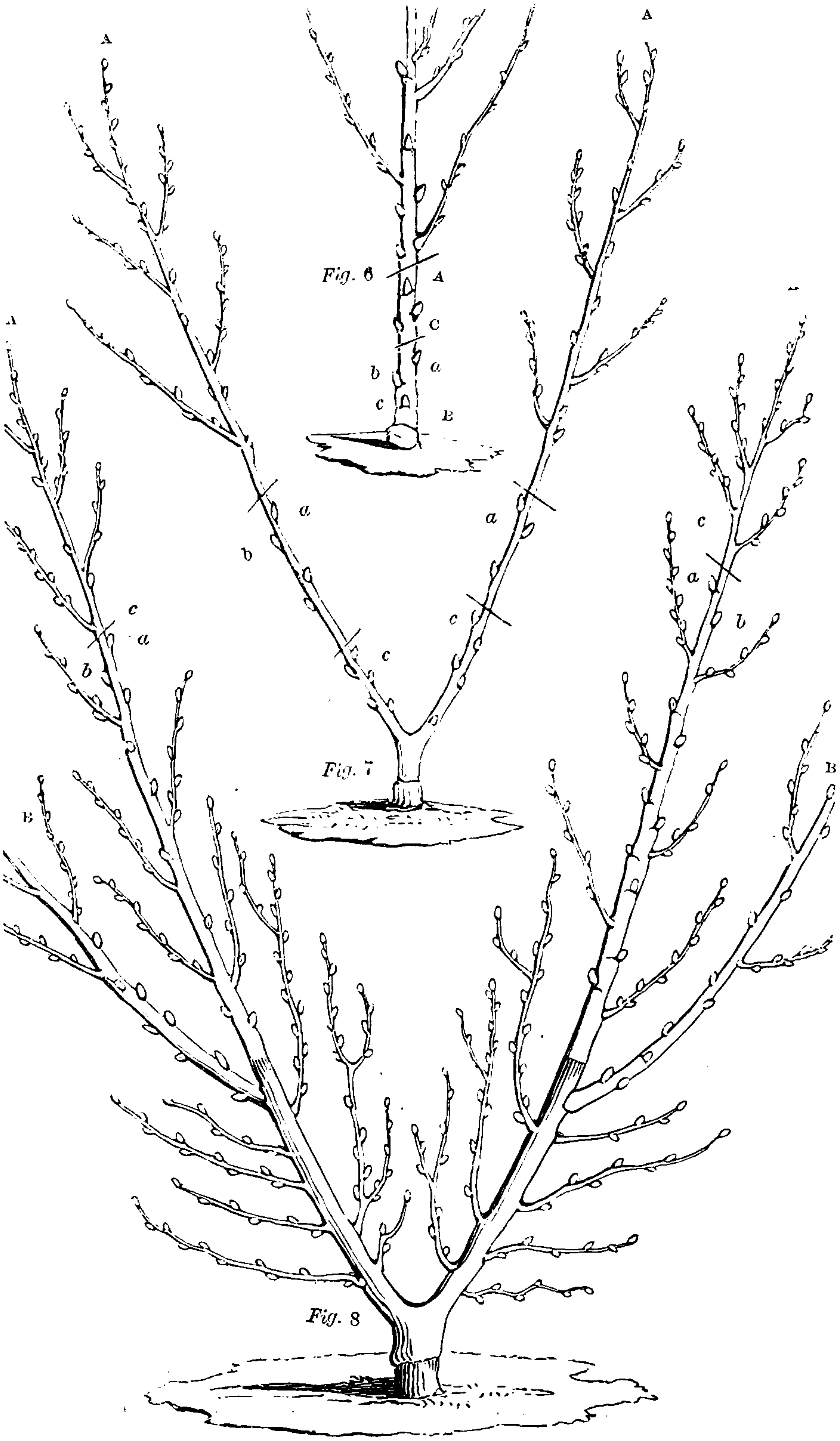


Fig. 6
A
C
a
b
c
B
Fig. 7
a
b
c
Fig. 8
A
B
c
a
b

be turned one way or the other, provided the eyes be properly placed. For the formation of a fine tree in a short time, this precaution is of greater importance than most people suppose. Gardeners usually plant their trees with the budded part in front, without paying the least attention to the position of the eyes. The following spring, when the tree shoots, they are astonished to see the greater number of trees thus planted with eyes before and behind; whilst those planted as I have directed have their eyes well placed, one on each side. When the tree is in the proper position the roots are carefully spread out, and then covered over to the height I have directed, or at least in such a way that the bud, *b*, may be kept out of the earth.

58. A space of twenty-six feet is left between those Peach-trees intended to be trained in the square form. When a Peach and a Pear are to be planted alternately, there should then be a distance of thirty-nine feet between them. The intermediate spaces may be usefully employed by planting between each Peach and Pear-tree a young tree, which can be brought up till three years old, and which may be employed to make a fresh plantation, producing a crop in a short time.

Section IV.—Theoretical Explanation of the Various Operations of Pruning.

59. The tree being planted as above directed, the next care is to regulate it every year by pruning, so as to cause it to produce shoots proper for training, according to the intended form. But before entering into the details of the operations that a tree requires, from the time of its being planted to that of its death, it is highly necessary to explain the general principles, the application of which frequently occurs, and which, once explained, will not require to be repeated when I detail the successive manual operations. We shall commence by describing the instruments that are used.

I. *Necessary Instruments and Tools.*

60. The tools or instruments necessary for pruning fruit-trees are the *sécateur*, the pruning-knife, and the saw.

I need not describe these instruments, which are sufficiently known ; I will only comment on the *sécateur*. This instrument is now used by nearly all the growers at Montreuil. It can be

have no fixed time of pruning. I have occasionally pruned some of my trees in December, with the same result as those that were pruned later. It may therefore be concluded, that it can be done from January till April; but I recommend it to be done soon rather than too late; for when vegetation is active, pruning causes a more sensible reaction on the trees. There are, however, cases where late pruning may be of use. When a tree not yet growing is pruned, it loses no sap; for on the latter beginning to circulate, it flows to the buds, which, by expanding, afford it an outlet; at the same time the cuts are so far dried up as to offer a sufficient resistance to the escape of the sap. If, on the contrary, we prune when the sap is actively circulating in the tops of the shoots, their pores, opened by the cuts, allow a portion of it to evaporate. Whence the conclusion, that it is proper to prune old trees when the sap is down, because they have none to spare; and that, on the contrary, it may prove beneficial to prune young or very vigorous trees after the sap has risen; the loss of a part of this fluid cannot be disadvantageous to them; for, by moderating their vigour, it insures the production of fruit. We must not forget that fructification weakens the trees. One of the objects of pruning is to diminish the superabundant strength of a tree; and when once it has put it in a state for fruit-bearing, pruning maintains a due balance between the production of wood, and that of fruit, so as to economise the strength of the tree, and insure its prolonged existence. Since I have been a cultivator, I have had numerous opportunities of convincing myself, by experience, of the correctness of this observation.

63. To render the operations of pruning more intelligible, I shall consider it in two points of view: 1st, the pruning of wood-branches; 2nd, the pruning of fruit-branches.

64. 1st, *Pruning of the Wood-branches.* Its principle is a consequence of their natural organisation. I have explained (19—26) what is a shoot, and what is a branch. The first, which ultimately becomes the second, is furnished throughout its length with wood-buds, or with shoots of large or small size; and is always, itself, terminated with a bud which is designated by the name of terminal *bud* or *eye*, or *growing-point.* The sap, which tends to rise in all trees with great force, but more especially in the Peach, gives a greater development to the terminal bud than to the others, which become gradually weaker in proportion to their distance from the top of the shoot, and as they come nearer to their origin at the place of the last pruning. The result of this

constant natural tendency is, that we can direct the sap to whatever lateral bud we please on that shoot, by cutting the latter at a very short distance above, to make a new terminal bud, or eye, which takes the name of *œil terminal combiné*, to distinguish it from the natural terminal eye, and because the effects of pruning are combined in its development. It is a bud, or eye, rendered terminal by pruning.

65. Thus the shortening of branches has not the effect of stopping their growth, but that of giving a great vigour to the eye above which the cut is made; and to the lower buds a strength which varies according to their distance from the bud to which the shoot was cut back. This bud, in growing, forms a shoot which constitutes a new prolongation, terminated by a growing-point, and is furnished, in turn, with lateral wood-buds.

We now perfectly understand, that, as we can make any lateral bud a terminal one, by pruning above and near it, we can choose it according to our requirements and the end we have in view.

66. This is the fundamental principle of pruning the wood-branches. They should be pruned long or short, according to the strength of the tree. In those that are vigorous it is not uncommon to see branches make shoots of from four and a half to six and a half feet long in one season, and sometimes even of greater length. In such cases it is well not to prune them short, because, by leaving them at considerable length, there is space for several shoots likely to be produced of medium strength for furnishing the branch. This is a better mode of subduing the impetuous growth of young trees, than that of delaying the pruning till such time as the wood and flower-buds commence to open, and thus cause a loss of sap as mentioned (62). Moreover, I have only spoken of late pruning in order to meet a case, where, from some cause, the operation could not be performed at its proper time; and it should be understood that, under these circumstances, it is the youngest and strongest trees that suffer the least from such delay.

67. If, on the other hand, short pruning is adopted, it will produce strong young shoots, often too near each other, the vigour of which can neither be repressed by pinching, nor by any other operation. There would be no resource left but to cut them out at the following pruning; this increases the number of wounds, weakens the tree, and prevents it from assuming a regular form, with branches tapering uniformly from their bases to their extremities.

68. Therefore, short pruning must not be adopted, except on the wood-branches of feeble trees. It is advisable in this case, because it would be improper to give them a greater length of wood than they can nourish; and because it is desirable that branches should have a thickness in proportion to their length. In cases like these, short pruning concentrates the sap, and the branch thus pruned becomes thicker. When ultimately such a tree takes a more active growth, the shoots, when pruned, must accordingly be left at greater length.

69. The Peach-tree, trained in the square form, is first set off with two main branches (*branches mères*); and, in order that its form may be complete, each of these must be furnished, on its under side, with three *secondary branches*, which are called *lower;* and on its upper side, with three *secondary branches* called *upper.*

70. In gentlemen's gardens, where the walls are higher than ours, four lower and four upper secondary branches may be established on each of the main branches; but as they are formed in the same way as the other three, I shall confine myself to describing the operation according to the method I pursue with my own wall-trees.

71. The operation that forms the lower secondary branches, which should always be permitted to grow before the upper ones, is based upon the above-mentioned principle (64); that pruning to a wood-bud favours its development, and that of the eyes that are beneath it, in proportion to their proximity. Therefore, the wood-bud, which is immediately below the terminal one, is that which takes the next greatest growth. This being the case, when we want to form a lower secondary branch, we prune the leading shoot of the main branch (A, Fig. 7) to an eye on the upper side or in front of the shoot, the next lower bud being on the under side; the first is intended to prolong the main branch, the second to form a lower secondary.

72. For the formation of a lower secondary branch, we can also make use of a shoot or of a summer lateral—if they spring from immediately below the bud to which the main branch has been pruned. The shoot or summer lateral is either left entire, or pruned back to the first wood-bud; and it is trained in the direction which it ought to take. It is sometimes useful to facilitate its development by one or more longitudinal incisions on the main branch immediately above it, and extending to the base of the shoot.

73. In pruning the lower secondary branches, it is best to cut

75. From what has been said, it is now evident that there is no great difficulty in pruning wood-branches, and any one can ensure success when the operations necessary to be performed on them, from the time the tree is planted till that of its complete formation, shall have been detailed.

76. 2nd, *Pruning the Fruit-branches.* In a Peach-tree, trained according to the square mode, if we except the two main branches and the twelve secondary branches that compose the skeleton, all the others may be considered as shoots and fruit-branches of a mixed nature; for the greater number of them bear both leaves and fruit.

77. The way of obtaining the greatest possible quantity of fruit from a tree, without exhausting it, consists, then, in the art of keeping the whole extent of all the leading branches well furnished with shoots capable of producing fruit, a property which they lose when more than one year old. We must therefore know how to procure a succession of these by suppressing those branches that have borne fruit, and which, after that, are merely wood-branches. This is done by properly pruning the fruit-shoots, and by promoting the growth of others to succeed those that have borne fruit.

78. On the fruit-branches there are eyes which may be single, double, triple, quadruple, or even more numerous (9 to 14). Hence there are four sorts of fruit-branches. The first, which has single eyes, usually a flower-bud, is long and slender, and is terminated by a pushing-eye or growing-point. It is shown in Fig. 1. The terminal pushing-eye is seen at *a*; all the buds, *b*, are single and flower-buds. Sometimes it has also at its base another wood-bud, *a*, and when this is the case the shoot is considered well constituted. These wood-buds are found more especially on the under side, and at the base of wood-branches, particularly in aspects not much exposed to the sun.

79. The second (Fig. 2) has double eyes, *c*; the one, *a*, a wood-bud; the other a flower-bud.

80. The third (Fig. 3) has triple eyes, *d*; two of them flower-buds, and a wood-bud, *a*, between them.

81. The fourth, the length of which varies from an inch and quarter to about three inches, forms a little spur, which in growing displays a small cluster or bouquet, composed of four flower-buds, and sometimes more (Fig. 4, 5, *g*), in the midst of which is a pushing-eye, *a*. This kind is a fruit-branch properly so called, for it produces with greater certainty the finest fruits. It is only

found on well-established trees, and generally on the old wood. It appears to be the result of a wood-bud being prevented by the scarcity of sap from becoming a shoot. A deficiency in the flow of sap converts nearly all the wood-buds into flower-buds. (See Fig. 5.) We call it *cochonnet* at Montreuil, and in other localities it receives the names of *branche à bouquet* and of *bouquet de mai.*

82. It must be understood, that well-constituted fruit-branches have always wood-buds close to their bases. It is these eyes that afford the means of forming replacing or successional branches, the importance of which will be explained in pointing out the proceedings by which their development is induced.

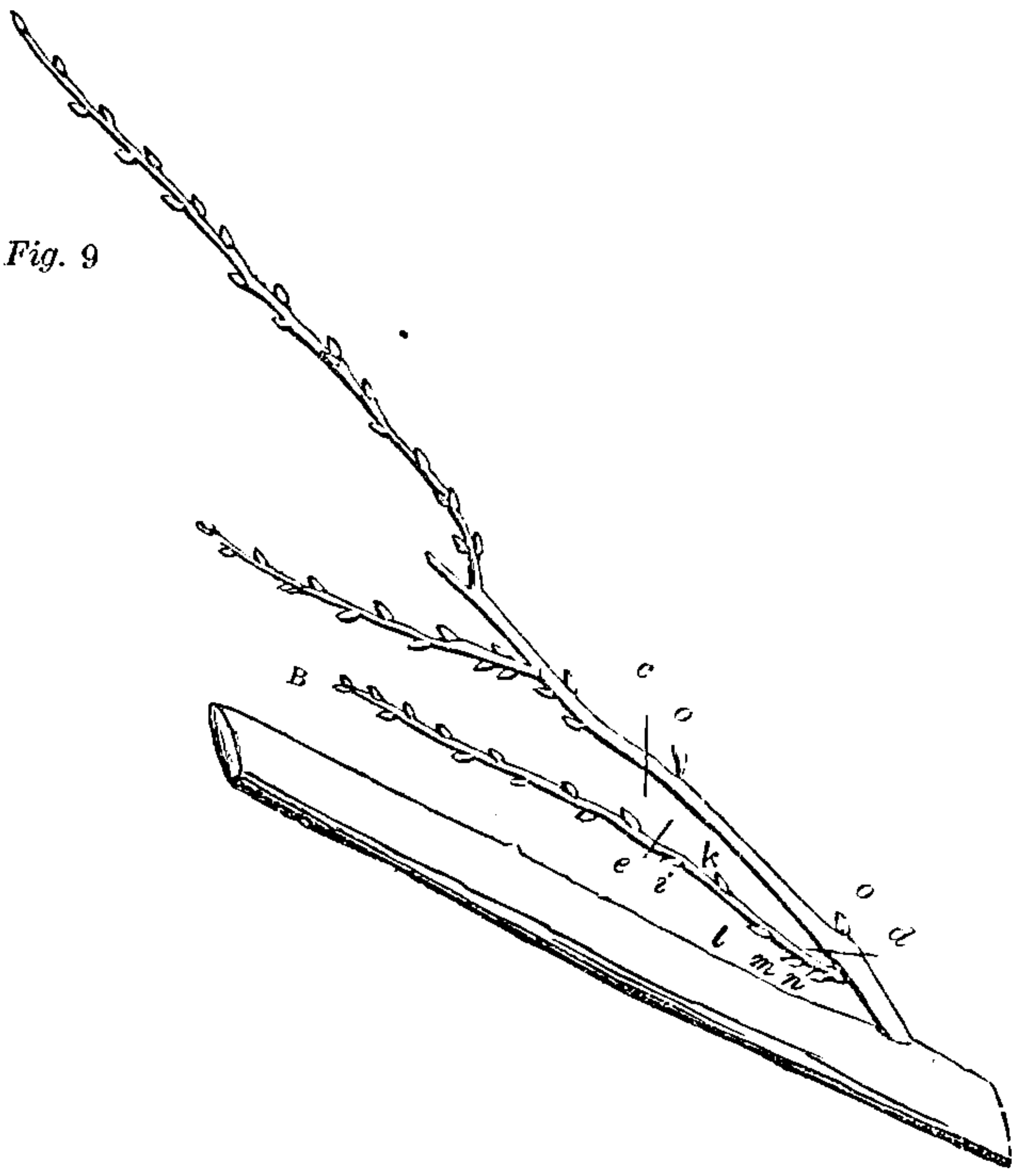
83. The fruit-branches almost invariably push as many shoots as they have eyes. Whence it follows, that, with this natural disposition, a tree would very soon have nothing but fruit-branches, the terminal of which would be the only wood-bud. Shoots having no wood-buds on their lower parts, and which, consequently, cannot be properly shortened, would elongate more or less, but all below each year's terminal shoot would become entirely naked branches, ultimately bearing only at their extremities a small wood-shoot. Besides the disagreeable appearance which a Peach-tree in that state would present, its produce would be small, and its life would be shortened. We must, therefore, prevent such bad consequences by judicious pruning.

84. This consists in operating so as to cause the sap to flow with greater force into the lower part of each fruit-branch, in order that the eyes there situated, and more especially the lowest one, may not die off in consequence of the sap being drawn up to the top of the branch. Such might be the case if the shoot were left entire; and it might likewise occur even if pruned, if we did not watch the growth of the terminal and of all the wood-buds situate above the one nearest to its base, so that the development of the latter, which is most important, may not be arrested. The whole art, then, in pruning the fruit-bearing shoots consists in encouraging the eyes at their bases, in order that they may be in a state to develope themselves. To attain this, every fruit-shoot is pruned, for the first time, to a length proportionate to its strength, and to the place it occupies; that is to say, as many fruit-buds are left on as it can support without being exhausted, The cut is made above and near to a pushing-eye, which becomes the terminal. The effect of all pruning being to improve the parts beneath, all the wood-buds and fruit-buds that are allowed to remain uniformly open. The growth of the young shoots is

conducted so as to always encourage that of the lowest one; all those that are useless are pruned off, and we check, by pinching, if they are growing too luxuriantly, those intended to be preserved; and lastly, the shoot which has been selected to become, at the following pruning, the successional one, is maintained in a proper degree of vigour.

85. The following year the whole of the former year's fruit-branch is cut off above the shoot encouraged at its base, which

Fig. 9



now becomes a fruit-branch, bearing fruit in its turn, and is pruned so as to encourage, as before said, the development of one or two shoots at its base, one of which is to become its successional shoot. The same operation is performed year after year. For the better understanding of this see Fig. 9. The branch A, at first pruned at *c*, has borne two fruits at *o o*, and has made the shoot seen from *c* to A; at the same time it has produced the shoot B, which has now become a successional fruit-branch, and with this view the branch A is pruned at *d*, immediately above the insertion of the old fruit-branch; and this successional shoot at *e*, above the double eye *i* which will bear fruit, as well as the two single eyes lower down the shoot, viz., *k*, *l*. At *m* and *n* are seen

pinching, so that the one recently sprung from beneath run no risk of being impoverished. This mode of treatment is so much the more important in consequence of this kind of branches existing more especially on the lower parts of the tree, towards which we must lose no opportunity of inducing the flow of sap, which has always a comparatively strong upward tendency.

89. SECOND SORT.—*Branches with Double Eyes* (Fig. 2); *and* THIRD SORT.—*Branches with Triple Eyes* (Fig. 3). These two kinds of branches, which are the most common on Peach-trees, are both pruned in the same manner. The branch which has fruited is cut down to the successional shoot; and the latter is pruned on a wood-bud, leaving it long enough to have a sufficient number of flowers. The shortening is made with the view of leaving on each bearing-branch only as many fruits as it can support without weakening itself, and also with that of concentrating the sap so as to favour the development of the buds, or young shoots at or near the base, one of which becomes in turn a successional shoot at the following pruning.

90. In these, as in the preceding sort, it may happen that a fruit-branch, pruned the year before on a single wood-bud, may not have produced others at its base during the time of its growth. It must then be cut back to the wood-bud, nearest to where it was pruned before. If a lower eye do push, it must be treated as directed (88).

91. The fruit-branches on the upper side generally become of a greater length than those on the under side, which tends to cause more difficulty in getting buds to push near the base. In this case, after having been pruned sufficiently long to preserve the fruits, they are trained as will be shown at 93. If an eye form at the base of any of them it is well to encourage its growth, by pinching and cutting off, or disbudding, all the young shoots above it, at the summer-pruning. Without the precaution of pinching and disbudding, the upper shoots would absorb the sap, and the lowest one would become so impoverished as to be destitute of eyes at its base, and we should then be obliged to replace with a better constituted young shoot, further situated however from the main branch.

92. *The Flower-buds,* on shoots from the upper sides of the branches, are very often found at a considerable distance from the base, and we are consequently obliged to leave the shoots much longer than would otherwise be proper, in order to have fruit. There is no objection to this, only it is advisable to take out the

wood-eyes that are beneath the lowest flower-bud, with the exception, it must be well recollected, of at least two of the nearest to the base of the shoot. In this way, there is no opposition to the development of the latter, either of which may replace the fruit-branch at the following pruning.

93. I have spoken of a particular mode of nailing a branch without a developed eye at its base so as to make it produce one, that being indispensable for the formation of a replacing shoot. It is done in the following way:—As soon as a fruit-branch of this description is pruned, it is nailed in winter to the wall, bringing it as close as we can, without breaking, to the branch on which it grows. It is well known that every fruit-branch forms with the branch that bears it an angle more or less open; we must endeavour in this case to render the angle as acute as possible, and the extraordinary bend imposed on its lower parts, by this mode of nailing, compresses strongly the woody fibres of the base, and stretches the bark on the outside of the curve. The sap attempting to effect a passage through its proper vessels, which are now closely squeezed together, often breaks through the bark and pushes the eye desired. This proceeding is, however, only applicable to branches one or two years old.

94. It is not absolutely necessary to wait till the usual time of pruning to cut back to their successional shoots those branches retained as fruiting-branches at the winter-pruning. There is always an advantage in doing so whenever we can, excepting when the successional is growing too vigorously, notwithstanding our endeavours to check it by close nailing and pinching off. During the summer-pruning, if we have time, we cut off all the branches on which the fruit has not set permanently; and, in general, it is well, after the fall of the leaves, to cut out all the useless wood; this leaves so much the less to be done at the regular winter-pruning. By cutting off at this time the greater part of the branches that have borne fruit, we strengthen their successional shoots, and render available for the latter the portion of sap which the parts cut off would have appropriated: and there is always an advantage in not allowing the tree to nourish useless productions. This attention is especially necessary for the weaker branches. Unfortunately, the cultivators and gardeners who have large gardens under their charge are, on account of their many occupations, unable to perform these various operations, which, although useful, are not absolutely indispensable.

95. FOURTH SORT.—*Fruit-branches, the Buds of which consist*

of four or more Flower-buds. It is called at Montreuil, *cochonnet* or *bouquet de mai* (Figs. 4, 5). This sort of fruit-branch, or spur, being only one and a quarter to three inches in length, and most frequently forming a cluster (Fig. 5), with a single pushing-eye in the midst, which suffices for drawing nourishment to the fruits, ought not therefore to be shortened. It is preserved, wherever it may be, in order to produce fruit. As it forms almost exclusively on the old wood, we often find it in front of the principal branches; and when thus situated, it must necessarily be cut off after the fruit is gathered. With regard to those on the sides, they are then pruned to the lowest wood-bud; if there be none formed, and that the spur may still be useful, it is pruned to the wood-bud formed on the last summer's shoot pushed by the terminal eye. We must endeavour, as much as possible, to retain one or two flowers beneath this pruning. As soon as the operation is performed, the branch is nailed, as was said at 93; and sometimes a wood-bud, capable of replacing it at the following pruning, is produced at its base. When they have eyes at their bases they are properly constituted, and are pruned as directed at 89.

96. Although I have hitherto, in conformity with the old belief, directed the fruit-branches always to be pruned on a wood-bud which was judged necessary to preserve a good state of vegetation, yet I am now able to affirm that a terminal wood-bud is not absolutely necessary for the growth and maturity of the fruit. Whence it follows, that under certain circumstances, such as the necessity of prolonging a fruit-branch to a great length, in order to obtain a wood-bud, which after all is too high up, I prune above a flower-bud, without any bad consequence, provided that the base of the branch is sufficiently vigorous.

97. The tree must be completely unnailed before pruning, lest some of the branches be split, or broken, during the operation. The walls and trellises are inspected, the insects destroyed, and the whole made as clean as possible. The tree must not be unnailed till we are ready to begin pruning; and the principal branches must be trained in, and secured immediately after the operation is completed, lest they suffer from the effects of severe frosts, which often occur at that time of the year.

98. In pruning, I always commence with the fruit-branches, going along the principal branches, beginning with the highest of these and working downwards. This method has the advantage of enabling us to judge better of the strength of the upper fruit-branches, and of rendering it easier to balance them with those

according to circumstances. Sometimes we even bring the weak side forward from four to eight inches from the wall, supporting it by props placed for that purpose; and when the equilibrium is restored, it is put back in its place. This method must only be adopted when there is no longer any fear of frost.

101. Again, in training the branches of the Peach-tree, we can fasten the weak part more vertically and the strong more horizontally. The sap consequently flows with greater force into the former, and the balance is restored. These two means may be employed at the same time on young trees; but in those which have attained their full growth, it frequently happens that we cannot bring the strong part any lower, and in that case our only resource is to train the weak part more upright. The use of these various modes ought to cease as soon as a more even distribution of the sap has rendered the respective parts equal.

102. In order to facilitate the operation of training, and to give it the desired regularity, we fix guides on the wall, or trellis, so as to regulate thereby the position of the principal branches. These guides are taken away when the formation is complete, and the branches are then maintained in the place assigned to them.

IV. *Nailing.*

103. The nailing consists in fastening all the branches of a Peach-tree, whatever their nature may be, in the place most suitable to them. The regulation or training of the principal branches, which has just been treated on (99), is, properly speaking, the nailing of them.

104. But nailing, as I understand it, is chiefly applicable to the fruit-branches, and to the shoots as soon as their growth requires it. It will thus be perceived that we may carry on the nailing of the tree throughout the whole course of its existence; nevertheless there are two periods of the year more especially devoted to this operation—namely, when the tree is without foliage, and when it is furnished with leaves. Hence the operation is distinguished as winter-nailing and summer-nailing.

105. At Montreuil, woollen shreds and nails are used in training and nailing. These shreds surround the part to be fastened without becoming so tight as to cause strangulation. For this reason, neither linen nor cotton rags are employed, as they contract or expand according to the quantity of moisture they absorb: and because, from their not allowing the nails to pierce

them readily, we cannot well calculate the tension which we wish to produce.

106. When there is a trellis, we train the principal branches upon it, fastening them with osiers. The fruit-branches and young shoots are tied with rushes. In gentlemen's gardens, guides, of which I have before spoken (102), are fixed to the trellis; and also a rod at each side of every principal branch, and parallel to its direction. The above is a convenient way of training the fruit-branches in their proper place, which could not always be done if they happened to be opposite the openings of the trellis.

107. Latterly some walls have been covered with trellises of iron wire. I prefer those made of wood; but if the iron ones are used, guides must be employed for training the principal branches, and when they are fastened to such trellis, care must be taken to wrap the wire several times round with osier, so that the branches may rest on the latter, in order to prevent their bark from being bruised and rusted by the iron.

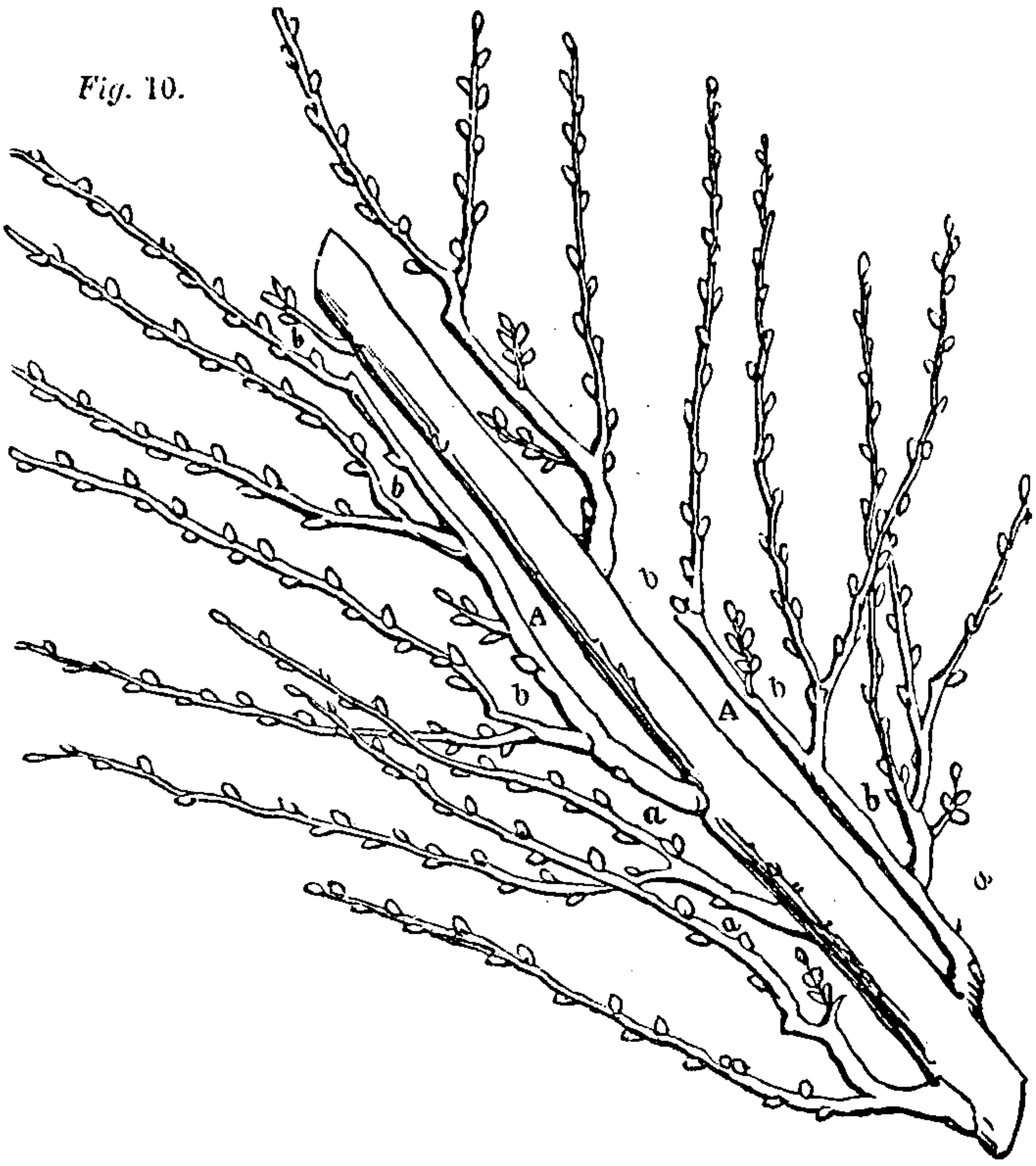
108. A, *Winter-nailing*. This is the first operation performed after the winter-pruning, and the training of the principal branches. All the fruit-branches are fastened in the place they should occupy, having due regard, at the same time, to their form and strength.

109. It has been shown (100) that the growth of a wood-branch, likely to become too strong, is diminished by close training, and keeping it in a confined position; and that, on the contrary, it may be roused from a state of languor by giving it greater liberty. Nailing acts in the same way on the fruit-branches. The restraint that can be produced by nailing has beneficial effects chiefly on the upper sides and near the extremities, where vegetation is always more active, and which ought to be the more restrained, as it tends to increase the distance of prominent eyes from the place where the branch takes its rise. On the other hand, the branches on the lower side must be so nailed as to be in the best position to allow of a free flow of sap. The fruit-branches must be nailed near enough the principal branches to shade them with their leaves from the sun, and so that no naked spaces may exist. In short, with a few exceptions, among which are the fruit-branches that require to be constrained, all the fruit-branches ought to form, with the branch that gives rise to them, a rectilinear angle of greater or less extent.

110. Whatever care or foresight may be used in maintaining a

supply of fruit-branches, naked spaces may occur on principal branches, more especially on their under sides. Such cases may be remedied in the following manner:—

Fig. 10.



At A, Fig. 10, a naked space may be seen on the upper and under side of the branch. In order to fill it, the fruit-branches *a*, *a*, situated on each side, and immediately beneath the naked space, are left, when pruned longer than usual, and are allowed to grow to the required extent. I suppress all the eyes in the intervals of the three shoots *b*, *b*, *b*, and I encourage the growth of the latter, in order to convert them into fruit-branches. When these are obtained, and the branches *a*, *a*, trained as near as possible to the principal branch that bears them, no naked space appears, and the branch is as well covered at this place as elsewhere. The three shoots *b*, *b*, *b*, are treated in the same way as the fruit-branches; and being successively replaced, like them, they produce fruit equally as well. This simple proceeding is advantageous in two ways; it prevents the branch from being naked, and it affords fruit from the three fruit-branches on each side, of which we should have been deprived, if this proceeding

It also economises nails, prevents the tree from being galled, and some of the fruit from being injured by nails pressing against them. It often happens, especially in young Peach-trees, that in training them after the winter-pruning a sufficient inclination cannot be given to the principal branches for fear of breaking their bark at the origin of the branch. If that be the case, we unnail the tree in order to bring these branches down to the proper place, which can be done with greater ease when they are rendered more flexible by the flow of sap. Under these circumstances the main branches are not always strong enough to support the secondary branches loaded with leaves and fruit; therefore, before completely unnailing the tree, they must be tied to each other, at a foot from the stem, with strong osiers to prevent them from splitting. The bark of the main branches should be protected from the pressure of the osiers by a piece of cork. Even in old trees, where all the principal branches after being unnailed would remain in their right position, it is still advisable to support each of the two main branches by one or two nails and shreds. It is of course understood that all the ties of a tree on a trellis, which were made at the winter-nailing, must be cut as the summer-fastening proceeds.

116. In this operation all the young shoots which are situated towards the extremities of the principal branches, and those on the fruit-branches, are nailed or tied in the right direction, at proper distances, and without confusion. In summer-nailing we always begin at the upper part of the tree, and work downwards.

117. The summer-nailing produces the same effect on the young shoots that the winter-nailing has on the fruit-branches, according as more or less freedom is allowed them. Therefore, if it is desirable to increase the growth of a young shoot, we give it greater liberty in nailing.

118. After having first nailed the upper parts, which are always further advanced than the lower, by reason of the natural inclination of the sap to ascend, there are cases where we leave all the lower parts at liberty during ten or twelve days, thereby increasing the strength of these parts, and equalizing it with that of the upper shoots.

119. During the winter-pruning, it is sometimes necessary to remove superfluous eyes; and, during the summer-nailing, pinching, disbudding, and summer-pruning are requisite operations.

V. *Winter Disbudding.*

120. This operation is performed at the same time as the winter-pruning and nailing. Although it is but little practised at Montreuil, I shall notice it lest it should be supposed that we are ignorant of it. It consists in removing with the fingers the wood or fruit-buds that are considered useless, and of which the growth would be likely to absorb that sap which would prove beneficial to the buds retained. On the wood-branches, the eyes that push before and behind are taken off when it is certain they are useless; also some of the double or triple eyes that are often found at their extremities, when it is needful to moderate the strength of the branch. On the fruit-branches, those wood-buds are taken off that are likely to prove prejudicial to the one at their base. This operation should not be performed without due reflection, because, if done rashly, thereby destroying too many eyes, it may prove fatal by reason of the frosts, which often come on unexpectedly. It is always better to have too many than too few eyes. In fact, I do not much approve of winter-disbudding, because the summer-disbudding is an excellent means of regulating the growth of the tree with much greater certainty; for when it is performed, the more advanced state of vegetation enables us better to distinguish the growths which ought to be removed.

121. The same holds good with regard to removing the eyes from the upper fruit-bearing branches, which, when pushing vigorously, have their bases furnished with several wood-eyes, whilst their flower-buds are situated towards their extremities; so that in pruning, to have fruit, they must be left long. In such a case, the two eyes nearest the base are retained for successional shoots; and in order that their development may not be prevented, the other wood-buds, between the two lower and the flower-buds, are removed at the winter-pruning, or after they have pushed in spring, as I shall hereafter explain. The first proceeding is without any inconvenience in full-grown trees, where the sap does not flow so strongly; but, in order to make this suppression in young and vigorous trees, it is better to wait till the eyes push young shoots, so that sufficient time for a partial diversion of the sap may be given, thus preventing it from flowing too strongly towards the successional shoot.

VI. *Disbudding, or Removal of Young Shoots.*

122. Disbudding is the suppression of all the useless or badly-disposed shoots and laterals, with the intention of concentrating the sap, of encouraging the growth of the young shoots retained; and of keeping a sufficient space in which to nail them with regularity and symmetry. Disbudding, to produce the best results, should be divided into two distinct operations. The first takes place as soon as all the buds of the Peach-tree become developed into young shoots, so as to enable us to know the ones that are unnecessary; it is the operation subsequent to the winter-nailing. The second takes place successively as vegetation proceeds, and applies to the laterals as well as to the primitive young shoots.

123. The first operation is a very good substitute for winter-disbudding, which I do not recommend. It most commonly takes place early or late in May, according as vegetation is more or less forward; but always before the young shoots have acquired too much strength. If we deferred too long, the suppression of the young shoots would cause a great derangement in the cirenlation of the sap. It is, therefore, very important to make the first removal of young shoots whilst the latter are herbaceous, and scarcely three-quarters of an inch long. It is performed on the fruit-branches in the case mentioned at 121, and on shoots of the former year which terminate the wood-branches recently pruned. In fact, these shoots, the result of the former year's pruning, will have formed a great number of triple eyes, more especially on strong trees. These eyes, opening at the same time, would produce young shoots, which, if retained, would consume too great a quantity of sap. For this reason, the middle one, which is always the strongest, must be invariably suppressed at the time of its first starting into active growth, preserving only the best-placed of the remaining two, in order that it, and others managed in the same way, may, on their becoming fruit-branches, regularly furnish the principal branches. With respect to double shoots, the same procedure is adopted as in the two latter cases. This first disbudding is of very great importance for ensuring the beauty which a tree presents when its principal branches are regularly furnished with bearing-shoots, and for the maintenance of an equal growth throughout the tree. It may be performed by the hand on the fruit-branches, and with the point of the pruning-knife on the prolonging shoots of the wood-branches.

124. It is always worse than useless to cause a waste of sap,

balance of the tree is threatened, recourse must be had to pinching. It is well, therefore, to watch the progressive indications of the flow of sap; for in consequence of strong shoots resulting elsewhere from its check by the first pinching, the operation frequently becomes necessary on them. Those young shoots, which, by their appearance or position, promise to become very strong, should be pinched before they reach the same length as the others that are less favourably situated, and not so well established. The former should be pinched when three or four inches long; the others must be left untouched till they attain the length of from twelve to sixteen inches. In every case we must bear in mind the necessity of preventing the eyes that form on the young shoots, and especially those on their bases, from becoming blind, which might take place if the shoots were allowed to grow too long. We must also avoid, as much as possible, the pinching of them before they are of sufficient length, as it is likely to make them produce laterals. I usually pinch the young shoots behind a leaf, so that the tree does not appear to have undergone the operation; and many cultivators wonder at the regularity and well-balanced strength of its shoots.

128. Some laterals cannot be prevented from forming on the young shoots that are retained, and particularly on those which have been pinched. The laterals which push on the leading shoots should, for the most part, be pinched when six to eight inches in length, above the second, or from that to the sixth leaf, according to their strength. On the leading shoots, pinching should be preferred to disbudding, which entirely destroys the origin of the lateral. Pinching, moreover, is favourable to its good organisation, by encouraging the eyes that are formed along its base, and which fit it for becoming a fruit-branch on the prolonging shoot when the latter shall have become a wood-branch.

129. It is by no means uncommon for the terminal shoot of fruit-branches, situated on the upper sides of the principal branches, to grow to an extent likely to prove hurtful to the successional shoot. The former must then be pinched, but leaving it so long as not to make too much sap flow to the latter. If this pinching cause some of the eyes to burst into laterals, it must be discontinued, and the shoots must be cut down on the lowest lateral by a summer-pruning. If, in its turn, the young successional shoot acquire too much strength in consequence of these operations, we must endeavour to moderate it by pinching. If, occasionally,

some of its eyes push laterals, it may be cut down, by summer-pruning, on a dormant eye; or, if none such exist, on its lowest lateral.

130. With respect to the laterals which break out prematurely on the young shoots, pinching is much more important for those situated on the upper side than for those on the lower. The latter, from having a less flow of sap, do not always require to undergo this operation.

131. Pinching being an operation entirely depending on foresight, it should be well considered; for when carried to too great an extent, its effects are disastrous; therefore I recommend great care to be taken in practising it; and I may say, that on my trees only a third, at most, of the young shoots undergo the operation.

VIII. *Thinning the Fruit.*

132. The danger of frosts, which are often so fatal to the blossoms of the Peach-tree, obliges us, at the time of pruning, to retain more flowers than is absolutely necessary; and if the weather be favourable, too many fruits is the consequence. Fructification being a very trying process, the trees might be injured by its being allowed to take place too extensively; therefore an excessive setting of fruit must be prevented. Nevertheless, in years when only a moderate quantity sets, the thinning should not be made till the month of June, the time that the stone is formed, which is a crisis at which much fruit drops. When those that remain appear secure, the superabundant ones are removed, so as to leave only as many as the tree can bring to perfection, and nourish without exhausting itself. In this operation, the fruits that are too close together are thinned out, so as to distribute the whole equally, and as nearly as possible at uniform distances, giving the preference to those that are best placed, and of a regular form.

133. We first thin out those fruits that are at the tops of weak branches, or on branches of which the successional shoot appears weak; and there is always a less number left on the lower than on the upper parts, although the former have more flowers. The fruits to be removed must be detached by turning them with the thumb and the two first fingers without jerking, taking care not to break off those intended to remain. When the growth of the tree is well balanced, the number of fruits left on

each wing must be as nearly equal as possible; and if the thinning is well done, a sort of regularity is obtained which would make one believe that they had been placed on by hand. The green Peaches taken off may be turned to account by the confectioners. Notwithstanding the number of fruits dropped and thinned out, I still leave on each square-trained Peach-tree, about four or five hundred Peaches, which, from their beauty and nearly equal size, well repay the trouble I take.

134. But in abundant seasons, if we did not thin till the stone is formed, the tree would be weakened. In such a case, the thinning should be made at two different times; the first in June, when all that are evidently superfluous must be thinned out; and the second after there is no danger of their dropping.

135. The greater or less quantity of fruit is a means of equalising the strength of the different parts of the tree, as will be further explained.

IX. *On Summer Pruning.*

136. The object of this operation is to remedy any bad results of winter-pruning, of pinching, and of omissions in the disbudding; also to concentrate the sap in the tree, by removing those useless productions which would have to be cut off at the winter-pruning, and which, meanwhile, would have fed on the sap at the expense of others necessary to be preserved.

137. Summer-pruning, which is performed with the sécateur, or with the pruning-knife, as may be requisite, is less applied to the wood-branches than to the fruit-branches, especially when the winter-pruning is well done. The following, however, are some circumstances where it should be employed. When the extremity of a vigorous young shoot has been too severely pinched, the upper eyes usually open at the same time, and several laterals are formed causing great disorder. These are perhaps pinched in their turn, and very often the result is a crowd of young shoots, originating near the same point. Such agglomerations receive the name of *willow stools;* they consume a great quantity of sap, and tend to impoverish the neighbouring shoots. In this case, all these injurious shoots must be cut down to one of the lowest and weakest laterals; and the growing-point must be pinched before there is time to form eyes along the shoot. The consequence is, the sap, finding all outlets at this part temporarily closed, turns into other channels before the former can be re-opened.

until after the fruit has been gathered. The more it is attended to, so much the more is the winter-pruning advanced.

X. *Defoliation.*

144. The object of this is, to remove leaves that shade the fruit so as to deprive it of the amount of light necessary to give it the proper flavour and colour.

145. The leaves are taken off at several times. We ought not to commence uncovering the fruit until it is about to accomplish its maturity, that is to say, when the Peaches are nearly at their full size. They are not exposed all at once to the sun, nor are all on the same tree uncovered at one time, at least when not grown for sale, as at Montreuil. The colder the season, the more leaves are taken off. It must not, however, be forgotten, that an excessive defoliation may prove detrimental to the full development of the fruit; and that, as leaves are essential to the existence of the eyes, or buds, that grow from their axils, it is necessary to cut the leaf with the sécateur, and to retain the petiole, and sometimes a third or half of the leaf, in order to preserve the embryo buds. It is also important not to take off any leaves from weakly shoots, the growth of which requires to be encouraged. Defoliation must be so performed as to assist the maturity and colouring of the fruit, taking care at the same time that it may not prove prejudicial to those young productions that should insure us future crops.

Section V.—The Practice of Pruning applied to the Peach-tree trained in the Square Form.

I. *Formation of the Tree.*

146. It has been shown (55) how the young tree was planted. We will now return to that point, and examine the operations which it must each year undergo, in order that it may assume the square form of training, and be well filled up in all its parts, with an equal vigour throughout.

147. As stated (56), the young tree on being planted in autumn is cut back to eight or ten inches above the place where it was budded; see Fig. 6, which represents the tree as it comes from the nursery: B is the bud, A is the point to which it is headed back when planted. In the following spring, the develop-

ment commences of the eyes *a* and *b*, destined to originate the two main branches of the tree; and eyes situated lower than these, as *c*, are not destroyed till the two shoots from *a* and *b* are fairly started.

148. During this first year of planting, it is sufficient to superintend the growth of the two young shoots by training them loosely in the form of a somewhat open V. Their training is continued according to their growth, and so that the young shoots may take a perfectly straight direction. The first year's growth, except in case of accident, generally gives the results which are represented by Fig. 7. At this stage, it is of importance to direct the young shoots by two perfectly straight rods.

149. If by any chance one of the young shoots should perish, the survivor must be trained upright, and pinched when ten or twelve inches in length, in order to form well-established eyes at its base, with the view of obtaining, in the following spring, two young shoots fit for commencing the two main branches.

150. First Pruning.—*Second year of planting.* Fig. 7 represents the results of the first summer's growth. We begin by cutting off the piece c, closely to the angle formed by the two branches. This portion of stem has been retained till now, in order that its three young shoots, which have been pinched when necessary, might assist the two buds *a* and *b* (Fig. 6) in drawing the sap. The latter have made the shoots A, A (Fig 7), of sufficient growth to allow of our pruning the two main branches to the proper length. This length is about fifteen or sixteen inches, measuring from the insertion of the branch. We must now examine the state of the two main branches, and endeavour to find two properly placed eyes at the above height. One of them, *a* (Fig. 7), situated on the upper side, is intended to serve for the prolongation of the main branch; and the other, *b* (in the same figure), and situated on the lower side, to form the first lower secondary branch. The other main branch, A, is examined for two similar eyes at the same height, or nearly so. When that is done, each of the two main branches is pruned on the eye *a*, which becomes the terminal pushing one; and the eye *b* gives rise to the first lower secondary branch.

151. As the effect of the pruning on the eye *a* is to induce great activity of vegetation (65), the resulting shoot must be watched, and nailed at the proper time. The eye *b* must be equally watched, and nailed when necessary, training it by a rod in the right direction, endeavouring at the same time to keep its

strength in proportion to that of the leading shoot of the main branch, A. If necessary, superfluous shoots are removed at the disbudding, especially those at the front and back. The excessive growth of those that are overbearing is kept down by pinching; and lastly, we must endeavour to maintain a constant balance as regards length and thickness of shoots between the two wings. It is of importance not to concentrate the sap too much in young trees, but to leave it the necessary outlets. All regulating operations, such as pinching, should be conducted according to the state of growth of the tree, and should be performed to a greater extent when it is very vigorous.

152. If the balance is disturbed, it can be restored in several ways. The tree may be unnailed and re-nailed, so that the weakly wing may be more or less vertical; whilst the stronger one is lowered. This means, seconded by disbudding and pinching, is generally sufficient. But if it do not produce the desired effect, the weakly wing may be brought out from the wall, in order to give it still greater liberty (100). Nevertheless, that its branches may not take an improper direction, one or more props are placed behind them at six or eight inches from the wall. The wing is supported on these props so as to give it more air, which will greatly tend to strengthen it. It might be left perfectly free, if it were not for fear of the blasts of wind, which might break some of the branches, or bruise the bark and the green parts by shaking; it is therefore prudent to fix it as above. When the equilibrium is restored, the tree is re-nailed with regularity. The wing should not be brought forward from the wall except in fine weather, because, from its distance from the wall, it is deprived of the protection of the copings and screens, and would be more exposed to frosts. In pointing out this mode of restoring the balance between the two wings, a mode which can be employed for trees of any age, the necessity of giving a perfect regularity to the young tree from the very commencement is insisted on; because it appears that when once the sap begins to distribute itself equally through the different parts of the tree, it continues to flow with greater regularity, and presents fewer difficulties to a fine formation.

153. There is another very simple mode, which, though not so efficacious, suffices in the majority of cases. It consists in placing a shading of straw mats, or boards, at eight to ten inches above the stronger wing. This privation of a certain amount of light and air is often sufficient to enable the weakly wing, which

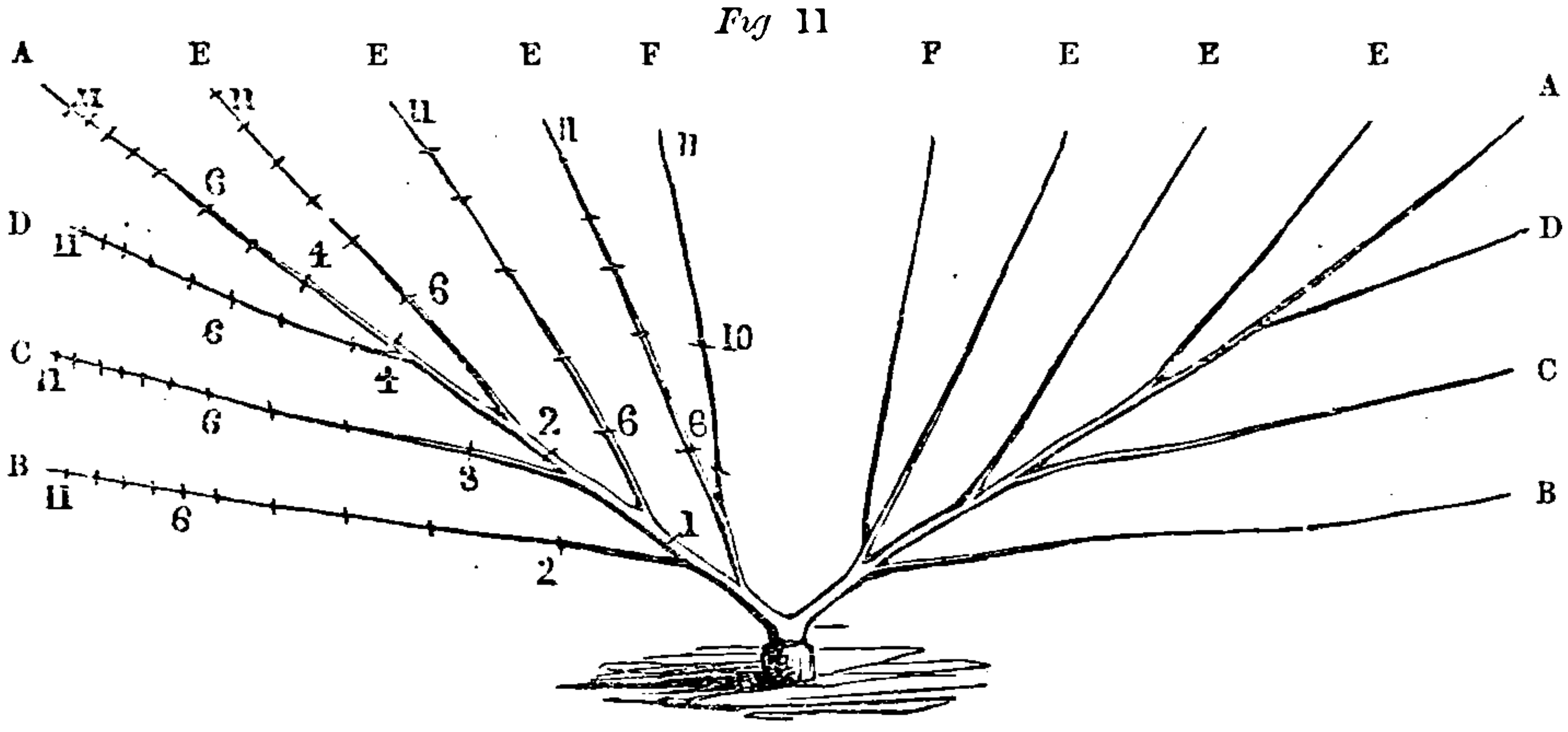
the first lower secondary branch. If such be the case, its formation must be deferred till the following year; and the two main branches are pruned to eyes properly situated for their prolongation. At the second winter-pruning, whatever may be the length of their leading shoots, they must still be cut down to the stated height of fifteen inches and three quarters, each of them to two eyes chosen as aforesaid—one for the prolongation of the main branch, and the other for forming the first secondary branch. I have shown at *c* (Fig. 7) the point at which the pruning must be made in this case, which causes no other inconvenience than that of retarding the formation of the lower secondary branches for one year.

158. SECOND PRUNING.—*Third year of planting.* Fig. 8 represents the state of the tree after the second year's growth. The two main branches, A, A, have increased in length; so also have the two first secondary branches, B, B. All the shoots and laterals which have grown on the sides of these four branches are pruned to two or three eyes; then the main branch A is pruned at about thirty-one inches and a half from the insertion of the secondary branch B, after having ascertained that there are eyes properly situated at a like height on the other branch A, in order that a symmetry as perfect as possible may exist between the two wings of the tree. This interval of thirty-one inches and a half affords facility in nailing the fruit-branches formed along the secondary branches, and allows a free play of air and light. The main branches A and A are pruned at *c*, each on a wood-bud, *a*, situated on the upper side; and having a second eye, *b*, situated on the under side, which is to become the second lower secondary branch. If there should not be a wood-bud properly situated for a leader, there is no objection to choosing one in front; but then, when it pushes, and as it proceeds in growth, it must be nailed so as to make it gradually take the right direction, because it has a tendency to grow outward. The two branches B, B are then both pruned to the same length, about thirty-one inches and a half, in order that, when the four arms are nailed, the points of the branches on each wing may nearly touch a perpendicular line supposed to be drawn from the base of the wall to the coping. This would be the case if the tree, represented by Fig. 8, where the cuts on the leading branches are seen at *c c*, were nailed; because the ultimate depression of the main branches would make the two points on each wing nearly touch the same vertical line.

159. Very often in trees of this age the vigour is such that nearly all the eyes on the leading shoot break forth; so that, at the time of pruning, laterals only are found on the shoot, especially at the height to which it ought to be shortened. In such a case, choice is made of a lateral situated on the upper side, with another immediately below it on the under side; and after having cut the principal shoot, the two laterals are pruned each on a wood-bud suitable for prolonging them according to their respective destinations. They are then regulated by nailing. The pruning of the main and secondary branches may also be effected either on a latent eye followed by a lateral—that is, having a lateral immediately below—or on a lateral followed by a wood-bud, according as they are found at the point where the amputation should take place. Disbudding and pinching are still employed according as they are needed.

160. THIRD PRUNING.—*Fourth year of planting.* The tree is unnailed, and shows the results of the third year's growth. I begin by examining the comparative state of each wing, so as to act accordingly. Supposing no unfavourable accident has occurred to the tree, I cut down all that are solely wood-shoots to two or three eyes, according to their strength. All the fruit-branches that were pruned the preceding year are cut back to the lowest shoot, or to the successional nearest to the principal branch; and this successional is itself shortened to two or three eyes, according to its strength when it has no flowers; and when it has flowers it is pruned to the first wood-bud above the flower-

Fig 11



buds. The laterals that it may be thought proper to preserve on the leading shoots of the principal branches must be pruned in the same way, and they are thus treated at every subsequent pruning. This done, we proceed to prune the three branches A, B, C (Fig. 11), on each wing, commencing with the uppermost.

161. The two main-branches, A, A, are pruned thirty-one inches and a half higher up than at the preceding pruning, and on an eye situated on the upper side, and which eye becomes the leading shoot. On the under side there must be an eye at the origin of D, which is intended to form the third lower secondary branch. After having thus operated on the two main branches, the two secondary ones, C and C, which must now undergo their first pruning, are next attended to. They are pruned at about thirty-one inches and a half from their base, on a bud situated as much as possible in front; the shoot from it afterwards receives its proper direction by nailing. The branches B and B are next pruned for the second time, and on a bud also placed in front, and thirty-one inches and a half higher up than the preceding pruning. It is necessary to remark, that, in order properly to constitute the lower secondary branches, they must be so pruned that their extremities exceed the perpendicular line supposed to be drawn where the end of the main branch touches when the latter is temporarily bent down with the hand. This excess of length should be greatest for the lowest secondary, and diminish to the highest. I should add, that, when a secondary branch is to be formed, it is always important to make the pruning, on the main branch, exactly at the proper point, where the eye immediately below it, which is to produce the secondary branch, may be placed at the proper distance for giving an equal space between the lower branches.

162. Immediately after the pruning is finished, the main branches are brought to a proper position, by bringing down each wing equally, so that the secondary branches may take a right direction. The requisite nailing of all branches is then completed.

163. As vegetation advances the young shoots are successively nailed, commencing at the upper part of the tree; for that part has always a tendency to make the strongest growth, and which tendency it is well to counteract by the greater or less amount of constraint that can be imposed by this operation. About the same time, the first disbudding takes place, and is followed by the pinching of all the over-luxuriant young shoots; and it is generally necessary, for the reasons above stated, to commence likewise these operations on the upper part of the tree. In short, we disbud when needful, and especially two of the shoots from triple buds on the upper sides of the branches; and all

Particular care must be taken at the summer-pruning to cut off all the snags, wherever they are found; because healing over is more readily effected at that than at any other period.

169. Fifth Pruning.—*Sixth year of planting.* The operations of the fifth pruning are exactly the same as those of the fourth. The extremities of the four branches A, B, C, D are pruned to an equal length, and in proportion to their growth. We must carefully watch all the shoots on the upper sides of the branches, especially those on the two main branches, where the sap produces the strongest shoots, and which must be controlled; but the suppressions ought not to be too considerable, because the sap must be employed, lest its superabundance should cause disorder. We must endeavour to replace too vigorous shoots by the young ones that spring from their bases, or occasionally by a lateral; so that vegetation may still go on, but under circumstances that may admit of the growth being so regulated, by pinching, as to prevent over-luxuriance. Besides, much trouble may be avoided by lengthening the pruning, and restraining the vegetation, by nailing close to the wall.

170. At the time of the second disbudding, I choose, on the upper side of the main branch, three fruit-branches which have already received one or more prunings. The three branches should be at equal distances, of the thickness of a quill, and, respectively, originating lower down the main branch than where each of the lower secondary branches takes its rise.

From these three branches, which are intended to become the three upper secondary branches, E, E, E, I take off all the useless young shoots situated in front and behind; and I make choice of one for a leader which, without being too vigorous, appears well conditioned. I winter-prune it to a wood-bud, and nail it somewhat more upright than the other fruit-branches, and so close to the wall that its growth may be moderate, and any disposition to the contrary must be checked.

171. This preparation for establishing the three upper branches, E, E, E, is not made till the following year in trees which have made only weak shoots, and in those of which the lower branches do not appear sufficiently strong; but then the tree is not completely formed when eight years old.

172. Sixth Pruning.—*Seventh year of planting.* It will be perceived, by referring to Fig. 11, that the main branch, A, bears three branches, E, E, E, on its upper side, which are much more developed than any of the other productions on that side. These

three branches are the ones preserved at the disbudding of the preceding season, and which are now becoming the three upper secondary branches. If it was not possible to form these the preceding year (170, 171) they must now be originated.

173. The pruning of the fruit-branches, and successional shoots, and the treatment of the young ones, by disbudding and pinching, are still carried on. The same course is adopted with regard to the four branches, A, B, C, D, the extremities of which are shortened back at the winter-pruning.

174. With regard to the three branches, E, E, E, their leading shoots are pruned, for the first time, by shortening them to wood-buds, situated at heights proportionate to the respective conditions and state of growth of the shoots. If any of them have blossom-buds, the shoots must be pruned to a wood-bud above the blossom-buds; and care must be taken to disbud, as soon as they push, all wood-buds situated below the flowers, with the exception of one or two wood-buds that are nearest the base of the shoots. Immediately after pruning, the three secondary branches, E, E, E, are nailed obliquely, tightening the shreds more or less as is needful; and afterwards all the young shoots that are retained are nailed in the same way. During the growing season, the progress of the leading shoots is watched, and they are pinched when necessary. Their laterals are also pinched to six or eight leaves. In short the growth of the branches of this part of the tree and that of their shoots must be particularly attended to lest they impoverish those below; the upper young shoots must be nailed as soon as possible, in order to keep the sap in the lower parts. If, notwithstanding these precautions, the leading shoot become too strong for the others, it must be cut on a lateral, situated in front, which must be immediately nailed in the proper direction, and close to the wall.

175. SEVENTH PRUNING.—*Eighth year of planting.* This pruning is, in every respect, like the preceding. The main branch A (Fig. 11) is pruned for the seventh time; the branch B for the sixth; C for the fifth; and D for the fourth time. The secondary branches, E, E, E, are pruned for the second time since their formation was commenced, without counting the prunings on the fruit-branches from which they have originated. By designating all the principal branches by the letters of the alphabet, the whole course of proceeding can be seen at a glance, as the order of the alphabet also shows that of the formation of the branches. Thus, the letter A indicates the main branch that

was first formed; whilst the three upper secondary branches are marked E, E, E, they being formed the last, and all three at one time.

176. The management of these three last-named branches is similar. They should always be nailed the first; and should be several times disbudded, and their shoots likewise pinched whenever it is necessary to do so. The essential point is to leave sufficient outlets for the sap, so that it may not open fresh ones by producing over-luxuriant shoots and laterals, which would monopolise an undue share of nourishment, and impoverish the lower branches of the tree. The suppressions on the upper branches are made with the intention of checking the sap, so that it may nourish the lower parts of the branches, which, notwithstanding, sometimes remain inactive. We should, however, recollect, that the vegetation of the Peach-tree being incessant till the end of October, in ordinary years, it is always possible to remedy disorder by adopting proper means when it appears.

177. EIGHTH PRUNING.—*Ninth year of planting.* Conducted during eight years in the way explained, and no accident happening to it, the Peach-tree acquires at this pruning the form of a long and regular parallelogram. Fig. 11 represents the principal branches of a tree planted twelve years. The marks show the number of prunings which each branch has received; and the figures indicate the years in which the respective cuts opposite to them were made, reckoning from the second year of planting. Thus, the first cut on the branch E is marked 6, denoting that it was made in the year corresponding with that in which the main branch, A, received its sixth winter-pruning.

The tree covers a surface of about twenty-six feet in length and eight feet in height, and the extremities of the four branches, A, B, C, D, touch the same perpendicular line, whilst those of the three upper secondaries touch the same horizontal line as the extremity of the main branch, A. In other respects, the eighth pruning is the same as the seventh. The fourth upper secondary branch, being formed at a later period, does not exist at the eighth pruning.

178. The main branches are everywhere regularly furnished with fruit-branches. The tree, complete, as figured in my work, exists in my grounds; and it may be seen there, together with other thriving specimens which present the same regularity. Those Peach-trees which were fully formed in 1841 are still as regular and vigorous as ever, proving by their results that my

and that it is prevented from running through all the sap-vessels of the principal branches so rapidly as only to leave badly-elaborated juices. During the existence of the tree, the pruning of the fruit-branches is always the same; and disbudding and pinching are the regulators by which we can conduct the development of these branches at will (87—96).

182. With regard to the principal branches, their pruning ought to be governed by two principles. The first is to encourage the prolongation of the branches A, B, C, D; the second, on the contrary, is to restrain as much as possible the growth of the extremities E, E, E. These two opposite means mutually assist each other. In fact, it may easily be conceived that, in consequence of the elongation of the extremities A, B, C, D, producing young shoots and leaves, these branches attract a greater quantity of sap than flows to the upper secondaries, checked as it is at the same time by the obstacles opposed to the growth of the latter, and thus inducing its flow towards the extremities A, B, C, D, thereby contributing so much the more to their growth.

183. Therefore the four last are pruned as long as possible, in order that their points may regularly touch the perpendicular line drawn from the top of the wall to the earth. The only limit to this elongation is the height of the wall which prevents the branch A from attaining a greater length than that at which it touches the under side of the coping; and which, consequently, obliges us to keep the three secondary branches, B, C, D, in a relative proportion, so that their extremities, when nailed, may not extend beyond the perpendicular line falling from the point of the branch, A.

184. When it has reached the coping, there are three modes of proceeding. 1st,—By the annual cutting back of each of the four branches A, B, C, D, on shoots proper for replacing the extremities of the branches shortened back. These shoots are each pruned on a wood-bud suitable for a leader. This is the way generally adopted; and must necessarily be so when, as has been pointed out (59), the Peach-trees are only twenty-six feet apart, and consequently there is no more space for the extension of the branches.

185. 2nd,—By the annual cutting back of the branch A only, which must be treated from that time the same as will be directed at 187 for the branches E, E, E, and by the equal elongation of the branches B, C, D, until the branch D, in its turn, reach the coping. But, to employ this method, there must be certain con-

ditions not always to be met with. It will be understood that the elongation of the lower branches is a secondary consideration to that of their being maintained in good condition; and that they should always be well furnished with young wood; for if they were prolonged without care being taken, it might prove injurious to the vigour of the lower part of the tree, and produce ugly gaps. Therefore, the elongation of the four branches A, B, C, D must be proportionate to their strength; and when they are weakly, they must be kept shorter, by every year cutting back their extremities to a lower shoot, which, with proper nailing, forms a new leader (184). This proceeding concentrates the sap for the better nourishment of the lower parts, and for the producing in them a more active state of growth. But if, on the other hand, the growth of the tree is so vigorous that the lower parts are healthy, and the principal branches there well furnished with fruit-branches, there is no danger in treating the branches A, B, C, D as has been explained in the beginning of this article, and thus we may even be able to give each wing an extent of twenty feet—a proportion that cannot well be exceeded on walls ten feet high; and this does not prevent us from keeping the tree in the form of a long parallelogram forty feet in length by ten feet in height. But the second method, which can be very seldom resorted to, requires that a greater distance between the trees be provided for at the time of planting. It will be easily understood that the equilibrium of strength and growth is more difficult to maintain in a tree disposed in this way, the lower principal branches being only three against four upper ones; and, therefore, I do not recommend the adoption of this method.

186. 3rd,—In carrying successively the depression of the main branch, A, to its utmost limit, its length relatively to the extremities of the three lower secondaries must, however, be maintained. This extreme lowering of the main branch, which thus ceases to divide the wing into two equal parts, still more increases the distance from each other of the upper branches, E, on each wing; and there would be a great space left between them if a fourth upper secondary (F,) were not formed.

It is obtained, as stated at 170, by the prolongation of a fruit-branch chosen at the base of each of the two innermost branches E.

This method is preferable to the second (185), but it should only be employed on trees that are very vigorous, especially in their lower parts; and in those in which a greater number of outlets for the sap can be afforded.

187. The pruning of the upper branches, E, E, E, consists in cutting each of them back every year, at the winter-pruning, on a fruit-branch, the shoot from the terminal bud of which replaces the extremity of the branch. This shoot is nailed as closely to the wall as possible, in order to restrain its growth. If this branch be shortened to a wood-bud, care must be taken to nail it as soon as it is sufficiently developed to admit of its being fastened. The extremities of the three upper branches should, after the winter-pruning, be at the distance of eight or ten inches from the coping.

188. Notwithstanding the constraint imposed on these upper extremities, they soon begin to grow rapidly; and we must take care, first to pinch them, afterwards to cut them down on the lowest lateral which the pinching produces; and, lastly, whenever one of them approaches too near the coping it is cut down at a summer-pruning on a lower shoot, or on a very slender branch of old wood, which is nailed in as soon as possible, and which becomes a new terminal. Attention to these shortenings is required during the time vegetation is going on; nevertheless if they prove ineffectual, and the branch gain the ascendant, it must be cut down at the following winter-pruning to a small fruit-branch, situated at its base (170), which is pruned and nailed as there directed. It is of course understood that disbudding and pinching are performed on the shoots of these upper branches, and that they should all be nailed as soon as it is possible to lay them in. They are pinched when necessary, and summer-pruning is employed for dispensing with the crowd of laterals which results from the pinching, cutting them off to the lowest lateral. All these precautions are necessary for producing and maintaining a supply of fruit-bearing branches on the three upper secondaries, E, E, E, of each wing.

The omission of these operations is often the cause of gaps in Peach-trees. The treatment of the upper secondary branches is the same throughout the life of the tree. Lastly,—As repetitions must be made in order to draw the attention of the reader to the fundamental principles of the pruning of the Peach-tree, I will conclude by stating that its success depends on the care of the cultivator:—

189. 1st,—To form well-nourished main branches, A, A, each tapering from its base to its top without inequalities even at the

REPORT FROM THE COUNCIL

TO THE

ANNIVERSARY MEETING, MAY 2, 1853.

THE year that has now elapsed has been so little suited to Horticultural operations, that the Fellows of the Society could scarcely have been surprised had the Report now about to be read conveyed much more unsatisfactory intelligence than the Council have to communicate. Bleak, uninviting weather at the most important of the Garden Exhibitions, almost incessant rain from the end of October to the beginning of March, during a large part of which time the water stood nearly on a level with the highest parts of the Garden, contributed in different ways to render the year 1852-3 singularly unprosperous. On the one hand, the revenue derived from the Exhibitions was diminished to the extent of 1820*l.*; and on the other, improvements to the Garden during the winter were rendered impracticable. Nevertheless, the Council have the satisfaction to find that if they have no surplus income to record, they have no material increase of debt to announce; the whole addition to the liabilities of the Society not exceeding 121*l.* 16*s.* 5*d.*, as will be explained in the following Report.

The Garden Exhibitions were probably more rich in finely cultivated plants, and more free from bad ones, than they have been in any former year; showing that horticultural skill is not only advancing, but is becoming more generally diffused. The attendance was as follows:—

May 8	2755
June 12	4719
July 10	8820
	16,294

being nearly 4000 fewer than in 1851. This seems to have arisen chiefly from the excessive coldness of June 12, the day on which it has been customary for the greatest number of visitors to attend, and which itself presented a falling off of 4664. Owing in part to this cause and in part to an increase in the value of medals awarded by the Judges, the net produce of the Garden Exhibitions was less by 1898*l.* 2*s.* 4*d.* than in 1851, although the working cost of the Exhibitions in 1852 was less than in 1851 by the sum of 116*l.* 5*s.* 8*d.*, as will be perceived from the following comparative statement:—

Expense of Exhibitions.	1850. £	*s.*	*d.*	1851. £	*s.*	*d.*	1852. £	*s.*	*d.*
1. Miscellaneous timber	23	10	2	27	3	8	18	7	7
2. Miscellaneous repairs	60	2	7	39	0	6	45	13	4
3. Carpenters, painters, tent-pitchers, &c.	126	4	7	121	10	11	140	2	5
4. Miscellaneous labour beyond the ordinary service of the Garden	188	13	7	69	17	5	72	13	8
5. Miscellaneous printing	31	13	6	64	17	10	59	17	4
6. Admission tickets	37	15	0	30	14	0	25	7	0
7. Advertisements	86	13	6	125	4	6	119	1	0
8. Judges	30	9	0	31	10	0	31	10	0
9. Extra clerks and temporary rooms	28	11	6	22	16	0	24	0	0
10. Police	60	11	0	81	9	0	71	12	0
11. Bands and all musical expenses .	270	6	0	300	0	0	270	0	0
12. Provisions for exhibitors, police, &c.	55	10	2	56	0	11	56	16	10
13. Watering roads	—			15	15	0	15	15	0
14. Miscellaneous expenses, including stationery, carriage, postage, &c.	54	12	6	48	3	0	41	4	8
15. Cost of new tents	—			65	0	0	32	0	0
16. Green baize for tables	—			46	3	9	5	0	0
17. Extra labour for New Exhibitors' Yard and Alterations	52	9	0	—			—		
	1107	2	1	1145	6	6	1029	0	10
Medals awarded	1066	5	0	1033	5	0	1227*	0	0
	2173	7	1	2178	11	6	2256	0	10

It will be observed in this account that the cost of Medals was augmented by the sum of nearly 200*l.* beyond that of 1851, no less than 1227*l.* having been expended upon that head alone. The attention of the Council having been directed to this point, the Exhibition Committee was instructed to consider whether in preparing the schedule of prizes for 1853 some arrangement could not be made for diminishing this head of expenditure.

* This is part of the sum of 1299*l.* 5*s.* entered in the balance-sheet as Medals awarded—the balance of 72*l.* 5*s.* being for Awards at Meetings in Regent Street.

in future with two friends instead of one. By this arrangement the Fellows of the Society and their personal friends have now the power of viewing the Exhibitions an hour and half earlier than visitors not accompanied by Fellows of the Society.

They have also authorised the construction of a zinc roof over the iron tent, instead of renewing the canvas covering; by which means the tent itself will become far more useful as well as more durable than it has hitherto been.

The funds at the disposal of the Council would not have enabled them to incur much cost in new works at the Garden, even had the winter rendered ground-work of any extensive kind practicable. They have, however, to announce that Messrs. Pilkington and Co. have fixed a very good specimen of Ewing's glass walls; that a new and improved heating apparatus has been adapted satisfactorily, by Messrs. Weeks and Co., to some brick pits; and that the condition of the Arboretum, of the new American Garden, and of its approaches has been still further improved.

They have also permitted Mr. McGlashan, of Edinburgh, to exhibit the capability of his transplanting apparatus to remove trees of considerable magnitude—a Poplar, 50 feet high, having been selected for the purpose; on which occasion H.R.H. Prince Albert honoured the Garden with his presence.

A large number of varieties of fruits having been introduced to cultivation since the last edition of the Fruit Catalogue was published, Mr. Thompson has been instructed to prepare a supplement to it, which will be ready in the course of the ensuing summer.

It will be within the recollection of the Society that in the year 1850 the distribution department of the Garden was reorganised on the retirement of Mr. Munro, in whose charge it had been for many years, and by the construction of better houses for the propagation of plants. The Garden Committee report that this change has proved satisfactory; that a better class of plants is now provided for distribution among the Fellows; and that many imported plants, which there had been previously no sufficient means of multiplying, had been sent in some abundance to the applicants. It also appears that the number of demands upon the Garden still remaining to be complied with is very much smaller than it has been at any time for more than twenty years. The Council had, however, previously found that the new plants obtained for dispersion had ceased to be sufficient to satisfy the just expectations of the Fellows of the Society; that little was to be expected from the Scotch expedition to Oregon, to which the Society had subscribed, and that fresh importations of seeds and plants had become necessary. It was therefore announced at the last anniversary that the Council felt the period to have arrived when it was desirable once more to despatch a Collector of plants in search of horticultural novelties, and that it was under consideration whether one might not be advantageously employed in some of the temperate regions of South America. The unsettled state of the Argentine Provinces having, however, compelled the Council to pause, and some negociations with a naturalist in South America having failed, the Council provisionally availed themselves of the very liberal offer of Mr. Phillips, one of the agents of the Mining Company of Real del Monte in Mexico, to permit their officers to collect a supply of seeds of the valuable Coniferous and other plants inhabiting that locality, and an expenditure of 50*l.* in defraying the expenses of the collectors was authorised. Subsequently, after much consideration, the unexhausted richness of Mexico in fine plants, its varied climate, and the rapidity with which it can now be reached, have finally induced the Council to take that country once more for a collecting-ground. But they have determined that the agent to be sent there shall no longer, as on former occasions, travel incessantly from place to place. They believe that it will be more economical as well as more advantageous that the Collector should remain stationary in some rich field until he has gleaned all that is most worth having, before he is transferred to fresh ground; and they have to announce that a Committee has been appointed which is engaged in arranging the details of the enterprise. It has already been settled that Mount Orizaba shall be the first district to be explored; and the Committee have every reason to believe that they have engaged the services of a Collector who will skilfully and energetically fulfil the trust reposed in him.

The number of Plants, &c., actually given away by the Society, during the period now reported on, was as follows :—

	Plants.	Seeds.	Cuttings
To Members	4,390	40,192	1,689
To Foreign Countries, Correspondents, &c.	211	670	20
To Her Majesty's Colonies.	34	472	—
Total	4,635	41,334	1,709

The number of Visitors to the Garden has been 5931, notwithstanding the almost constant bad weather.

The more important of the presents made to the Society have been the following:—

From M. Seitz, of Munich, Seeds of the Burgundy Radish, and 8 other varieties of Vegetable Seeds.

From Sir Robert Schomburgk, of St. Domingo, Seeds of Calonyction speciosum, and 17 other sorts of Seeds.

From C. A. Uhde, Esq., of Hadschusheim, near Heidelberg, a Plant of an Early White Grape, and 18 ornamental Plants.

From M. Baumann, of Ghent, 12 Plants of Deutzia gracilis.

From H. C. Calvert, Esq., of Erzeroom, a collection of Erzeroom Seeds and some Acorns and Bulbs.

From G. U. Skinner, Esq., a Plant of Masdevallia coccinea, a tuberous-rooted Fuchsia, with various newly imported Orchids, Plants, and Seeds.

From J. B. Pentland, Esq., Seeds of the Titicaca Maize, Cinchona Calisaya and Cinchona Boliviana, a new Annual from Bolivia, 4 Acorns from Italy, and Cones of the Silver Cedar.

From Messrs. Rinz, of Frankfort, Plants of 5 varieties of Juniper, 5 of Helleborus, and 16 other hardy ornamental Plants.

From the Lord Ashburton, a basket of Orchids, consisting of 2 species of Cattleya and 20 other kinds of Orchids; and a woody tuberous-rooted Plant.

From Messrs. Bossin, Louesse, and Co., of Paris, a Plant of the Précoce Malingre Vine, Tubers of Pomme de Terre Comice d'Amiens, and 7 sorts of Seeds.

From Prof. Chas. A. Meyer, Superintendent of the Botanic Gardens, St. Petersburgh, a collection of curious Botanical Seeds.

From Mr. D. Moore, Botanic Gardens, Glasnevin, a Plant of Orchis speciosa.

From Dr. J. E. Stocks, Superintendent of the Botanic Garden, Dapooree, Poonah, Bombay, Seeds of Citrullus fistulosus and Cucumis cicatrisatus.

From the Honourable Court of Directors of the East India Company, Roots of Sonerila orbicularis and a Balsam, Seeds of Abies Deodara and Berberis nepalensis, with a collection of Seeds from the Botanic Garden, Calcutta, and some Orchids.

From John Tinné, Esq., of Liverpool, Seeds of a Runner called "Turkishe Bohne," together with Seeds of a Kidney Bean resembling the Haricot Riz.

From Edward Smith, Esq., of Sheffield, a Plant of Caladium (?) distillatorium.

From the Royal Botanic Gardens, Kew, Gloxinia fimbriata, Primula Sikkimensis, and 3 other new Plants.

From Mr. Barlow, of Grove Terrace, Notting-hill, 3 sorts of Mexican Seeds and 2 tuberous Roots.

From Henry Southern, Esq., H. M. Minister at Rio de Janeiro, a bag of Araucaria imbricata Seed.

From the Marquis of Winchester, 5 sorts of Russian Seeds.

From Dr. J. D. Hooker, R.N., Seeds of Rhododendron argenteum.

From Mr. Wakefield (through J. R. Gowen, Esq), Tubers of the different varieties of New Zealand Potatoes.

From G. T. Davy, Esq., of Sussex Square, Hyde Park, Seeds of Bignonia semperflorens.

HORTICULTURAL SOCIETY OF LONDON.

RECEIPTS, PAYMENTS, AND LIABILITIES, FROM THE 1ST OF APRIL, 1852, TO THE 31ST MARCH, 1853.

RECEIPTS.

RECEIPTS.	£	s.	d.	£	s.	d.
To compositions for life from Fellows				572	5	0
To annual subscriptions do.				2685	1	8
To admission fees do.				75	12	0
To Quarterly Journal sold				80	16	3
To Transactions and Fruit Catalogues sold				9	18	0
To rent of apartments let off in Regent Street				150	0	0
To garden produce sold				25	11	1
To receipts from Fellows for garden charges				28	18	0
To miscellaneous receipts				34	1	10
To Garden Exhibitions, 1852				3225	14	6
				6887	18	4
To Sir W. P. Call & Co. on loan				1000	0	0
To Balance at Banker's, April 1, 1852	98	12	1			
do. with Vice-Secretary	13	16	3			
				112	8	4
£				8000	6	8

April 8, 1853.

We have examined this account with the Vouchers, and find the same to be correct.

SAMUEL F. GRAY,
GEORGE CHARLWOOD, } *Auditors.*

PAYMENTS AND LIABILITIES.

PAYMENTS AND LIABILITIES.	£	s.	d.	PAYMENTS. £	s.	d.	LIABILITIES. £	s.	d.
By interest on loan notes, &c.				231	17	7	48	10	10
By rents, taxes, &c., Regent Street and Chiswick				233	11	4	411	8	11
By repairs, furniture, &c., Regent Street				92	4	11			
By housekeeping expenses, do.				41	5	0			
By salaries and wages, collector's poundage, &c.				815	19	0	153	16	9
By cost of Quarterly Journal				301	2	1			
By cost of Transactions and Fruit Catalogues				13	14	3			
By library charges				9	17	4	8	8	0
By printing, stationery, &c.				66	9	10	6	16	11
By foreign missions and imports				5	0	9			
By expenses of meetings, postage, carriage, &c.				98	5	1			
By garden labour				1329	3	0			
By implements, mats, seeds, &c.				99	14	0			
By tan, dung, &c.				34	15	2			
By coals and coke for garden				66	14	6	86	15	3
By miscellaneous expenses at garden				115	12	5			
By garden repairs				74	2	10	56	16	0
By distribution expenses				52	8	2	68	5	8
By Exhibition expenses, 1852				1029	0	10			
By new works at garden				124	3	7	34	9	9
				4835	1	8	875	8	1
By medals' account:—									
Balance outstanding, April 1, 1852	435	7	0						
Awards, &c., since	1299	5	0						
	£ 1734	12	0	1415	8	6	319	3	6
By Sir W. P. Call & Co., Loan, Feb. 2, 1852, repaid				500	0	0			
By outstanding accounts, April 1, 1852, paid off				1063	13	1			
By Balance at Banker's	£163	1	2						
ditto with Vice-Secretary	23	2	3						
				186	3	5			
				8000	6	8	1194	11	7

A. DUNCAN, *Accountant*,
10, TOKENHOUSE YARD.

Amount of Debt 1st April, 1853, viz. :—	£	s.	d.
To Creditors on Loan Notes	5400	0	0
To Sir W. P. Call & Co., on Loan	1000	0	0

The items in this document will be better appreciated upon perusing a comparative account of the Income and Expenditure in the present and previous year.

Income.	1851-2.			1852-3.		
	£	s.	d.	£	s.	d.
Annual Subscriptions	2533	12	0	2685	1	8
Admission Fees from Fellows	107	2	0	75	12	0
Quarterly Journal sold	26	4	3	80	16	3
Transactions and Fruit Catalogue sold	6	9	6	9	18	0
Rent of Apartments let off in Regent-street .	150	0	0	150	0	0
Garden Produce sold	28	3	1	25	11	1
Receipts from Members for Garden charges .	36	5	6	28	18	0
Miscellaneous Receipts	30	13	6	34	1	10
Garden Exhibitions	5046	7	6	3225	14	6
American Exhibition, 1851	18	7	0	—		
Total	7983	4	4	6315	13	4

Expenditure.	1851-2.			1852-3.		
	£	s.	d.	£	s.	d.
Interest on loan notes, &c.	268	18	11	280	8	5
Rent, taxes, &c, Regent-street and Chiswick . .	643	11	1	645	0	3
Repairs, furniture, &c., Regent-street	86	4	6	92	4	11
Housekeeping expenses ditto	32	17	7	41	5	0
Salaries and wages, collector's poundage, &c. .	966	7	0	969	15	9
Cost of Quarterly Journal	312	1	0	301	2	1
Cost of Transactions and Fruit Catalogues . .	11	2	3	13	14	3
Library charges	22	8	5	18	5	4
Printing, stationery, &c..	82	2	3	73	6	9
Foreign missions and imports	1	2	7	5	0	9
Expenses of meetings, postage, carriage, &c. . .	76	12	11	98	5	1
Garden labour	1332	1	9	1329	3	0
Implements, mats, seeds, &c.	118	8	6	99	14	0
Tan, dung, &c.	31	11	9	34	15	2
Coals and coke for Garden	96	13	9	153	9	9
Miscellaneous expenses at Garden	127	16	4	115	12	5
Garden repairs	109	5	3	130	18	10
Distribution expenses	124	15	1	120	13	10
Exhibition expenses	1145	6	6	1029	0	10
New works at Garden	360	2	8	158	13	4
Law expenses, 1850 and 1851	20	18	6	—		
American Exhibition expenses, 1851	275	5	8	—		
Cost of medals awarded	1120	0	0	1299	5	0
Total	7365	14	3	7009	14	9

It here appears that the annual Income from the subscriptions of Fellows has increased by 151*l.* 9*s.* 8*d.*, and from the sale of the Journal, by 54*l.* 12*s.*; but that there has been a falling off in the amount received on account of Admission Fees to the extent of 31*l.* 10*s.* This, however, does not indicate an equivalent diminution in the number of Fellows elected; for, in reality, the number elected in 1852 has been only four fewer, representing 8*l.* 8*s.*, than in 1851. The difference is caused by several Admission Fees, which were unpaid on the 1st April, 1851, having been received and carried to account in the last Report. The other sources of income have been nearly stationary, with the exception of receipts for Garden Exhibitions, to the falling off in which allusion has been already made.

In the Expenditure it will be found that a reduction has been effected in the cost of the Journal, in Library expenses, Printing and Stationery, Implements, &c., for the use of the Gardens, Exhibition charges, and Garden works; while there has been a small increase in some fluctuating heads of expense, especially in Expenses of Meetings, &c. (21*l.* 12*s.* 2*d*), caused by the improvements and alterations mentioned hereafter; in fuel at the Garden (56*l.* 16*s.*), in consequence of a large stock, at a very low price, having been purchased, and remaining unconsumed, and in the value of Medals given away, as previously explained; the general result being a reduction of expense to the amount of 355*l.* 19*s.* 6*d.*

The Debt on April 1, 1852, was	£7286	11	9
Since diminished by Compositions, to the extent of	572	5	0
	£6714	6	9
But the Ordinary Income having been less than the Expenditure by the sum of £694 1*s.* 5*d.*, that sum has to be added to the debt . . .	694	1	5
	£7408	8	2

Showing a balance against the Society upon the Year of £121 16*s.* 5*d.* as already announced.

With regard to the amended plan of compounding for annual subscriptions, referred to in the Report of last year, the Council find that it has been taken advantage of by the following Fellows.

	£	*s.*	*d.*
Wm. Gibbs, Esq., after paying 22 years' subscription, by further payment of	21	0	0
Rev. W. B. Lee, after paying 20 years' subscription, by further payment of	21	0	0
Sir P. Egerton, Bart., after paying 14 years' subscription, by further payment of	26	5	0
James Gadesden, Esq., after paying 17 years' subscription, by further payment of	26	5	0

In the course of the Autumn the Society passed a By-Law, increasing the number of Honorary Members from five to ten; this has enabled the Council to remove from the list of Fellows, and to place, as was most fitting, at the head of the Society, the names of the following Royal and Imperial personages:—

His Royal Highness Prince Albert.
His Imperial Majesty the Emperor of Russia.
His Majesty the King of Prussia.
His Majesty the King of Wurtemburg.
His Imperial Highness the Archduke John of Austria.

All the vacancies in the list of Foreign members have been also filled by the election of eight of the most distinguished Physiologists or scientific Horticulturists of the present day, viz.:—

His Excellency Prince Michael Woronzow, Tiflis.
The Count Francis v. Thun Hohenstein, Tetchen Castle, Bohemia.
Professor Alphonse de Candolle, Botanic Garden, Geneva.
Professor Wm. de Vriese, University, Leyden.
Professor Wm. Gasparrini, Naples.
Professor Adr. de Jussieu, Jardin des Plantes, Paris.
Professor Hugo Mohl, Tubingen.
Professor Treviranus, Bonn.

The Council trust that this recapitulation of what has been effected during a year of considerable difficulty, and of the measures which are in progress for the future, will satisfy the Society that its interests have been cared for to the utmost extent of the means which have been available. The object of the Council has been to render the Corporation useful to the Fellows as well as to the country, to increase its sphere of activity in every practicable manner, and at the same time to preserve its finances in a secure position; for all experience shows that whatever appearance of prosperity may attend a lavish expenditure exceeding the means of defraying it, such a system must eventually prove as fatal to a public association as to an individual. It is this feeling which has led them to pause before entering upon costly undertakings, and to administer all the branches of their administration with the utmost economy. If they have at last resolved upon incurring some expenses to which the Society has of late been unaccustomed, it has been in the full conviction that the finances of the Society will be improved, that its real utility will be greatly extended, and that the public will support them effectually by joining in greater numbers an institution of indisputable public value.

ORIGINAL COMMUNICATIONS.

XVII.—Notes on the Development of Bulbs and Tubers. By Thilo Irmisch.

(Concluded from page 124).

II. TERRESTRIAL ORCHIDS.

Spiranthes autumnalis.

The base of the new tuft of leaves and of the peduncle, which is clothed merely with small adpressed sheaths, is surrounded at the time of flowering with the more or less perfectly preserved remains of the old dry leaves. If these are completely removed, their circular lines of insertion are visible on an extremely short portion of the axis, which holds together the collective parts of the plant. Upon this stands the peduncle, and near this the new tuft of leaves, and at its base the tuberiform roots.

The number of these is not constant. There are generally two in the flowering plant, but frequently three or only one are present: the vigour of the peduncle and leaves is in direct proportion with their number. Younger specimens which do not yet produce flowers have usually one only: if there are two or three on the same plant, they are for the most part of unequal length, while one is an inch long (a length of two inches is sometimes attained), the other scarcely reaches three quarters of an inch, or even less. But this is not constant, for there is sometimes no difference of size. They are cylindrical and are only slightly attenuated below; there are generally minute transverse hollows in the surface like wrinkles; they are thickly clothed with very delicate simple hairs about two lines long, which are very hygroscopic, curling when dry. The hairs which frequently occur in the upper part of the peduncle are of quite a different construction, for they consist of a simple row of delicate cells, of which the highest is rather the stoutest. There is no reason, therefore, for supposing them identical. At the top of the pseudo-tubers, the hairs either fail or are more sparing. The cuticle sometimes peels off; in which case minute insects have been discovered; whether a new cuticle beset with hairs is in such case reproduced has not at present been observed. By means of these hairs the plant is firmly fixed to the surrounding soil, and the roots of other plants are often matted in, and penetrate the hollows in the root which close on them, so that they seem to take their origin from it. This may here give rise to the branched roots figured in Nees von Esenbeck's *Gen. heft.* 5. Careful washing soon shows their real nature; no organic connexion exists, and there is no reason to believe the plant parasitic. Indeed, it admits of cultivation in pots where no other plants accompany it.

The tuberiform roots are threaded by a central bundle of vessels, which is gradually attenuated at the lower end where the youngest elementary parts are found. If more than one is present, they are all equally organised at the time of flowering. They do not exhibit any trace of dissolution. They belong, therefore, to a single annual period, as they also spring from one axis.

If we now examine the tuft of leaves, we find that it stands near the peduncle, and indeed the axil formed with it by the uppermost dried leaf. This incloses also the peduncle with the lowest part of its short sheath. This also is terminal, the tuft of leaves on the contrary axillary, as is proved also by the arrangement of its leaves. On the basal axis of the flowering plant below the leaves are generally some small buds, scarce a line long, covered by a sheath; they are the axillary produce of lower and earlier leaves. One of these sometimes produces a tuft of leaves, so that two are present; more rarely the main bud near the peduncle still remains in its contracted state at the time of flowering, so that no new leaves are present.

The first or lowest scale-like leaf about two to three lines high, stands with its back towards the peduncle; with this the second alternates, but not strongly, since the leaves are spirally arranged. It is large, but has not so perfect a lamina as the following. If the second is torn off to the base, two light green roundish bodies are visible; they glimmer through the membranous base of the third and fourth leaves, in whose respective axils they stand. It seldom happens that one only comes to perfection. This swelling is often visible in the axil of the third leaf only; they are the first rudiments of the tuberiform roots, and a difference in size is often visible from their earliest appearance. In the axils of the two upper leaves there are either rudiments of their roots or minute buds. In the axils of all the upper leaves which are only partially grown, we find equally little buds, if not equally at the time of flowering; the point of most consequence is that in the

close above one another, which are at the time of flowering already dead. On the lower part of the axis there are from one to three pseudo-tubers; in the axils of the upper leaves many young lateral axes. Most of the leaves of the highest of these lateral axes, or sometimes of two, which are to flower next year, are, at the time when the peduncle of this year's axis is perfectly evolved, entirely expanded, forming a rosette. The new leaves belong, therefore, to a different axis from that of the peduncle. The pseudo-tubers contain the nutriment for the lateral axes with expanded leaves, and die with the leaves themselves the next summer, at which time new pseudo-tubers are formed on the lateral axis, which then becomes the principal axis at the same time with the axis on which they stand. By the decay of the basal axis, the buds in its lower leaves, and whose leaves are not evolved like those of the upper bud, become free. They put forth pseudo-bulbs, but do not flower till they have borne merely rosettes for many years.

SPIRANTHES AUTUMNALIS.

Fig. 1. Base of flowering plant.
a. peduncle.
b. basal axis.
c, c′. tuberiform roots.
d. lowest sheath of tuft of leaves.
f. accessory bud.
Fig. 2. g. rudiment of larger pseudo-tuber.
h. smaller do.
e. scale in whose axil they are produced.

Platanthera bifolia.

It is well known that when the plant flowers, there are two pseudo-tubers, the older shrivelled and about to perish, the younger plump and fresh. The older pseudo-tuber has at its upper extremity a larger or shorter appendage, at whose tip there is a scar formed of dead parenchym. This is the point of attachment of the peduncle of the previous year, which is now almost entirely decayed. Near this place is seated the peduncle of this year, on an oblique sloping area. The following appearances are observed on its axis:

1. A short sheathing scale; the base of this is perforated by numerous long simple roots, seated round the stem, and confined to that portion of it which is embraced by the scale, and thickly clothed with fine hairs.

2. A rather long sheathing scale projecting beyond the first, and alternating with it more or less perfectly. It is split behind at the base, and through the fissure protrudes the fresh tuber.

3. A third sheath, which is again longer, alternates with the second. These three sheaths are attached close to each other. They are generally quite dry at this time, though still perfect in form.

4. A leaf separated from the third sheath by a distinct internode.

5. A second leaf, for the most part apparently opposite to the first, but sometimes the internode is tolerably developed. This is followed by from three to five short leaves, whose axils are sterile, separated by distinct internodes, and then follow the bracts.

The new tuber, like the old, is clothed wtih delicate hairs, which are of the same nature as those on the filiform roots and the pseudo-tubers of Spiranthes. A short space below the point of attachment of the new tuber, on the side which is turned away from the peduncle, there is a shallow depression, and in this a bud about two to three lines long. At the time when the lower flowers are withering, but the upper are still blooming, it is plainly visible, consisting of numerous membranous sheaths which lie more or less closely above one another. The outermost is the shortest, and its margin is very soon withered; beyond this projects the upper margin of the second, and beyond this the tip of the third. If these sheaths are removed, the axil of the first, second, and often of the third is barren; the third, however, sometimes contains a bud which rarely arrives at perfection. At the base of the last sheath the first rudiments of the roots appear in the form of little round swellings. In the axil of the fourth appendage, there is the first rudiment of a bud, which is always greater than that in the axil of the third. The first leaf of the bud is a flat annular prominence or wall; this, being below at the point of insertion of the fourth leaf, is at an early period broader than at other points, since at that point there are the first indications of the future pseudo-tuber. A fifth sheath follows which incloses the succeeding leaves.

We have then in the flowering plant three individuals; the peduncle on the last year's pseudo-tuber, the bud on the new pseudo-tuber which is to flower next year, and the bud in the axil of the fourth leaf of this bud which is to flower the next year.

When the fruit is ripe, late in summer or in autumn, all the parts of the old plant die off, and the bud on the new pseudo-tuber, which has now attained its full size, becomes longer and thicker, and exhibits the two leaves and the blossoms inclosed within them. The root-threads break out from the axis of the bud (as early as July, if the weather is favourable), perforating the third sheath, and becoming elongated, especially towards autumn, if the ground is moist. The two lower sheaths of the bud perish, and by September scarcely any traces of them are visible, so that the sheath which is perforated by the roots, which was at first the third, is now the first, and that in whose axil the bud of the second succeeding year is seated is now the second.

This bud is now enlarged and somewhat changed. The annular appendage of spring is in autumn closed with the exception of a minute orifice, whose margins at a later period wrap over each other; other appendages are inclosed within this. The swelling which was visible in spring at the lower side of the bud is now much larger, and the young pseudo-tuber is visible within. It has thrust aside the lower or frontal side of the base of the first leaf of the bud from the portion of the stem of the mother bud, to which it was originally closely attached all round, while the upper or dorsal side of the base of the first leaf remains attached to the corresponding portion of the stem. The bud then rests on the top of the infant pseudo-tuber.

In order to display clearly the relation of the infant pseudo-tuber to its bud and to the leaf in whose axil the bud is seated, it is necessary to make a vertical section through the medial line of that leaf and through the whole of the parent bud. The tuber is not formed in the axil of the penultimate sheath of the parent bulb in such a way as to stand absolutely above the point of insertion of the sheath, and to be closely inclosed by it with its upper surface only; on the contrary, the leaf seems for a short space at the very base, which is rather thick, to be split into two plates at the point where the tuber is seated, and only at that point. The lower and thicker layer (o) invests now the lower and lateral surface of the tuber, and has normally its insertion on the corresponding point of the axis of the parent bud; the upper layer (n), which is very thin and runs for a short distance only, is inserted on the young tuber itself, and close beneath the point of insertion of the first leaf of the infant bud, seated on the crown of the infant tuber, so that the point of insertion of this upper layer, that of the penultimate sheath of the parent bud, and that of the first of the infant are parallel to each other, and scarcely take up a quarter of a line. In this fissure or cavity, which has no cuticle, the bulb is completely inclosed. This is the normal construction, but sometimes the two surfaces of the parent leaf are not separated in this way, but remain continuous. In this case, a thin membrane, inserted a little below the point

meanwhile entirely exhausted and crumpled. The bundles of vessels are in consequence isolated from the parenchym, so that the whole pseudo-tuber appears composed of a number of strings loosely held together by the cuticle.

The axillary bud, which was already visible last year on the parent bud, protrudes from the axil of its parent leaf, which soon dries up, bursting through it, and the pseudo-tuber, which also has ruptured its envelope, is elongated like a little handle, and diverges slightly from the parent plant. The first and second leaves of this bud are extended by reason of this elongation, and form frequently a tolerably long hollow or covered tube, whose under or dorsal wall is formed by the pseudo-tuber at whose base the other parts of the infant bud are seated. In consequence of this extension, both the first leaves of the bulb soon die. But there are also more normal cases in which the first and second leaves are directly above the inner leaves of the bud. The infant pseudo-tuber becomes spindle-shaped, thickening in the middle, but constantly attenuated above, so as often to attain a length of two inches; its whole surface is clothed more or less thickly with hairs. Everything now occurs as before. A new bud is formed in the axil of the fourth leaf, which is destined to produce a peduncle after an interval of two years.

It is not requisite to enter into the opinion broached by Schleiden, that the tuberiform organs belong to the axis : the whole history of their evolution shows that they are really roots, like the accessory roots in Crocus.

PLATANTHERA BIFOLIA.

Fig. 1. Base of flowering plant.
a. bud on do. which is to flower next year.
C. first sheath.
D. second.
E. third.

Fig. 2. section of the last year's pseudo-tuber.
a. bud which is to flower next year.
m. bundle of vessels from axis.

Fig. 3. bud with the new bud (a′) which is to flower the year after.
e. aperture of its sheath.

Fig. 4. section of the new bud when more advanced, to show the origin of the pseudo-tuber.
d. parent sheath split into two laminæ below (n, o).
p. young pseudo-tuber.
e. wall of parent bud.
a′. new bud.

Fig. 5. Base of a plant, to show development of new pseudo-tuber.
a′. the new bud.
n. border of do.

Liparis Loeselii.

The remains of the organs of last year are found at the base of the flowering plant; they are reduced to a bulb-like conical or ovate body, which is however compressed on two sides so as to present two flat surfaces and two rounded keels; on the outside are the sheathing bases of many leaves: the most external of which are decayed, the inner though dead tolerably firm, and threaded by strong longitudinal nerves, which are separated from each other by thin parenchym. The innermost sheath has a very narrow orifice, in which the nerves coalesce and the parenchym is much thickened. The dry peduncle of the former year often protrudes from this aperture. These sheaths encompass more or less the base of this year's plant. They arise from a generally short horizontal axis of but moderate strength, from which also the fibrous roots spring which for the most part perforate the leaves, and which now like the leaves are dead.

After the sheaths are removed, a firm, green, smooth, almost shining tuber is found about the size of a nail, and still fresh. At its base it is united with the portion of the axil which bears the leaves, bearing above the withered peduncle or at least exhibiting the scar of its point of attachment. The only part of last year's plant which is fresh is this tuber: on one of its angles there is a hollow, and in this the plant of the present year is connected with the tuber.

In the growing plant of this year we find always five leaves; the two outer or lower consist merely at the time of flowering of a fissured sheath or lamina; the third is generally a tolerably high unwithered sheath merely developed into a short lamina; the fourth and fifth are perfect leaves, which have however a closed sheath two to three lines high. The first stands with its back to last year's tuber; the second slightly alternates with the first, the angle of divergence being about 90°; the third with the second (about 180°); the fourth with the third, and finally the fifth with the fourth. The second and fourth are sometimes to the right of the last year's tuber, in which case the third and fifth are consequently to its left, but sometimes the contrary takes place. The corresponding internodes are generally undeveloped, and the filiform roots clothed with delicate hairs, which are about an inch long and rise from the axis, in this case perforate the base of the leaves. The internodes are rarely so developed, that at least those between the lower leaves are no longer concealed by them, in which case the position of the leaves as indicated above is not so easily visible.

Immediately above the fifth leaf the axis at the time of flowering is extremely thickened, and on this tuberiform body stands the biangular peduncle clothed only with a few bracts. A line through the greatest diameter of this tube, if produced, passes on the one side through the medial line of the second and fourth, and on the

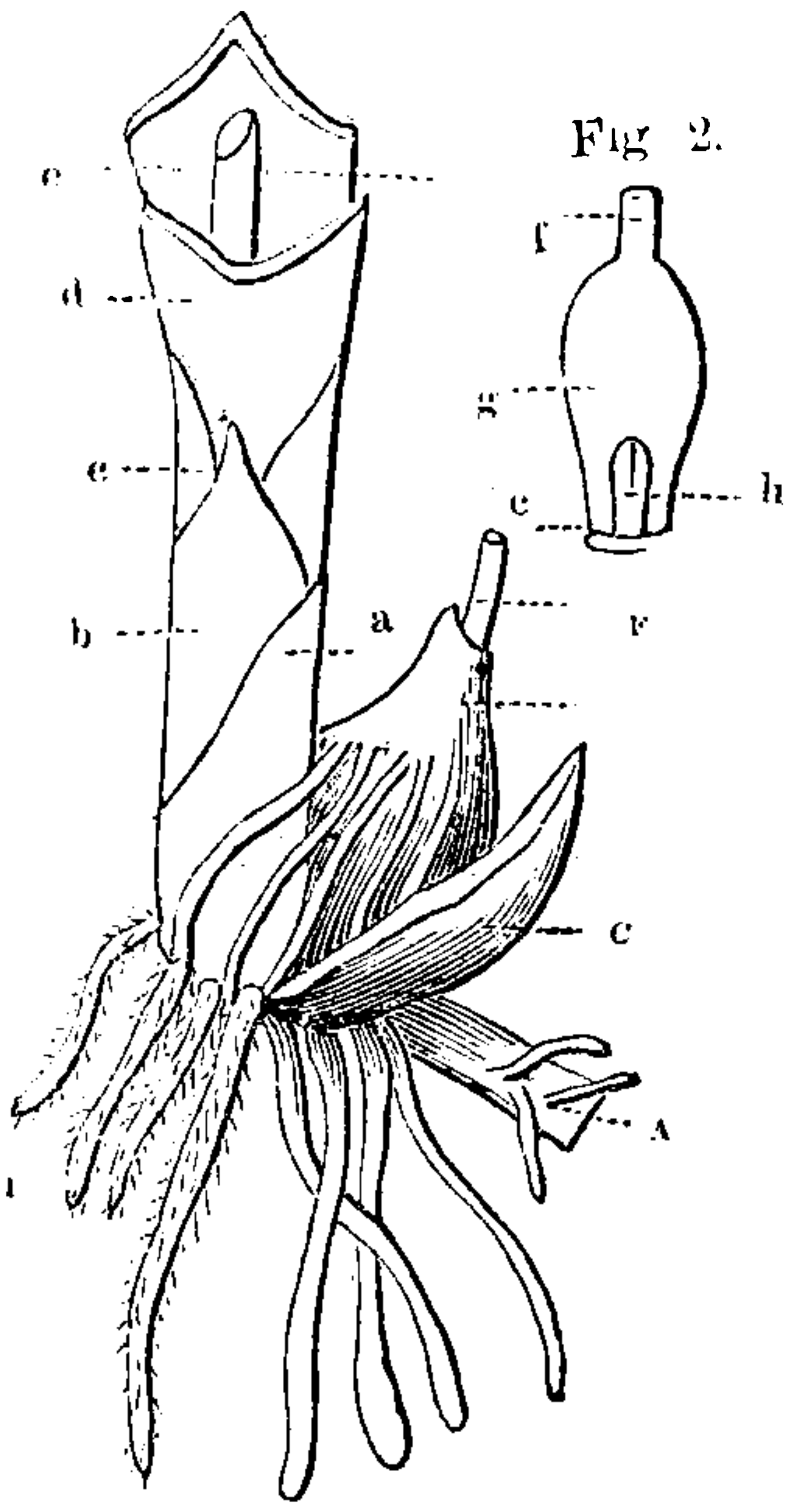


Fig 1.
Liparis Loeselii.

other through that of the third and fifth leaf, and since the middle nerve of the fourth and fifth projects externally like a keel, the base of the young plant appears broadly compressed. In the usual case, in which the internodes are not developed, the plant of this year is closely applied to last year's tuber, and consequently the larger diameter of the first is not in the same direction with that of the last, but at right angles to each other. The more the internodes are extended (and they measure together sometimes an inch) the farther the lower leaves are separated from the upper, and the young tuber from that of the previous year, the less marked is this relation of the young plant to the old tuber.

In the axil formed by the fifth leaf with the young tuber there is a little hollow in the latter containing the young ovate rather broadly compressed bud, which is to produce leaves and flowers the

are buds also in the axils of the lower leaves at the base of the axis ; the lower these leaves are seated the smaller the bud.

More frequently, however, the principal bud developes all the leaves of its axis (an axis of the second order as regards that which produced this year the first flower-stem), and gives rise to a second peduncle.

A bud is formed on the axis of this second flower-stem between it and the uppermost leaf, which may either remain till the following year and then produce a flower-stem, or may unfold its leaves and their peduncle (the third of the whole plant) during the present year, in which case a bud is found in the axil of the uppermost leaf of the axis of the third order, which in the next year will produce its flower-stem.

The peduncles are therefore always terminal, since the second breaks out by no means immediately from the axil of the uppermost leaf of the axis of the first order, but appears on the top of a leafy branch (the axis of the second order), the internodes of which are not however developed. The same holds good with the third head of flowers, with respect to the axis of the second order.

It was remarked that buds occur also in the axils of the lower leaves of the axis of the first order. These buds sometimes produce peduncles, but they are developed later than the blossom at the top of the axis of the second or even of the third order.

At the period of flowering, the leaves of the first axis are frequently withered ; the peduncles which belong to it stand near to but externally to the leaves which belong to the axis of the second order. In barren plants the principal bud is naturally terminal, and no part of the upper portion of the axis dies. The whole resembles greatly Alisma Plantago ; but in Primula the base of the axis lasts longer, but at length dies beneath, since it is nourished only by accessory roots, inasmuch as the main root which was present in the seedlings soon perishes.

Oxalis.

In a state of rest, late in autumn the bulbs of O. tetraphylla have the following composition. On the outside are many dry scales, on whose tips the remains, or at least the scars, of the dead leaves are visible ; below these dry scales, are fresh, rather fleshy broad scales ; these are the basal portions of leaves ; the free end of the stipules is visible at their tips, between which are the rudimentary petiole and lamina. The basal axis which bears all these parts is very low.

The roots break through the outer integument in spring, and are much branched. Many of these are delicate, but others are tuberiform, like those which frequently accompany the newly formed corms of Crocus vernus; occasionally all are of this description. The outer fresh scales do not develope their lamina, but the inner only. In the axils of the lower scales there are buds, which in the course of the summer increase in size and form bulbs. The outer leaves of these axillary bulbs are scale-like, and in general dry up very early; then follow perfect leaves, and then again scales. During the first summer they frequently produce no leaves, especially those bulbs which are highest on the axis, but are formed of scales only.

In the axils of the uppermost scales and leaves stand the peduncles, on which are seated only a few small bracts.

The uppermost leaves form again a terminal bulb, which in consequence of the decay of this year's axis and leaves becomes independent, and flowers the year following, as do the greater axillary bulbs which equally become isolated. It seems very difficult to deny the existence of bulbs in these plants.

In Oxalis acetosella the main shoot is equally terminal. It elongates after the manner of a runner, like Adoxa moschatellina; its first leaves are true leaves. Lateral shoots also are present, so that O. acetosella has a strong agreement with Adoxa in the arrangement of its parts, much as it differs in other respects. The main axis in O. acetosella is not, however, so transitory, for the stem, whose internodes are sometimes much developed though occasionally very short, last at least a year. The leaves die down as far only as the short fleshy basilar part, which is articulated with the petiole and the peduncles in their axils. The main axis is elongated yearly by means of the terminal bud.

In Oxalis stricta, on the contrary, the whole axis (which with respect to last year's axis is lateral,) dies off with the flower-bearing branches on it, and only the runner-like shoots remain, which spring from the subterranean portions of the primary axis, and are somewhat fleshy to their extremities. They are clothed with scales, from whose axils again fleshy branches frequently spring, and have internodes about half an inch long, giving rise to the scattered delicate branched roots, while still connected with the parent axis. In the following year they produce a peduncle, and die after the formation of the fleshy branches.

This plant then must be reckoned as perennial, and not as biennial, with Koch in his Synopsis. Otherwise, to be consistent, Gagea, Tulipa, Epilobium palustre, Mentha arvensis, and Stachys palustris must be reckoned as triennials. In true biennials, as in Cirsium lanceolatum, the course is quite different.

In Oxalis corniculata the whole plant perishes annually, and there is nothing perennial about it. The different habit of O. corniculata and O. stricta depends on this, that in the first the primary axis remains proportionally short, while the procumbent frequently rooting branches, which spring from the axils of the four or five lower leaves, spread out, but in O. stricta the primary axis is especially developed and has long internodes, while the branches in the axils of nine or ten lower leaves remain far shorter than in O. corniculata. These points are not in general sufficiently distinguished in their specific characters. In both, the first appendage of the branch is a small lanceolate scale, as is the case also in the lateral runners of O. acetosella.

Anemone Hepatica.

The common Hepatica presents several points of interest in its construction. If it is examined in spring during the time of flowering, we find at the top of the main axis, from whose lower part numerous branched roots are developed, thickly clothed with fine hairs, the coriaceous leaves of the former, here and there withered at the margin, and bearing about them the signs of approaching decay. Since the internodes are not developed they stand with the base of one directly on that of another. Immediately above these leaves, the internodes in this case also being undeveloped, there are from three to eight membranaceous imbricated scales exhibiting slight traces of a tendency to form a lamina, without, however, there being any gradual transition from the perfect leaves to these scales.

In the axil of the lowest scale, and if the number of scales is large, in that of the second, third, and fourth also, there are little buds whose outer coats are membranaceous scales, the outermost always seated with its back to the main axis, and which inclose the rudiments of perfect three-lobed leaves. In the axils of the scales above these are the solitary peduncles. In the axil, however, of the last, and sometimes of the last but one, there seems at first to be no peduncle, but, on close examination, the rudiments

such an amount of care, expense, and uncertainty, that gentlemen with more limited means, and market-gardeners who look to profit only, are altogether deterred from the attempt.

And, indeed, gentlemen and their gardeners generally, though rarely failing to point out to the admiration of their friends their specimens of "Bread-fruit" and Bananas, seldom entertain the remotest hope, or conceive an idea, of ever fruiting them, so universal is the notion of its impracticability.

I, having grown and cut their fruit by cart-loads on mountains within the Tropics, have become firmly impressed with the conviction that they may be *fruited* in this country, not only with little difficulty, but at so small an expense, and with such a degree of certainty, that any person with a properly constructed "house" may grow them with much advantage and profit.

The experience of upwards of five years within the Tropics "beneath the wild Banana Tree" has thoroughly convinced me that the practice commonly pursued in England is most admirably calculated to *prevent* their fruiting. Let them be removed from among the stove-flowering plants, give *more bottom heat* and *less* water, and fruit-bearing plants will not long be so rare in England as they now are.

The following are conditions under which I have grown richly-flavoured golden bunches of the Musa Sapientum of 60 lbs. weight and upwards, viz.:—

Hot season, or season of growth.	Mean Temperature of the soil	85° Fahr.
	„ „ atmosphere	78° „
	Maximum temperature in sunshine	145° „
	Day temperature in shade	87° „
	Night temperature	72° „
Cold season, or season of rest.	Mean temperature of soil	70° Fahr.
	„ „ atmosphere	65° „
	Maximum day temperature	78° „
	Lowest night temperature	59° „

The annual amount of *rain* falling in this district varies from 19 to 36 inches, distributed at uncertain intervals through the year, but doing evident injury to the plants when falling in quantity in the colder season.

The atmosphere during the hotter or growing season is *dry*; the thermometer *in the day time* falling 15° or 18° by the application of a drop of water to its bulb. At *night* the difference in the two thermometers is 4° or 5°.

During the *colder* or *resting* season the usual difference between the wet and dry bulb thermometers is *at noon* from 4° to 8°. The *night air* at this season is usually saturated. The soil is a light loam formed from decomposed lava and volcanic cinders with a small percentage of rotted vegetable matter.

The principal growing season is during the hot, dry weather, and the plants make such rapid advances that the smallest sucker becomes a large fruit-bearing tree in the space of eighteen months.

A plantation once made requires no renewal. As the plants advance to maturity, a new progeny of "suckers" rises around their bases, one of which is retained to occupy the place of its parent, which, when the fruit is ripe, is cut down with the axe, the bunch of fruit conveyed to the storehouse, and the old stem with its foliage buried in the soil to assist in supplying nutriment to the young generation.

The manner in which the above conditions of growth, and the practices adopted, may be imitated in our own country is familiar to every gardener. But, for the information of those less conversant with such matters, I submit the following plan, being one which I conceive well adapted to ensure a successful result, viz.:—

The plants are to be cultivated *by themselves* in a Banana-house, which should be constructed as near of one height as possible, say about twelve feet above the surface of the soil. A house with ridge and furrow roof would perhaps be best—such an one as may be seen in the Gardens of the Horticultural Society,—erected by (if I remember rightly) Hartley and Co., of Sunderland.

The *ridge-rafters* of this house should be made to close firmly on a ridge-board, and the sashes be made by means of hinges, or other contrivances, to move about the axis of the *furrow-rafter*, in order that the sashes may be made to fold *upwards* from either side, and give the plants the benefit of the greatest possible amount of air.

In this house, a border should be made about two feet in depth, of common garden mould, and capable of being heated from a chamber constructed immediately beneath; the trees to be planted in this border about four feet apart from each other, and directly under the ridge-rafter. Before planting, cut off all expanded leaves to prevent evaporation, press in the plants with the foot *slightly*, and give *no water* whatever. Admit all possible air (when above 55°), and *never* under any circumstances let them be *shaded* from the sun. The best time to plant is *in the hottest weather* of spring or summer.

Their subsequent management should be as follows, viz., the *border* to be kept constantly *heated* from the beginning of March to the end of September to a temperature of 78°, 95°, 85°, increasing and decreasing gradually as the seasons advance and decline, adhering to the *maximum* through May, June, July, and August.

The *atmospheric* temperature *in the day* must be kept up to 78°, and *may* rise to any natural degree without harm, but that *of the night* must be *kept down* to 72° or 70° by a free admission of air. Keep *the soil* moderately *damp* only, never approaching to *wet*, but leaning rather to the other extreme, and, above all things, avoid creating any artificial moisture in the atmosphere.

The above instructions relate to the *growing season*, viz., from the beginning of March to the end of September, during which period the requisite temperature may be maintained with a very trifling amount of fuel.

From September to March the plants must be *rested* by lowering the temperature, which must now rapidly decline from that of the summer to — Atmosphere, 68° by day, 59° by night; Soil, 70° to 68°. The atmospheric temperature may, I have reason to believe, fall considerably below 59° without injury, though *the roots* can only be kept in health by maintaining the requisite *bottom heat.*

In the fine weather of summer give as much air as possible, opening not only all the *side sashes* but those of the roof also, by folding up the sashes; and, indeed, if it were practicable to remove the house entirely, the plants would probably succeed all the better.

When, in fine weather, cold *currents* of air prevail, open the *sashes of the roof* only. In *winter* give air as abundantly as is consistent with the maintenance of the proper temperature, and *remember above all things* to avoid *wet* both in the atmosphere and soil.

Under this system of management the plants may be expected *to fruit* in the second summer after planting, though it is not unlikely but *some* may do so *in the first.*

Their further management will be the same as I have described above, viz., cutting down the trees when the fruit is ripe, and training up a young sucker in its place, &c.

straw ropes, spruce fir-branches, and the like. The Lancashire gooseberry-fancier has been known to share even his bed-clothes with the gooseberry bush on a frosty night, rather than permit his "*Roaring Lion*" to suffer.

In nurseries the compartments are chequered with evergreen hedges, or, failing that, with Beech, whose leaves remain on the plant so long as to have earned for this tree the adage "that it keeps its old coat until it sees how the new one suits."

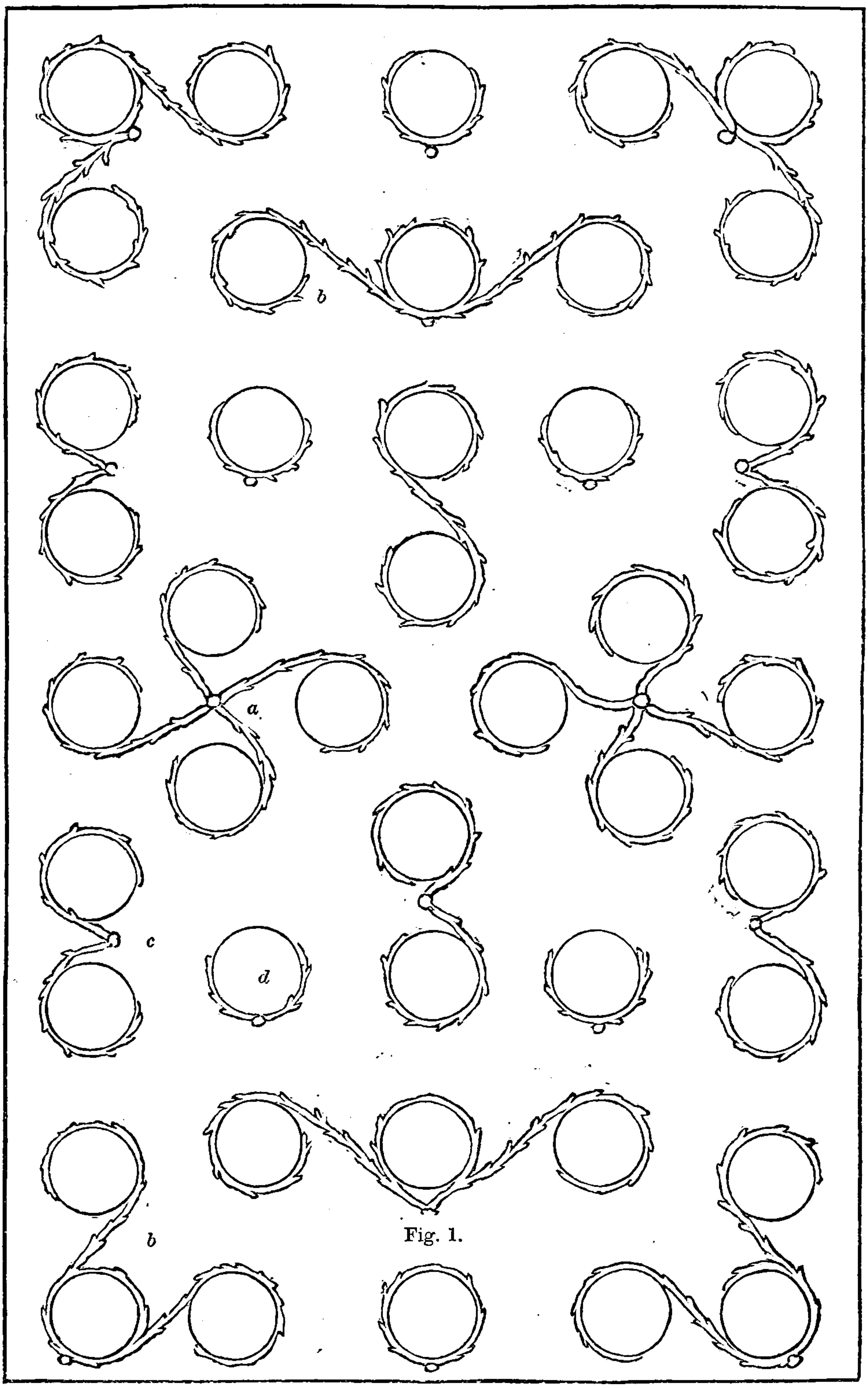
The growers of those splendid specimens of Cape Heaths &c., which we see at exhibitions, use a tent of bunting to lessen the sun's glare and the force of storms, in order to preserve the blossoms and the foliage in the finest possible condition.

The normal form of a standard fruit-tree is either globular or mushroom-shaped, and therefore it faces every point of the compass, and bears fruit all over it, having an aspect East, West, North, and South. Now, although one tree injures another by its shade and other robberies, still it is clear that the individual tree benefits as much by its foliage on the shady or northern side, as it does by that on its sunny or southern exposure, and in practice we find the foliage of fruit-trees, and that of many flowering-plants, as Camellias for instance, on a north wall unusually fine.

The distance of one fruit-tree from another on an ordinary garden wall, I may take to be 15 feet; I have therefore made the circumference of the fruit cylinders here introduced, 15 feet, and the height 5 feet.

The ease with which all tangents may be made to run into the circumferential line peculiarly adapts the circular form to this sort of work, and the ease too with which a shoot fruitful at the extremities may be made to return upon the barren end of itself, and thereby clothe the bole, is no small recommendation to this style of trellis, not to mention its unity of character, and consequent strength, having no ends, being a broad-based cylinder or low column. In explanation of this, the straight lines from the bole of a tree easily run into the circular form as in ground plan, Fig. 1*a*, and the barren part, at the bole end of the shoot, is by the circular trellis covered by the fruitful part, so that without any doubling back, the whole is covered with foliage and fruit; for everybody knows that fruits are scanty near the bole end of the branch and fruitful at the tips *generally*.

To show the practical value of small cylinders as compared with large ones, let us take one with a circumference of 30 feet instead of 15, and in round numbers try it thus:—



GROUND PLAN SHOWING A COMPARTMENT IN A GARDEN FILLED WITH FRUIT CYLINDERS.

Scale ⅜ inch to 10 feet.

Fig. 1,*a*, shows a tree occupying 4 cylinders or 60 feet of trellis; *b*, 3 cylinders or 45 feet of trellis; *c*, 2 cylinders, and *d*, 1 cylinder.

Diameter 5 × 5 × ·7854 = 19·635
Diameter 10 × 10 × ·7854 = 78·54
[19·635 × 4 = 78·54.]

Diameter 10 is only twice diameter 5, but area 78·54 is four times area 19·635, showing an economy of space and materials equal to cent. per cent. by using trellises of 5 feet diameter instead of 10.

Here it will be seen that a trellis or cylinder of circumference DOUBLE does not take just double the area, but no more than FOUR times the area to stand upon, and four times the amount of faggots to fill it. I have borrowed the evergreen foliage of the gorse plant, and built a column of it within the circular iron trellis alluded to, in order that the early blossoms of our fruit-trees may not any longer be borne upon naked twigs.

Trellises similar to the foregoing existed in the gardens of the late Sir John Stanley, in Cheshire, in 1837, when I was gardener there, and the only alteration that I have made in my late respected employer's plan is the adding a body to his skeleton trellis.

I have shown in the accompanying plan how different lengths

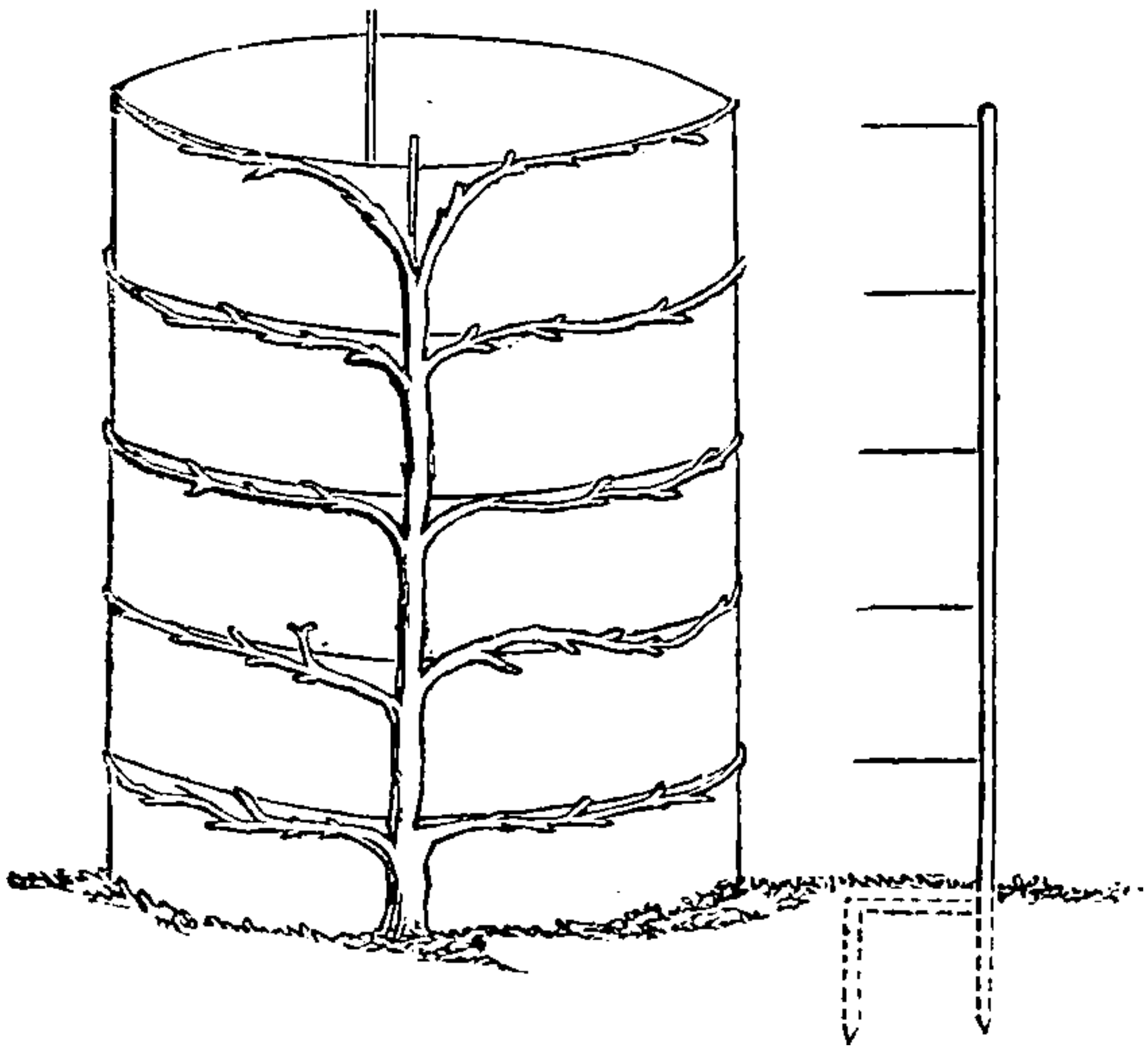


Fig ·2·

ELEVATION OF FRUIT CYLINDER, WITH THE IRON UPRIGHT AND RODS.

Scale ½ inch to 1 foot. Scale ½ inch to 1 foot.

may be accommodated with one or more cylinders, and I may

* Fig. 2. Elevation of a fruit cylinder whose circumference is 15 feet and height 5 feet, showing 5 wires and 5 tiers of fruit-bearing shoots, 1 foot apart.

thatched cottage will enable a tree to flower and perfect fruit that elsewhere would not thrive. The Fig wants but a very little to make it a hardy fruit-tree, for we see it at Hedsor Lodge, on the banks of the Thames, fruiting freely as a standard. Certain sheltered spots again are famous for Plums, as Dittisham parish on the Dart, where the noted Dittisham Plum (a very superior Plum, after the fashion of an Orleans), is cultivated for preserving, and again in Staffordshire, on the Churnet, below Alton, there is another Plum ground, where shelter and dryness appear to be the only good properties of the locality.

It is, therefore, evident that a wholesale system of fruit-growing might be established in well-selected spots with evident advantage to the community, but fruit walls for this purpose could not be built without an unreasonable outlay; besides they are not moveable, and in the case of a tree failing on a wall, a tree has to be torn up by the roots and put there to replace it, but here you leave the tree in the earth and transplant the sheltering trellis to it.

No other system ever offered to horticulture possessed the means of protection which this does, for there is now only one side of the tree exposed, and any protection laid on the tops of the columns will be so elevated that a person may walk under to gather fruit, &c., and it must be admitted that all fruits want a further protection than that from frost upon their blossoms. Cherries and Plums require netting from birds. Gooseberries and Currants the same. To cultivate Raspberries and Strawberries without protection would only be labour lost, for the birds would take all; even Apples and Pears are pilfered when exposed, and in the case of keeping such as Gooseberries and Currants on the trees till late in the season for dessert, they can now be snugly housed. I need only name one further advantage, and it is this, that the ripening of the wood depends mainly upon the amount of dryness, not only in the air but in the earth, and any one now, by regulating the communication between his tarpaulin overhead and his drain tiles under ground, may lessen foul weather amazingly, and, whatever the farmer may say of the fertilising effects of rain, I should prefer the great bulk of our winter storms to pass over fruit-tree grounds without wetting them. It is the sweltering hollows, coombs, or valleys that yield the best fruits, where the staple is good and the sun pours in and the storms blow over; therefore whatever is most convenient should be used for shelter all round, and in the orchard these cylinders will maintain their ground to shelter one another, for they will be a thick wood, and an orchard of this nature can be got up in half the time that one of standard trees could be reared.

This principle is capable of further extension by means of hollow wooden cylinders of one-inch boards on end, and of circular single brick walls; but, as this paper is already sufficiently long, I will conclude here, as I have had no practical experience of culture in the hollow cylinder, whereas the other is in good working order.

XX.—On the Disease of the Vine. Read before the Royal Academy of Georgofili of Florence, on the 5th September, 1852, by Prof. Giovanni Battista Amici, Hon. Member.

(Translated from the Italian.)

In order to preserve an accurate record of the disease which has caused, and still continues to cause, such injury to our vines, Sig. Antinori, director of the Imperial and Royal Museum, ordered models in wax to be prepared, illustrating the diseased state as well of the grapes themselves as of the shoots. I was instructed to assist at the operation, and to add, with appropriately magnified dimensions, such particulars as should be furnished by my microscopical observations. The plastic operation, confided to young Sig. Tortori, under the distinguished Lusini, head of the manufacture, has been executed by him in wax with such ability as to give to the models a perfect resemblance to the originals, and although the whole of the intended preparations are not as yet completed, yet such as are now finished have appeared to me of sufficient interest to lay them before the Academy, who, I trust, in a subject of such serious importance, will allow me to accompany this presentation by some considerations suggested to me by the recent perusal of a memoir by Sig. Berenger, inserted in the new *Giornale d'Agricultura* entitled *Il Coltivatore,* on the 5th of August of this year. In this memoir is the following remarkable sentence, "The celebrated Oidium Tuckeri of the Italian vines is a chimera, and the cryptogamous plant described under that name is no other than the Erysiphe communis in its sterile, flocciferous state." The author laments that such men as De Notaris, Balsamo, Crivelli, Pietro Savi, and others should have fallen into such an error, allowing themselves, he says, to be led astray by some French writer. He calls the disease which has appeared on the vines in England a spot, because of the analogy of its pathological characters with the spot of the Orange tribe which appeared in Italy in the commencement of the present century, and still attacks other plants, and which appeared on the vines of Prussian gardens towards the year 1835, and was described by Nietner, and especially by Fintelmann, under the name of small-pox. Berkeley, probably not aware of these previous publications, only speaks of it in 1847, and figures in the *Gardeners' Chronicle* the little fungus under the name of Oidium Tuckeri in honour of the gardener who first called attention to its fatal effects on the Vines cultivated near Margate.

But if we admit with Sig. Berenger that the Grape mildew was the disease which prevailed first in Prussia and afterwards appeared in England, we must nevertheless conclude that it differs considerably from that which began to spread so much last year in Italy. Indeed no one amongst us has observed the appearances, at the end of May, from the effect of a fungus, on the epidermis of the young wood or on the leaves, of those spots which (as stated by Sig. Berenger, quoting the observations of Meyer) have the appearance of ulcers, spreading at the expense of the organic substance in which they originate, and leaving, especially on the leaves, cavities pierced like a sieve which corrode the extremity of the shoots, causing the latter to disarticulate and separate from the old wood, and the old wood itself to be finally attacked by the disease and destroyed down to the roots.

I am persuaded that not a single case has been authenticated, at least in Tuscany, in which the Vines, however strongly attacked by the prevailing parasite, have been destroyed, as in Germany and England, without the root and the main stem remaining uninjured. We have it, on the contrary, as an ascertained fact that the shoots of the Vine in the present year, 1852, are considerably more vigorous than those of the spring of last year before the appearance of the disease. The mischief suffered by us has been confined to the total loss of the crop of Grapes in some localities, and a deterioration of the quality in others, but our Vines vegetate with the usual vigour, and give hopes that in future years we may have our usual harvest.

Passing over, therefore, the theory that the disease which has done so much injury in the northern gardens and hothouses is identical with that which has rendered our vintage less productive

transformation of one organ into the others became perfectly clear; sometimes also I met with fructifications contracted in the middle as if they were formed of two joined together. All these details are faithfully introduced in the preparation No. 2, which shows at a glance on a highly magnified scale the whole development of the cryptogam.*

On carefully examining with transmitted light, and with a magnifier of at least 600 diameters, the sporangia of our cryptogam, we find them to consist of a coloured cellular membrane, with the polygonal faces somewhat convex, and which includes some hundreds of spores, which, at their maturity, issue in jets by the mere action of water (I counted as many as 289 in one heap). The form of these spores, which are tolerably transparent, much resembles that of the sporidia of some lichens. They are reniform and ovate-oblong, and under a very powerful object-glass, two little cavities may be observed at their extremities, containing a most minute globule of some denser matter. The preparation No. 3 represents a sporangium with its contents magnified to 1800 times the diameter.†

Probably the spores which I have mentioned are the reproductive corpuscules, which Professor Pietro Savi saw vegetate under the microscope, believing them to have issued by a regular longitudinal dehiscence from the utricles of the moniliform filaments which had been supposed to be the sporangia. But this opinion, although maintained by other eminent botanists, is at variance with the facts shown by my own observations. The preparation No. 4 includes five of the above-named utricles, magni-

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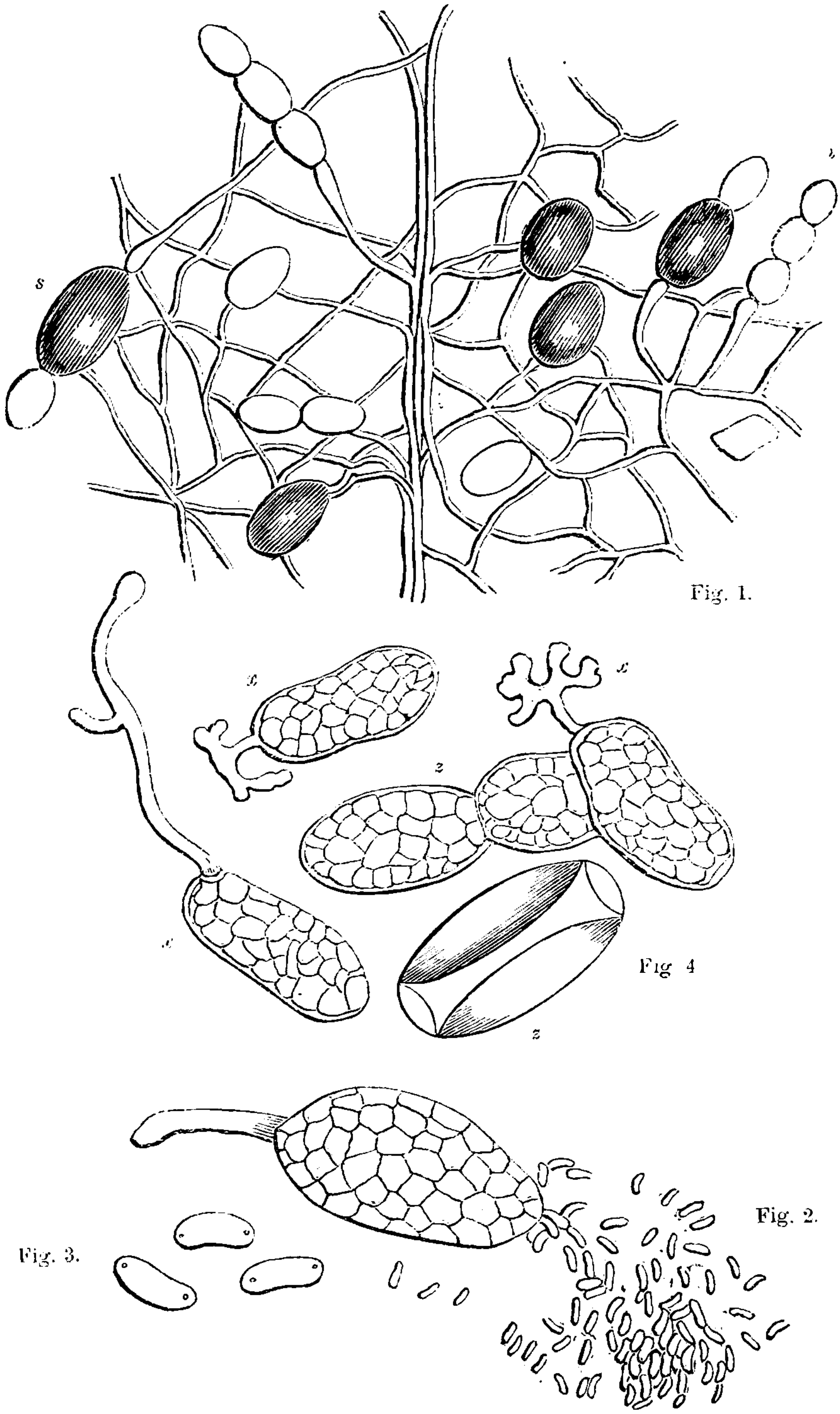
* The publication of the present paper as it was communicated to the Academy of Georgofili required the addition of some figures for the elucidation of the descriptions, to supply the place of the preparations in relief, which could not be placed before the eyes of the reader. The distinguished botanist, Adolfo Targioni Tozzetti, having offered to furnish some drawings corresponding to the principal figures in wax, I have here to express my obligations to him, which I feel the more from the circumstance that as he has drawn all the details faithfully from what he has seen himself under the microscope, his figures give an authentic testimony in confirmation of the facts I have described.

Fig. 1 represents a small portion of the surface of a Grape on which the cryptogam has spread itself, magnified to 300 diameters. From the mycelium arise moniliform filaments *m*, and the sporangia *s*. Two of the latter have an utricle directly attached to their upper extremity.

† In Fig. 2 the sporangium is represented magnified to 600 diameters, and by its side are the spores it has emitted, which, taken separately, are as transparent as white glass; seen in a mass they have a very slight yellow tint. In Fig. 3 are three spores magnified to 1800 diameters, in order to show the nuclei or globules at their extremities.



Plant of the Vine disease in various states. (See pages 234 and 236, notes.)

fied to 1800 diameters. The first utricle is in the ordinary state, attached to the apex of the ascending filament, with a portion of the corresponding mycelium. Two other utricles are in the process of germination, and vegetate, and reproduce the plant after the manner of grafts or cuttings. The appendage which they emit from one extremity of the axis (which is always excentrical) resembles the pollen tube issuing from its grain. It is very easy to obtain this result. It suffices to moisten a bit of glass with the breath, to cause a number of fresh utricles to attach themselves to it, disarticulating from the filaments. After about three hours nearly the whole of them will vegetate, and the germs will grow under the eye of the observer, till after one or two days, the nutriment supplied to them by the internal substance of the utricle being exhausted, they will die and dry up. A fourth utricle in the above-mentioned preparation No. 4 shows the manner in which these organs usually shrivel and dry up. On losing by evaporation or any other cause the fluid by which the membrane was distended, it compresses on three sides. The extremities, being of a more compact substance, do not give way so much, and hence three longitudinal ribs or angles are formed, and the central one, by an optical illusion occasioned by the manner in which the light is refracted, may easily be mistaken for an aperture, whilst it is in fact nothing more than a plait or fold. The fifth utricle in the preparation is a representation of an artificial section in order to show the very variable globules, and the mucilaginous liquor which the membrane contains.*

From the above data it clearly results that the cryptogam prevailing on our grapes, which is identical in all the specimens I have been able to procure within a radius of twenty miles round Florence, is a very different plant from the Erysiphe communis, which no one has observed to appear upon the Grape berry.†

* Fig. 4, magnified 1000 diameters, shows at *x* three utricles in germination. At *y* are two fresh utricles showing the little globules, and the mucilaginous liquid contained in them. At *z* is an utricle shrivelled up by lateral compression, which has given rise to the optical illusion of a longitudinal slit.

† The Chevalier Rendu, Inspector-General of Agriculture in France, has had the kindness to transmit to me diseased Grapes from the neighbourhood of Bastia and of Marseilles, in which I have recognised the same cryptogam as that which attacks our own Vines. So also Sig. Ferrari, Secretary of the Agrarian Society of Bologna, has sent me Grapes from eight different localities of that pontifical province, on which was the same plant in fructification. From these more recent observations I am led to conclude that the cryptogam which has spread over the Vine in various countries forms everywhere but one species.

Having cleared up this point, there yet remains the most important question. Is the cryptogam the cause or the consequence of the disease of the Grape? I have not the presumption to solve this difficult problem; it would be necessary to have data more evident, more incontestable, and more detailed, to establish any undeniable demonstration. I will only state, that I am for various reasons disposed to adopt rather the opinion that the appearance of the mildew is owing to a morbid change which the Grape has previously suffered.

Last year I collected bunches of grapes branches of Vine, leaves of gourds, roses and chrysanthema, all covered with their respective mildews, and shut them all up in a wooden box, with the intention of scattering in the following spring, over healthy individuals of different kinds, the reproductive sporules which it was to be presumed existed amidst the mycelia, and thus, as it were, to inoculate the disease. The experiment was carried out in June this year without producing any cryptogam. It might be supposed that the spores had lost their vegetative powers by too lengthened a state of desiccation. I therefore repeated the experiment in the month of July, making use of fresh mildews which had appeared naturally; the result was the same, the healthy grapes were not attacked. From this it would follow that the mildew does not produce the disease, or at least that one

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of development, that is to say, the sterile state with moniliform filaments, the fructiferous state like that I have described, and lastly, another fructiferous state, such as understood by Sig. Berenger. The finding even of the three states visible at once on the field of the microscope would not be sufficient to support the opposite doctrine; it would be necessary to prove distinctly the origin of each—for it is not an uncommon occurrence that several of these productions are found so intermingled together as to appear at first to arise from a common mycelium.

In Fig. 5, magnified to 230 diameters, is to be seen a conceptacle of the Erysiphe communis taken from a leaf of Convolvulus arvensis, on which I found at the same time the other cryptogam with a fructification analogous to that of the Grape. I say analogous and not identical, because some slight differences are observable which might constitute a variety. There also may be varieties which I have observed to fructify in such abundance on Chrysanthema, on Clovers, on Chicory, on the Plantago major, on Artemisia campestris, on Lucern. On all these plants, excepting on the Chrysanthema I have likewise observed the different species of Erysiphe which are peculiar to them, and which are well known. On the Chrysanthema I could never discover a single conceptaculum which gave any indication of the Erysiphe. So, on the other hand, on the Acer campestre, on which the Erysiphe abounds, I never succeeded in finding any sporangia analogous to those of the cryptogam of the Grape. (*This figure 5 is not reproduced here, no one in this country supposing Oidium and Erysiphe to be identical.*)

condition was wanting—the predisposition to contract a disease. I feel indeed the force of the objections that may be made to my experiments as being made upon too limited a scale, but, however small, still some value must be attached to them.

The Secretary of Correspondence of our Academy has suggested to me that I should try the inoculating grapes already diseased, first removing carefully the mildew which may be upon them. I purpose to take it in hand during my next stay in the country; in the mean time, what I am about to state may supply the place of the experiment, and I think speaks pretty clearly. In a vineyard outside the Porto S. Niccolo near the walls, I was a few days back examining a Vine covered with grapes in the worst state; the farmer observed to me that they had been medicated, and that for a time they had appeared to be cured. I took two grapes and placed them under the microscope: I found on the grapes many crystals of urine mixed with other matter which showed that they had been drugged. But the cryptogam had reappeared as fresh as usual, and as thick as upon the non-medicated grapes. I hear that a great number of similar facts might be quoted, and they appear to me to prove two things; first, the inefficacy of the remedies hitherto used, and secondly, that the evil originates in the grapes themselves, or in other words, in a predisposition to contract disease.

The authors who have treated of the Oidium Tuckeri as the cause of the disease, admit the predisposition. The same Berenger, speaking of the Erysiphe, says, "Its luxuriant development (Generatio floccipara) is the true and natural cause of the immense diffusion of the cryptogam, and consequently the immediate cause, *although not the only one*, of the present malady of the Vines; I say *not the only one*, because it is not only probable, but almost certain, that it would not produce that pernicious effect, if a certain number of vines, either by individual constitution, by asthenia, or by some other pathological state, were not in a certain manner *predisposed* to receive it."

Now, I ask, if you grant the predisposition, in what consists, what is, this particular anomalous state of the Vine? If it had been a small vineyard only, or a few plants situated here and there in special localities, it is possible that conditions might be found to account plausibly for the phenomenon. But the question is that of a most extensive fact, of a disease, which, like an epidemic, has spread successively over the whole of Europe where Vines are cultivated. In this case how can the predisposition be explained? It appears to me that the cause of the predisposition remains as obscure as the cause of the disease.

I have said that I incline to believe that the cryptogam does not produce the disease. My opinion founded on the experiment of inoculation is confirmed by the fact, that, among the numerous observations I have made, I have never succeeded in seeing a single filament of the mycelium of the cryptogam without discovering also an alteration in the cellules of the epidermis of the Grape immediately under the cuticular membrane. Such alterations first show themselves in a cellule by a change of colour of the chlorophyll, which from green passes to a pale yellow, the fluid contained thickens and loses its transparency, subsequently crystals are formed, and granulations of various sizes, first of a bay, then of a brown colour. The cellulose, or the membrane which forms the sides of the cell, at the same time thickens and becomes coloured. This organ is now dead, and the lateral adjacent cells, going through the same changes, end also by losing all life. Thus are formed broad dark-coloured spots visible to the naked eye, and which extend even over the whole subcutaneous stratum of the epidermis, when the alteration has commenced at several points at once, and the spots have extended so as to run together and unite with each other. Sign. Adolpho Targioni Tozzetti gave last year to the Academy a very clear account of the changes which took place successively in the Grape, and of the apparent seat of the malady. My observations confirm his; I likewise agree with him that the connection between the fungus supposed to be parasitical, and the organs of the Grape, cannot be established but through the cuticular membrane, which in no one instance, not even immediately over the diseased cellules, is found to be perforated. No sucker can be discovered to proceed from the mycelium and penetrate into the internal membrane of the Grape.

When the cryptogam has appeared, its horizontal filaments extend, passing chiefly over the spotted spaces, which circumstance may be alleged in favour of the opinion that by some invisible communication the fungus exercises some pernicious influence on the Grape; but, for myself, having put forward the idea that the cryptogam is not the cause of the disease, an idea which is also mentioned by Sign. Brignoli in his learned Memoir on the Crambe, I am disposed to interpret this fact differently, and I say that if the fungus vegetates on the diseased Grape, it is because it there finds the proper aliment for its support. This aliment is most probably derived from the fluids exuding from the

you in a state of fructification, whilst hitherto it has constantly appeared to me, as well as to all others who have contemporaneously or successively examined it, in a sterile state; and I am the more sincerely thankful to you, inasmuch as having availed myself of the excellent microscopes you possess, I have been enabled to obtain so clear a view of the form of the spores, and of their connection with the mycelium, and with the summits of those utricles which I had hitherto considered as perfect sporangia, that I no longer entertain any doubts of their existence, and am fully persuaded of the correctness of your opinion.

On studying mycological works with a view to ascertain where to place this little fungus, and, judging from the characters which you have explained in your Memoir to the Academy of Georgofili, which correspond exactly with those which I had drawn up with your assistance, I must say that the genus to which it belongs appears to me to be a new one, for I do not find in Corda's *Icones fungorum hucusque cognitorum* any figure or description which resembles it. The only form with which at first sight it appears to have some analogy would be that of the genus Sporidesmium, but the want of mycelium, the dimensions of the parts, and the form of the sporangia so different from those of our species, separate them from each other. I am, however, obliged to give up the determining it with any accuracy; the want of mycological works and of sufficient experience in this vast and difficult branch of botanical learning, prevent my even ascertaining with any certainty whether it is or not a new generic or specific form.

With regard to the doubts you express as to the possibility of my having mistaken a longitudinal fold in the utricles for an aperture, I candidly confess that if I am disposed to acquiesce in your supposition it is more from indirect conclusions than from direct evidence; for I must say, that, even with the vast means you have afforded for microscopical observations, I have always seen so great a semblance of an aperture that I could not convince myself of its non-existence, and were I to trust to my eyesight alone, I should see no reason to change my opinion. It is nevertheless true, that I have never had under my eye either the actual operation of dehiscing nor that of the emission of the sporidial matter supposed to be contained in the utricles; that there is a considerable difference in form between the spherules of this sporidial matter and that of the seminules which accompany the germination; and that these facts combined with your reiterated assertions are sufficient to induce me to abandon my own opinion and adopt yours, and I feel now convinced of the existence of this more perfect mode of reproduction. Nevertheless, as I must give way in some measure to the evidence of my eyes, I abstain from professing any definitive judgment, confining myself to the admission that in any case the organs you observed undoubtedly constitute true and well characterised sporangia.

I close these few lines by saying that if you think proper to publish them you are liberty to do so, my wish being above all things that the truth should be brought to light, and that as much as possible we should eliminate from science those contradictions which have become but too much multiplied in mycography.

Accept, etc.,

PISA, *October* 10, 1853. PIETRO SAVI.

XXI.—SUPPLEMENT TO THE THIRD EDITION OF THE CATALOGUE OF FRUITS CULTIVATED IN THE GARDEN OF THE HORTICULTURAL SOCIETY OF LONDON.

THE Third Edition of the Society's Catalogue of Fruits was published in 1842; and the following pages have been prepared as a Supplement to that Edition, on the same plan. This being the case, it is unnecessary to repeat the explanations of the columns and descriptive abbreviations employed for the respective classes of Fruits. It is, however, to be observed that the numbers of the varieties are not consecutive: thus, Alfriston Apple is No. 8 in the Catalogue, and it is marked No. 8 in the Supplement, in which it has been introduced on account of additional synonyms and remarks; Barchard's Seedling follows, in alphabetical order, No. 26 of the Catalogue, and it is marked 26^1; and Bardon's Early immediately following, is marked 26^2; and so on.

The materials for this Supplement have been much limited, in consequence of unfavourable springs, and on this account some of the best Pomologists were inclined to think it desirable not to attempt publishing one till a good fruit season should occur. The Council of the Society, however, was anxious to afford, in the meantime, any information that a Supplement might possibly contain, even under the circumstances; and accordingly the following, such as it is, has been prepared with that view.

A considerable number of synonyms will be found indicated in this Supplement; and this, it will be admitted, must so far lessen the confusion which is apt to take place in the nomenclature of Fruits. Confusion in names occasions actual loss to cultivators, and great disappointment to amateurs; for a number of trees have often been obtained by different names, and after a lapse of years have proved to be but one sort; so that where only one tree of that sort would have probably been sufficient, the owner finds himself in possession of several, to the exclusion of others really distinct and valuable, which might have otherwise occupied the space. By inspecting the following pages it will appear evident that many such disappointments may be prevented.

In some cases, and particularly with regard to new sorts of Pears, characters have been assigned to varieties which have not yet been fully proven in the Garden. They have been inserted after a careful comparison of the statements derived from various sources respecting those varieties; but it is to be particularly observed that where such is the case, R. C., signifying *Reputed Character*, is placed opposite the name in the column of remarks. These characters have been given with the view of supplying some desirable information to those anxious to try new sorts. It will also be understood that the sorts so marked, when fully tried in this climate, may prove good, or they may not; but they all deserve trial.

It is to be hoped that favourable seasons will render it a comparatively easy matter to supersede, by a better, the Supplement now submitted.

	Camuesar, see *Reinette Blanche d'Espagne.*						
136	Chataignier	str.	ovate	2	K		2 year.
151	Cockle Pippin . . . . . Nutmeg Cockle Pippin. Brown Cockle Pippin. White Cockle Pippin. Nutmeg Pippin.	br. y.	ovate	2	T	1	Jan. A
161	Codlin, Manks . . . . . Irish Pitcher. Irish Codlin. Eve Apple, of Scotland. Frith Pippin.	p. y.	conical	1	K	1	Aug. O
182[1]	Corsonite.						
194[1]	Crow's Egg.						
198[1]	Danver's Winter Sweet. Epse's Sweet.						
205[1]	Dickskill.						
214	Donville	y.	roundish	3	C		
228	Early Harvest . . . . . Yellow Harvest. Large Yellow Harvest. Prince's Harvest. Prince's Yellow Harvest. Prince's Early Lemon. Large Early. July Early Pippin. Tart Bough. Early French Reinette (of the Americans). Pomme d' Eté (of Canada).	p. y.	roundish	2	T K	1	Aug.
233	Easter Pippin. . . . . . French Crab. Winter Greening. Ironstone Pippin. Ironside (in Gloucestershire). Young's Long Keeping. Claremont Pippin	g.	roundish	2	K T	1	2 year.
238[1]	Empress of Russia.						
	Epse's Sweet, see *Danver's Winter Sweet.*						
	D'Eté Pomme, see *Early Harvest.*						
	Eve Apple (of Scotland), see *Mank's Codlin.*						
242[1]	Fall Harvey.						
242[2]	Famagusta (from Cyprus).						
245	Fearn's Pippin . . . . . Ferris Pippin Clifton Nonesuch. Florence Pippin.	r.	oblate	2	T K	1	Nov. Fe
255[1]	Flushing Pumpkin Sweeting.						
	Forbes's Large Portugal, see *Reinette du Canada.*						
255[2]	Forge	y. r.	roundish	2	KTC		Oct. Ja
260[1]	Frangé.						
	Frith Pippin, see *Manks Codlin.*						
261[1]	Garden Striped.						
271	Gloria Mundi . . . . . American Gloria Mundi. New York Gloria Mundi Glazenwood Gloria Mundi Monstrous Pippin. American Mammoth. Ox Apple. Baltimore (of some). Josephine.	g. y.	roundish	1	K	1	Oct. Ja
273[1]	Golden Beauty.						

Name						
276 Golden Harvey, Pitmaston.	or. rus.	roundish	3	T	1	Jan. M
279[1] Golden Mundi, of Hawick.						
279[2] Golden Mundi, of Liverpool.						
281[1] Golden Pippin, American.						
282[1] Golden Pippin, Elford . .	y. rus.	roundish	3	T	1	Nov. M
283[1] Golden Pippin, Hawick.						
286[1] Golden Pippin, Pitmaston.	rus. y.	roundish ovt.	3	T	1	Dec. Fe
290 Golden Pippin, Summer .	y.	ovate	3	T	1	Aug. Se
Summer Pippin (of some).						
White Summer Pippin.						
298[1] Greaves's Pippin.						
303[1] Green Square.						
304[1] Greenup's Pippin	g. r.	roundish	1	K		Oct. D
Green Winter Pippin, see *Newtown Pippin.*						
315[1] Hammond's Pippin.						
319 Hanwell Souring	g. y.	conical	2	K	1	Dec. M
320[1] Hartford Sweeting.						
321[1] Haskel Sweet.						
339[1] Holland Pippin, of Hassendean Burn.						
339[2] Holland Pippin, of Hawick.						
342[1] Hopkins.						
Hunt's Fine Green Pippin, see *Newtown Pippin.*						
350[1] Hyde's Large Red.						
362[1] Jaques Lebel.						
Josephine, see *Gloria Mundi.*						
381[1] Kilham Hill.						
381[2] King of the Forest.						
382[1] *King Philip,* see *Jonathan.*						
388[1] Knowles' Early.						
391[1] Lady's Sweeting.						
399[1] Lawrence's Favourite.						
Llwynegrin.						
410 London Pippin	y.	oblate	2			Nov. A
Fine crown Pippin.						
New London Pippin.						
Royal Somerset						
White Pippin, near York.						
410[1] Long Stem.						
412[1] Lord Lenox.						
415[1] Lovett Sweet.						
416[1] Ludd, Dryburgh.						
416[2] Ludd, Lauder.						
417[1] Lyscom.						
Osgood's Favourite.						
419 Maclean's Favourite . . .	y.	roundish	2			Oct. Ja
419[1] M'Lellan.						
425 Margaret, Early Red . . .	str.	ovate	2			b. Aug
Margaret.						
Margaret, Early.						
Marguerite.						
Margaretha						
Red Juneating.						
Early Red Juneating.						
American Red Juneating.						
Striped June.						
Striped Juneating.						
Striped Quarrenden.						
Eve Apple (of Ireland).						
Summer Traveller.						
Margil	y. r.	ovate				Nov. Fe
Never-fail.						
Munche's Pippin (of some).						
Small Ribston.						
Muscat Reinette.						

No.	Name.						
429^{1}	Marmoriste Rosette.						
	Maschanzker, see *Borsdörffer.*						
	Maschanzkerl, Wiener, see *ib.*						
436	Mère de Ménage	r.	roundish	1	K	1	Oct. F
	Haus Mutterchen.						
	Riesenapfel.						
	Michelbocker, see *Nagli.*						
448	Mother Apple.						
451^{1}	Nagli.						
	Michelbocker.						
452^{1}	Neapolitan Lemon Apple.						
458	Newtown Pippin	g. y.	roundish	2	T	1	Jan. M
	American Newtown Pippin.						
	Large Newtown Pippin.						
	Green Newtown Pippin.						
	Hunt's Green Newtown Pippin.						
	Hunt's Fine Green Pippin.						
	Petersburgh Pippin.						
	Green Winter Pippin.						
476^{1}	Nonpareil, Penrhyn . . .	p. y.	oblate	3	T	1	Jan. M
490^{1}	Nonesuch, Hampshire.						
490^{2}	Nonesuch, Heath's Early.						
490^{3}	Nonesuch, Red-cheeked.						
497^{1}	Northern Spy	y. r.	conical	1	T		Dec. A
501^{1}	Nottingham Brown.						
511	Oslin	p. y.	roundish	2	T	1	Aug. Se
	White Oslin.						
	Arbroath Pippin.						
	Orgeline.						
	Orjeline.						
	Summer Oslin.						
	Osgood's Favourite, see *Lyscom.*						
	Ox Apple, see *Gloria Mundi.*						
523^{1}	Parson's Early.						
526^{1}	Patteswick Seedling.						
528^{1}	Pearlot.						
529	Pearmain, American Summer	y. r.	Pearm.	2	T		Sept.
	Early Summer Pearmain.						
536^{1}	Pearmain, Bradley's Golden.						
551^{1}	Pearmain, Mannington's .	y. rus.	Pearm.	2	T	1	Nov. M
567^{1}	Peeling, White.						
567^{2}	Peeling, Winter.						
	Pelican, see *Pennock's Red Winter.*						
570	Pennock's Red Winter .	g. r.	oblate	1	K		Nov. M
	Pennock's Large Red Winter.						
	Pennock, Red.						
	Pelican.						
	Philip Rick, see *Jonathan.*						
586^{1}	Pine Apple, Pitmaston . .	y. rus.	roundish	3	T	1	Dec. F
588^{1}	Pomona, Cox's.						
592^{1}	Pommewater.						
597^{1}	Pound Royal.						
599^{1}	President.						
	Prince's Yellow Harvest, see *Early Harvest.*						
600^{1}	Prince's Magnet.						
600^{2}	Prince's Yellow Winter.						
600^{3}	Princeall.						
602^{1}	Prussian Pippin.						
602^{2}	Pumpkin Sweeting.						
610^{1}	Queening, Winter, of Ohio.						
	Rawle's Janet, see *Rockrimmon.*						

	Name						
	Tart Bough, see *Early Harvest.*						
830[1]	Tifi	p. y. r.	round		K		Jan. M
835	Tower of Glammis . . . Glammis Castle. Late Carse of Gowrie. Gowrie.	g. y.	conical	1	K	1	Nov. F
843[1]	Ukranischer.						
855	Warwickshire Greening .	g.	roundish	2	K		April, M
855[1]	Watlingwood.						
858[1]	Westmoreland Longstart.						
858[2]	Whalley's Seedling.						
865[1]	Willis's Sweeting.						
869[1]	Wine, Long Island.						
	Woolman's Harvest, see *Summer Rose.*						
886[1]	Windham Pippin.						
	Yellow Bough, Large Early, see *Large Yellow Bough.*						
	Yellow Harvest, Large, see *Early Harvest.*						
887[1]	Yellow Superior.						
890[1]	Yschelebi.						

II. APRICOTS.

	Name.					
	Abricot d' Alsace . . .		o. r.	roundish	rich.	
	Kaisha		citron y.	roundish	rich transp.	I
	Précoce d'Esperen.					
	Précoce d'Hongrie.					
	Prince's Lafayette.					
	Tardif d'Orleans.					

	Name.							
2[1]	American Amber. Bloodgood's Amber. Bloodgood's Honey. Bloodgood's New Honey.							
4[1]	Baramdam.							
4[2]	Belle Audigeoise.							
6[1]	Belle Grosse d'Argovie.							
	Belle de Jodoigne, see *Reine Hortense.*							
	Belle de Lacken, see *ib.*							
7	Belle de Sceaux. Belle de Chatenay. Belle Magnifique. Magnifique de Sceaux.							
9[1]	Bigarreau d'Esperen.							
	Bigarreau Wellington, syn. *Bigarreau Napoléon.*							
18[1]	Black Heart (Manning's Early).							
20[1]	Black Heart, Winter's. Winter's Schwartze Knorpel Kirsche.	b.	heart	2	S	T	1	firm
	Bloodgood's Amber, see *American Amber.*							
	Bloodgood's Honey, see *ib.*							
	Bloodgood's New Honey, see *ib.*							
27[1]	Cobourger Frühe Herzkirsche.							
27[2]	Como	r.	round	3		R		
	Double Marmotte, see *Griotte Impérial.*							
28[2]	Donna Maria.							
29[1]	Downer's Late Red.							
30[1]	Duchesse de Palerme.							
	Griotte à Eau de Vie is *Morello.*							
44[1]	Griotte Imperiale. Double Marmotte.							
	Guigne de Petit Brie, see *Reine Hortense.*							
	Hybride de Laeken, see *Reine Hortense.*							
52[1]	Hyde's Seedling.							
	Indule d' Orleans is *Early May.*							
	Indulle is *ib.*							
	Lemercier, see *Reine Hortense.*							
	Louis XVIII., see *Reine Hortense.*							
	Magnifique de Sceaux, see *Belle de Sceaux.*							

	Name.								
	Monstrueuse de Bavay, see *Reine Hortense*.								
	Monstrueuse de Jodoigne, see *ib.*								
	Morestin, see *ib.*								
	Précoce de Montreuil is *Early May*.								
65[1]	De Prusse. Roi de Prusse.								
	Reine Hortense . . Monstrueuse de Bavay. Hybride de Laeken. Belle de Laeken. Morestin. Rouvroy. Guigne de Petit Brie. Seize à la Livre. Monstrueuse de Jodoigne (of some).	d. r.	obt. heart	1	W S	T	1	tender	Ju
70[1]	De Spa, Cerise de.								
71	Sparhawk's Honey. Sparrowhawk's Honey.								
	Winter's Schwarze Knorpel Kirsche, see *Winter's Black Heart*.								

IV. CURRANTS.

8[1] Pitmaston Prolific. A long-bunched red.
8[2] Raby Castle. Excellent late sort of Red Currant.
May's Victoria.
Houghton Castle.
Goliath.
10[1] Wilmot's Large Red.
10[2] Wilmot's New White. Very good; leaves much divided

	Name						
3^1	Almeria, Red.						
3^2	Almeria, White.						
	Askeree.						
7^1	Barbarossa, Black . .	long	bl.	oval	thick	sweet	2
7^2	Barbarossa, White.						
7^3	Bastardo.						
11	Black Cluster, Nice .	loose	bl.	roundish	thin	sweet	1
12^1	Black Monukka.						
13^1	Black Prince Hamburgh.						
18	Blussard Noir . . .	med.	b.	roundish	thin	sweet	1
	Cabriel.						
	Calokee.						
20^1	Casiles.						
23^1	Chasselas de Florence.						
25	Chasselas Musqué . . Josling's St. Alban's.	loose	w.	round	thin	muscat	1
	"Choicest Deccan Grape," see *Hubshee.*						
	Coussi noir is *Black Prince.*						
34^1	Damas Blanc.						
	Doomb-e-Roobah . .		w.				
	Faskbee (Persian).						
39^1	Feigentraube.						
44^1	Golden.						
44^2	Gros Gromier du Cantal	large	griz.	round	thick	sweet	1
44^3	Gros Guilliaume.						
44^4	Gros Panse Rose.						
46^1	Hamburgh, Judson's Richmond Villa Black.						
	Hamburgh, Wilmot's .	large	bl.	roundish	thick	sweet	2
	Hartäleber, see *Olwer.*						
	Hoolookee (Persian)						
49^1	Hubshee . . . . . Choicest Deccan Grape.	large	bl.	oblong	thick	sweet	2
50^1	Jaen Prieto.						
	Josling's St. Alban's, see *Chasselas Musqué.*						
	Kamadanee (Persian).						
	Keshmushee (Kishmish ?).						
	Kienzheimer Blanc Précoce is *Early White Malvasia.*						
	Kienzheimer Früher Weisser is *ib.*						

No.	Name.	Bunch.	Colour.	Form of Berries.	Skin.	Flavour.	Quality.
	Kohlauree (Persian) .		w.		thin		
52[1]	Largo.						
	Lauree (Persian) . .		w.			delicate	
52[2]	Loja.						
59[1]	Mantua Castellano.						
59[2]	Mantua de Xeres.						
60[1]	Mollar Sevillano.						
61[1]	Moscatellon Gordo Blanco.						
62[1]	Muscadine, Reeves's .	large	y. w.	oval	thick	sweet	1
66[1]	Muscat, Chandler's.						
67[1]	Muscat Noir Hâtif.						
67[2]	Muscat Réal.						
67[3]	Muscatel Jesus.						
67[4]	Muscatel, Malaga.						
67[5]	Muscatel Negro, or Morodo.						
67[6]	Muscatel Rosco.						
67[7]	Napoléon.						
70	Olwer . . . . . . Hartäleber. Grün Olwer.	comp.	w.	round	thin	vinous	2
71[1]	Ouilade Précoce.						
71[2]	Panse Jaune.						
72[1]	Pedro Ximines.						
72[2]	Perle Double.						
74[1]	Précoce Malingre.						
74[2]	Prune Blanc de Naples						
74[3]	Prune d'Herault.						
74[4]	Queen Muscat . . .	loose	y. w.	oval	thin	sweet	1
	Querci noir is *Black Prince.*						
75	Raisin de Calabre . . Calabrian Raisin.	long	w.	round	thin	sweet	2
	Reesh-e-Baba		w.				
78[1]	Rhodian Grape . . .	large	g.	roundish oval	thin	slight muscat	2
78[2]	Ribier.						
79[1]	Rogers' Seedling.						
	Rouge de Rolle.						
80	Sahibee	large	y w r	oval	thick	sweet	2
82[1]	Sheeraz.						
82[2]	Siderites Smyrne.						
83[1]	Strawberry Grape . .	comp.	r.	roundish	thick	foxy	3
87[1]	Temprano.						
88[1]	Tintilla.						
90[1]	Trebbiana.						
95	Verdal	loose	w	round	thin	sweet	1
98[1]	Xeres.						
	Yek-yendee (Persian).						
98[2]	Yellow Cabul.						

No.	Name.						
	Adair Green-Fleshed .	m. early	good	p. yel.	thick	p.g.yel.	4 to
	Anderson's Green-Fleshed.	early	good	grysh. gr.	thin	green	3 to
	Australind.						
	Benares	early	good	p. green	thick	green	5 l'
	Bromham Hall . . .	early	good	grysh. gr.	thin	green	3 to
	Cabul	late	good	y. green	thin	white	7 to 1
	Calabrian Green-Fleshed.						
	Camerton Court Green-Fleshed.						
	Cassabar	m. early	good	yellow	thin	white	4 l
	Castlebar.						
	Chapman's Green-Fleshed	m. early	indiff.	grys. gr.	thick	green	4 to
	Emperor Green-Fleshed	m. early	indiff.	y. green	thin	green	3 to
	Feri.						
	Frogmore Scarlet-Fleshed	early	good	y. green	thick	scarlet	4 l
	George the Fourth .	m. early	good	g. y.	thin	green	4 to
	Golden Ball, Tiley's.						
	Golden Queen.						
	Incomparable Green-Fleshed.						
	Khoi Bread	late		y. green	thick	green	7 lt
	Noir du Japon . . .	late	good	d. g. y.	thick	scarlet	3 lt
	Persian Hybrid.						
	Pitmaston Orange-Fleshed.						
	Prince Albert . . .	early	good	y. green	thin	green	1 or 2
	Quito.						
	Royal Albert.						
	Royal Arthur.						
	Royal Victoria.						
	Sirdar	m. early	indiff.	yellow	thin	white	4 lt
	Seymour's Green-Fleshed.						
	Sucrin à Chair blanche	early	good	y. green	thin	white	5 lb
	Syon House	early	good	grysh. gr.	thin	green	3 to 4
	Trentham Hybrid . .	early	good	yellow	thin	white	2 to 3
	Victory of Bath . .	early	good	grysh. gr.	thin	green	3 lb

No.	Name.								
0^{1}	Adèle de Saint-Denis .			2	T	J	1	Oct. Nov.	S
1	Alberty						3		
	D'Albert, see *Beurré d'Amanlis.*								
2^{2}	Alexandre Bivort . .		turbinate	2	T	J	1	Dec. Jan.	S
2^{3}	Alexandre Lambrè . .			3	T	J	1	Nov. Jan.	S
2^{4}	Alexandrine Hélie . .			2	T	J	1	Nov.	S
9^{1}	Andrews	y. g. r.	pyr.	2	T	J	1	Sept.	S
	Aurore, see *Beurré de Capiaumont.*								
	Angora (of some), is *Uvedale's Saint Germain;* (of others) is *Catillac.*								
12^{1}	Arbre Courbé		pyr.	2	T	J	1	Oct. Nov.	W
	Archiduc Charles, see *Napoléon.*								
	D'Aremberg Parfait, see *Buerré d'Aremberg.*								
16^{1}	Aubert.								
20^{1}	Baronne de Mello . .			2	T	J	1	Oct. Nov.	S
	De Bavay, see *Autumn Colmar.*								
20^{2}	Beadnell's Seedling . .	y. g. r.	turbinate	3	T	J	1	Sept. Oct.	S
21^{1}	Beau Présent d' Artois.								
	Belle Adriénne, see *Vicar of Winkfield.*								
23^{2}	Belle Après Noël . . Belle de Noël. Fondante de Noël. Bonne Après Noël.	b. r.	obovate	2	T	J	1	Dec. Jan.	S
	Belle Angevine, see *Uvedale's Saint Germain.*								
	Belle de Berry, see *Vicar of Winkfield.*								
	Belle de Bois, see *Flemish Beauty.*								
	Belle Canaise, see *Napoléon.*								
24^{1}	Belle Epine Dumas . . Belle Epine de Limoges. Epine Dumas. Epine du Rochois. Epine du Rochoir. Epine de Rochefort. Duc de Bordeaux. Colmar du Lot.	y. r.	pyr.	1	T	J	1	Oct. Nov.	S

	Belle d'Esquermes, see *Jalousie de Fontenay Vendée.*								
	Belle Excellente . . .	y. b.	obovate	2	T	B	1	Nov.	S
	Belle Héloise, see *Vicar of Winkfield.*								
25[1]	Belle Julie		obt. pyr.	3	T	J	1	Oct. Nov.	S
	Belle Lucrative, see *Fondante d'Automne.*								
32[1]	Bergamot, Gansel's Late	b. rus.	roundish	1	T	B	1	Dec. Jan.	S
33[1]	Bergamot, March . . .	b. rus.	roundish	2	T	B	1	Feb. Apr.	S
	Bergamotte d'Angleterre is *Gansel's Bergamot.*								
43[1]	Bergamotte d'Esperen .		roundish	2	T		1	Mar. Apr.	
	Bergamotte de Flandres, see *Flemish Beauty.*								
	Bergamotte d'Hiver (of some), see *Easter Beurré.*								
44[1]	Bergamotte Libotton .		roundish	2	T	C	2	Oct. Nov.	S
44[2]	Bergamotte de Louvain .		roundish	3	T	C	2	Nov. Dec.	S
46	Bergamotte de Parthenay . . . . . . Poireau.		roundish	2	T	C		Apr. May	S
46[1]	Bergamot Piquet.								
51	Beurré d'Amanlis. . . Wilhelmine. D'Albert. Hubard. Kaissoise.	g. b.	obovate	1	T	B	1	Sept. Oct.	S W
51[1]	Beurré d'Amanlis Panache	y. r. str.	obovate	1	T	B	1	Sept. Oct.	S
	Beurré d'Antein, see *Napoléon.*								
53	Beurré d'Aremberg . . Duc d'Aremberg. Deschamps. Orpheline d'Enghien. Délices des Orphelines. Beurré des Orphelines. L'Orpheline. Colmar Deschamps. d'Aremberg Parfait.	p. g. b.	obovate	2	T	B	1	Dec. Jan.	W
	Beurré d'Août Ronde, see *Summer Franc-Réal.*								
	Beurré Beaumont, see *Bezi Vaet.*								
54[1]	Beurré Berkmans . .		pyr.	2	T	B	1	Nov. Dec.	S
	Beurré d'Anjou (of some) is *Brown Beurré.*								
55[2]	Beurré d'Austerlitz.								
	Beurré de Bois, see *Flemish Beauty.*								
59[1]	Beurré Brettoneau . .	y. rus.	obt. pyr.	1	T	B	1	Feb. Apr.	W
	Beurré Boussoch, see *Doyenné Boussoch.*								
61[1]	Beurré Burnicq . . .		oblong	2	T	B	1	Oct. Nov.	S
62	Beurré de Capiaumont . Capiaumont. Calebasse Voss. Aurore. Beurré Spence (of some collections).	b. r.	obovate	2	T	B	1	Oct.	S
62[1]	Beurré Clargeau . . .	y. b.	turbinate	1	T	BJ	1	Oct. Nov.	S
65[1]	Beurré Duhame . . .			1	T	J	1	Jan. Feb.	S

No.	Name.	Colour.	Form.	Size.	Use.	Texture.	Quality.	Season.	Situation.
68	Beurré, Easter	g.y.r.b.	obovate	1	T	B	1	Jan. Apr.	W
	Bergamotte de la Pentecôte.								
	Bergamotte d'Hiver (of some).								
	Beurré de la Pentecôte.								
	Beurré d'Hiver de Bruxelles.								
	Beurré de Pâques								
	Beurré Anglaise.								
	Beurré Roupé.								
	Chaumontel très gros.								
	Bezi Chaumontel très gros.								
	Doyenné d'Hiver.								
	Doyenné d'Hiver Nouveau								
	Doyenné du Printemps.								
	Doyenné de Pâques.								
	Seigneur d'Hiver								
	Philippe de Pâques.								
	Du Pâtre.								
	Pastorale (not of the French).								
	Canning.								
	Grüne Winterbutterbirne.								
68^1	Beurré d'Esperen.								
	Beurré de Fontenay, see *Beurré Gris d'Hiver Nouveau.*								
68^2	Beurré Giffard		turbinate	2		B	1	Aug.	S
68^3	Beurré, Golden of Bilboa.								
68^4	Beurré Goubault . . .	g. y.	roundish	2	T	J	1	Sept.	S
70	Beurré Gris d'Hiver Nouvean	g.y.rus	obovate obovate	1	T	B	1	Jan. Feb.	S
	Beurré Gris Supérieur.								
	Beurré de Luçon.								
	Beurré de Fontenay.								
	Beurré de Fontenoy.								
72^1	Beurré Hardy				T	B	1	Oct.	S
	Beurré Hâtive, see *Summer Franc-Réal.*								
72^2	Beurré Kennes . . .			2	T	C		Oct. Nov.	S
72^3	Beurré de Köning . .			2	T	B	1	Nov.	S
72^4	Beurré, Langelier's . .	b.	pyr.	1	T	B	1	Dec. Jan.	S
	Beurré Lefebor, see *Beurré de Mortefontaine.*								
	Beurré de Luçon, see *Beurré Gris d'Hiver Nouveau.*								
72^1	Beurré Léon Leclerc.								
72^2	Beurré de Millot.								
72^3	Beurré Moiret		pyr.	2			1	Oct.	
	Beurré Moiré.								
72^4	Beurré, Mollet's Guernsey	y.b.rus	pyr.	1			1	Dec. Jan.	
72^5	Beurré Mondelle.								
73^1	Beurré de Mortefontaine		irreg. ov.	1			1	Oct.	
	Beurré Lefebor.								
73^2	Beurré Nantais.								
	Beurré Noirchain, see *Beurré Rance.*								
	Beurré des Orphelines, see *Beurré d'Aremberg.*								
	Beurré Picquery, see *Urbaniste.*								
7	Beurré Rance	b. g.	obt. pyr.				1	Jan. May	S
	Beurré de Ranz.								
	Beurré Epine.								
	Hardenpont du Printemps.								
	Josephine (of some).								
	Beurré de Flandre.								
	Beurré Noirchain.								
	Bon Chretien de Rance.								

153^{2}	Chevreuse.								
153^{3}	Choix d'Amateur . . .			1	T	J	1	Nov. Dec.	S
	Clion, see *Vicar of Winkfield.*								
150^{1}	Colmar d'Aremberg . .	y. b.	turbinate	1	T	J	1 2	Nov. Dec.	S
	Kartoffel.								
151	Colmar, Autumn . . .	p. g.	obt. pyr.	1	T	B	1	Oct. Nov.	S
	Do Bavay.								
151^{1}	Colmar Blanc d'Hiver.								
	Colmar Deschamps, see *Beurré d'Aremberg.*								
	Colmar du Lot, see *Belle Epine Dumas.*								
	Colmar Nelis, see *Winter Nelis.*								
157^{1}	Colmar de Silly . . .								
157^{2}	Colmar Tardif.								
160^{1}	Colombia.	y.	obovate	1	T	J	1	Nov. Jan.	S
	Columbian Virgalieu.								
	Columbia Virgalouse.								
160^{2}	Comstock.								
162^{1}	Comte de Flandre . .		pyr.	1	T	J	1	Dec.	S
162^{2}	Conseiller de la Cour .	y. b.	pyr.	1	T	B	1	Nov.	S
167^{1}	Crassane d'Hiver Bruneau			2			1	Mar.	
169^{1}	Crassane Seedling.								
	De Curé, see *Vicar of Winkfield.*								
174^{1}	Cushing.								
	Davy, see *Flemish Beauty.*								
179^{1}	Délices de Charneau . .			1	T	J	1	Nov.	
179^{2}	Délices de Chaumont.								
181^{1}	Délices de Jodoigne . .			1	T	J	1	Oct. Nov.	S V
181^{2}	Délices de la Meuse.								
	Délices des Orphelines, see *Beurré d'Aremberg.*								
183^{1}	Deux Sœurs		pyr.	1	T	J	1	Nov.	
196^{1}	Doyen Dillen		oval	1	T	J	1	Dec.	
198	Doyenné Boussoch . .		obovate	1	T	B	1	Oct. Nov.	
	Beurré Boussoch.								
	Nouvelle Boussoch.								
198^{1}	Doyenné du Comice . .	y.b.rus	turbinate	1	T	B	1	Nov. Dec.	
198^{2}	Doyenné Crotté . . .								
198^{3}	Doyenné d'Été	y. r.	obovate.	3	T	J	1	July.	S
	St. Michel d'Été.								
	Doyenné de Juillet.								
	Beurré d'Été								
198^{1}	Doyenné Goubault.		obovate.	1	T	J	1	Jan. Mar.	S
199^{1}	Doyenné Gris jaune d'Hiver.								
	Doyenné de Pâques, see *Easter Beurré.*								
	Duc de Bordeaux, see *Belle Épine Dumas.*			1 1					
205^{5}	Duc de Némours . . .	g. y.	pyr.		T	J	1	Nov. Dec.	
207	Duchesse d'Angoulême	b. y.	obt. obov.		T	B	1	Oct. Nov.	W
	Poire de Pézénas.								
	Poire de Éparonnais.								
207^{1}	Duchesse d'Aremberg.								
207^{1}	*Duchesse de Berri,* see *Uvedale's Saint Germain.*								
	Duchesse de Berri d'Hiver, see *ib.*			1 2					
208^{1}	Duchesse d'Orléans . .	y. rus.	pyr.		T	B	1	Oct.	W S
216^{1}	Eliza d'Heyst		turbinate		T	J		Mar.	

No.	Name.	Colour.	Form.	Size.	Use.	Texture.	Quality.	Season.	Situation.
	Empereur, see *Napoléon.*								
	Éparonnais, Poire de, see *Duchesse d'Angoulême.*								
	Épine Dumas, see *Belle Épine Dumas.*								
	Épine du Rochoir, see *ib.*								
	Épine du Rochois, see *ib.*								
244[1]	D'Été d'Issenheim.								
	Féodale, see *Flemish Beauty.*								
227[1]	Figue d'Alençon. Figue d'Hiver. Figue d'Hiver d'Alençon.								
	Fondante d'Automne . Belle Lucrative.	p. y.	obovate.	2			1	Sept. Oct.	S
	Fondante de Brest, see *Inconnue Chêneau,* and *Summer Franc-Réal.*								
230[1]	Fondante du Comice.								
231[1]	Fondante de Malines.								
231[2]	Fondante de Millot . . Mont Parisette.			2			1	Nov. Dec.	S
228	Flemish Beauty . . . La Belle de Flandres. Bouche Nouvelle. Fondante des Bois (of some) Impératrice de la France. Josephine (of some). Bosch Sire. Bosch. Brilliant. Belle des Bois. Beurré des Bois. Beurré Spence (of some). Bergamotte de Flandres. Davy or Davis. Féodale. Nouvelle gagnée à Heuze. Tougard.	b. rus.	obovate.	1			1	Sept. Oct.	S
238	La Fortunée . . . . La Fortunée de Parmentier. Fortunée Belgé. Fortunée d'Angers. La Fortunée de Paris. Beurré d'Hiver Nouvelle (of some).	rus.	roundish	3				Apr. May.	S
243	Franc-Réal, Summer . . Franc-Réal d'Eté. Fondante (of some). Gros Micet d'Été. Franc Royal d'Eté. Beurré d'Août ronde. Beurré Hâtif. Franse Caneel-peer. Knoop's Franzosische Zimmtbirne. Fondante de Brest, Inconnue Chêneau } erroneously of Knoop.	y. g.	obovate.	2				Sept.	S
250[1]	Glout Morceau de Cambron	p. g.	obt. pyr.	1				Oct. Nov.	W
249[1]	Gloire de Cambron.								
	Gloire de l'Empereur, see *Napoléon.*								
250[1]	Goodenough.								
256[1]	Grand Soleil.								
256[2]	Graslin.								
	Grosse de Bruxelles, see *Uvedale's St. Germain.*								
	Hardenpont's Winter Butterbirne is *Glout Morceau.*								

No	Name.			Si	D			Season.	Situa
269^1	Heathcot.								
	Gore's Heathcot.								
269^2	Henri Caperon.								
275^1	Hill's Fall Butter.								
	Hubard, see *Beurré d'Amanlis.*								
277^1	Hunt's Connecticut.								
278^1	Hutton.								
	Inconnue Chêneau, (of Knoop) see *Summer Franc-Réal.*								
280^1	Inconnue Van Mons.								
280^2	Jalousie de Fontenay Vendée	b. r.	obt. pyr.	2	T	B J	1	Sept. Oct.	S
	Belle d'Esquermes.								
284	Jargonelle (of the French) , . . .	p. g. r.	obovate.	2	T	C	2	Aug.	S
	Bellissime d'Eté.								
	Suprême.								
	Bellissime Suprême								
	Bellissime Jargonelle.								
	Vermilion d'Été.								
	Sabine d'Été.								
	Red Muscadel.								
	Summer Beauty, English Red Cheek, Red Cheek } Of some American Gardens.								
284^1	Jargonelle d'Automne.								
286^1	Johonnot.								
287^1	Josephine.								
	Colmar Josephine.								
287^2	Josephine de Malines.								
287^3	La Juive		roundish	2	T	T	1	Nov. Dec.	S
287^4	Juvardiel.								
	Kessoise, see *Beurré d'Amanlis.*								
	König von Baiern is *Passe Colmar.*								
293^1	Kostliche Von Charnue.								
293^2	Lamartine.								
293^4	Laure de Glymes.. . .		turbinate	1	T	J	1	Sept. Oct.	
	Liard, see *Napoléon.*								
296^1	Locke's.								
297^1	Louise de Boulogne.								
299	Louise Bonne (of Jersey)	g. y. r.	pyr.	1	T	B	1	Oct.	W
	Louise Bonne d'Avranches								
	Beurré, ou Bonne Louise d'Arandoré.								
	Bonne de Longueval.								
	William the Fourth.								
299^1	Louise Bonne (of Vienna).								
299^2	Louise d'Orléans . . .		oblong.	2	T	J	1	Nov. Dec.	
300^1	Lucien Le Clerc . . .		turbinate	2	T	J	1	Nov.	
301^1	Madame Durieux . . .			2	T	B	1	Oct. Nov.	
304^1	Maréchal de la Cour.								
309^1	Marquess of Lansdowne.								
	Médaille d'Or, see *Napoléon.*								
311^1	Miel de Waterloo.								
311^2	Millot de Nancy . . .		turbinate	2	T	J	1	Nov. Dec.	S
	Mont-Parisette, see *Fondante de Millot.*								

No.	Name.	Colour.	Form.	Size.	Use.	Texture.	Quality.	Season.	Situation.
378[1]	Saint Germain Vauquelin	g. b.	oval pyr.	1	T	J	1	Dec. Apr.	S
	Vauquelin.								
380[1]	Saint Jean Baptiste.								
389[1]	Schönlins Stuttgarter Spate Winter Butterbirne.								
390	Seekel	b. r.	obovate	3	T	B	1	Oct.	S
	Red Cheeked Seckel.								
	New York Red Cheek.								
	Shakespeare.								
391[1]	Seigneur d'Esperen.								
391[2]	Seigneur Everard.								
395[1]	Simon Bouvier			3				Oct.	
	Shakespeare, see *Seckel.*								
	Soldat Laboureur, see *Beurré d'Aremberg.*								
396[1]	Sorlus		pyr.	1	T	B	2	Nov. Dec.	S
396[2]	Souvenir d'Esperen . .		pyr.	2	T	J	1	Dec.	
	Stück is *Glout Morçeau.*								
	Sugar Top, Prince's.								
408[1]	Suprême de Quimper .			2	T	J	1	Aug.	S
409[1]	Suzette de Bavay . . .		turbinate	2	T	J	1	Mar. Apr.	S \
410[1]	Swan's Orange.								
412	Tettenhall	b.	obt. obov.	3		T		Nov.	S
412[1]	Theodore Van Mons. .		pyr.	2	T	J	1	Oct. Nov.	S
	Thessoise, see *Beurré d'Amanlis.*								
414[1]	Tombe de l'Amateur.								
	Tougard, see *Flemish Beauty.*								
415[1]	Triomphe de Jodoigne .	y. r.	pyr.	1	T	J	1	Nov. Dec.	W
415[1]	Tyson.								
416	Urbaniste	p. g.	obovate	2	T	B	1	Oct.	S
	Beurré Picquery.								
	Vauquelin, see *Saint Germain Vauquelin.*								
422	Vezouzière		roundish	3	T	J	1	Dec.	S
423	Vicar of Winkfield . .	y. b. r.	pyr.	1	T	B	2	Nov. Jan.	W
	Clion.								
	Belle de Berry (of some).								
	Belle Héloise.								
	Poire de Curé.								
	Belle Adriénne.								
431	Washington, (Smith's) .	g. y.	obovate	3	T	B	1	Oct.	S
432[1]	Webber's Yellow.								
	Wilhelmine, see *Beurré d'Amanlis.*								
436[1]	Willermoz			1	T	J	1	Oct. Nov.	
437[1]	Williams' Early.								
439[1]	Wredow.								
441[1]	Zephirin Grégoire . .			2	T	J	1	Jan. Mar.	

8[1]	Autumn Bolmar.								
8[2]	Autumn Compote.								
10[1]	Belle de Septembre.								
11[1]	Brevoort's Purple . . New York Purple. Brevoort's Purple Bolmar. Brevoort's Purple Washington.	s.	p.	oval	1	adh.	2		Sept.
21[1]	Columbia . . . . . Columbian Gage.	d.	p.	round	1	sep.	1	T	Sept.
	Corse's Dictator.								
	Corse's Nota Bene . .	s.	p. p.	round	1	sep.	1	T	Sept.
37[1]	Dean's Jedburgh Seedling		p.	roundish	2	sep.	1	K	Sept.
37[2]	Denbigh.								
38[1]	Denniston's Superb.								
42[1]	Downing's Emerald Drop	s.	y. g.	oval	2	sep.		T	Sept.
43[1]	Dshan Erick	s.	y.	oval	2	sep.		T	Sept.
44[1]	Early Prolific, Rivers'.								
46[1]	Fellenberg.								
	Fellenberg (of some), see *Quetsche d'Italie.*								
47[1]	Gage, Autumn. Roe's Autumn Gage.								
49	Gage, Bleecker's . . . German Gage. Blücher's Gage.	d.	y.	roundish oval	1	sep.	1	T	Sept.
49[1]	Gage, Cant's Seedling Green.								
	Gage, Columbian, see *Columbia.*								
50	Gage, Imperial . . . Flushing Gage. Prince's Imperial Gage. White Gage. Superior Green Gage.	d.	y. g.	oval	2	sep.	2	T	b. Sept.
50[1]	Gage, Prince's Orange.								
50[2]	Gage, Prince's Red.								
50[3]	Gage, Prince's Yellow.								
50[4]	Gage, Scarlet.								
53[1]	General Hand's.								
53[2]	Gifford's Lafayette.								
	Gloire de New York, see *Huling's Superb.*								
54[1]	Gold Pflaume.								
	Green Gage, Superior, see *Imperial Gage.*								
61[1]	Huling's Superb . . . Keyser's Plum. Gloire de New York.	d.	g. y.		1	sep.	1	T	Sept.
61[1]	Impérial Ottoman . .	s.	y.	roundish	2	adh.	2	T	Aug.
74[1]	Lewiston Egg.								
74[2]	Lombard.			roundish					
	New York Purple, see *Brevoort's Purple.*								

No.	Name.	Wood.	Colour.	Form.	Size.	Stone.	Quality.	Use.	Season.	
96^1	Primordian, Prince's Red									
96^2	Prince's Orange Egg .		y.	roundish	2	adh.	3		Sept.	
96^3	Prince of Wales, Chapman's	s.	p.	oval round	1	sep.	1	K T	e. Aug.	A
99^1	Quetsche, Grosse Englische.									
100^1	Quetsche d'Italie . . . Fellenberg (of some). Fellenberg Quetsche.	s.	p.	oblong	2	sep.	1	P	e. Sept.	
105^1	Red Honey.									
105^2	Reine Claude de Bavay .	s.	g.	rnd. oval	1	sep.	1	T	e. Sept.	L G
105^3	Reine Claude Diaphane.									
116^1	Siamese.									
120^1	Tay Bank, Guthrie's . .		y. g.	roundish oval	1	sep.	1	T	Sept.	J n
122	Victoria, Denyer's . . Alderton.	d.	r.	oval	1	sep.	2	K T	e. Sept.	A h A

XII. RASPBERRIES.

	Name.			R
5^1	Cornwall's Victoria . . . . Superbe d'Angleterre.	r.	1	
6^1	Fastolff . . . . Filby.	r.	2	
6^2	De Hollande ou d'Anvers à Gros Fruit allongé . . . . Long Fruited Antwerp.	r.		Amongst all the cu berries, none is k rich aroma of the has been so long g that the stock appe The three reputed Raspberries have cently introduced i
6^3	De Hollande ou d'Anvers à Gros Fruit arrondi . . . . Round-Fruited Antwerp.	r.		
6^4	De Hollande ou d'Anvers à Fruit Jaune . Yellow-Fruited Antwerp.	y.		
6^5	Large-Fruited Monthly, Rivers'	r.	1	A free grower, a valuable for produ different from th Double-bearing.

ORIGINAL COMMUNICATIONS.

XXII.—On Edgings for Garden Walks and Flower Beds. By Robert Glendinning, F.H.S., Chiswick Nursery, Turnham Green.

(Communicated June 17th, 1853.)

The mind can never contemplate with any satisfaction or delight a walk, however well it may be kept, or a flower-bed planted with the most beautiful flowers, unless the margins present some degree of mathematical precision. Nothing, in my opinion, tends so largely to set off order and high keeping in a garden as clear and definite marginal demarcations: the contrary only evinces a want of accuracy and good taste. It is marvellous how some gardens might be improved were these hints acted upon, and without incurring a farthing of extra expense, because no more trouble is required to define the truthful line than the converse. Whether a walk is placed at right angles or on a curve the breadth should be uniform, and this is best indicated by proper margins, which, in gardening, are as essential to express the truthful character of the design as those in a building are of correct architecture. This holds good whether the verges are of turf or some dwarf shrub, for they equally influence the character of a garden. Those accustomed to high keeping and good marginal lines cannot look upon anything else with satisfaction: when entering dressed grounds with shaggy edgings, broken and defaced borderings, however well the ground may be kept otherwise, these defects always prove self-condemnatory.

Let us examine for a moment the effect which verges are capable of producing when introduced by an artistic hand. The meagreness produced by a line of turf or a verge of Box tree is apparent enough, and yet how many seem to think otherwise, or are at least satisfied with them. No garden with any pretensions to artistic design can be so margined with anything like effect; a square brick or stone building, destitute of all architectural enrichment, may, in the eyes of a few, be perfect, but it will scarcely be admitted as such by those who are acquainted with the classic works of a Wren or a Barry, the one being the square block thrust from the quarry, the other bearing the impress of intellectuality. As mouldings and enrichments express the character of a building, so verges in the hands of a garden artist, if properly dealt with, will effect the same object in ornamental grounds. It should be the paramount object of the artist to keep these principles continually in view, and be able to discriminate the various circumstances which control the degree of embellishment and artistic finish which a particular garden demands: hence, therefore, the necessity of accumulated knowledge and extensive experience being brought to bear on the subject, in order, on the one hand, that baldness and puerility may be avoided, and on the other prodigal extravagance and lavish excess. An acquaintance with the principles of correct taste and their practical application is essential to the proper dispositions of a garden, for glaring defects and absurdities will, and must of necessity, always be the production of an untutored mind. On terrace gardens, where a profusion of sculptural ornaments is introduced, edgings of stone are frequently employed, and with good effect when the walk does not extend to the stone at the next marginal line, for in that case the roller is prevented from defacing the stone, as it would otherwise do even under the most cautious management. This objection applies to all stone, slate, or tile edgings bordering beds against walks, how much soever in character they may be. But this defacing of the verges may, in most instances, be avoided. Supposing stone to constitute an edging to a bed where flowering plants are placed, a narrow verge of fine gravel, of a colour to contrast with the stone, may extend round the exterior. Then a verge of turf may follow; the breadth of these exterior margins must be proportioned to the extent of the garden and the size of the beds, this being a point of great importance; for, if the parterre is on a grand scale, then these turf margins may be of sufficient breadth to admit of sculptural decoration, and also of formal-growing evergreen shrubs, which will heighten and improve the general effect.

There are other kinds of gardens, besides the terrace-garden, connected with the mansion, where edgings may with as much propriety and equal consistency be introduced. The naked mass of flowers on a lawn must have struck most individuals of taste as a meagre and unsatisfactory production. Indeed this wretched mode of planting is not less mean and poverty-stricken in its effect, than in its universality throughout the country; a circumstance as much to be deplored as condemned, deplored because of the paucity of existing taste, and condemned because of the undignified effect all such arrangements produce on minds capable of appreciating anything beyond this semibarbarous mode of gardening. If there existed no appliances to correct this state of things, or no means by which they could be improved, then a valid excuse would exist, but the contrary is the fact; materials of various descriptions are abundantly at command to wipe away this effete practice.

In order therefore to show how improvement may be introduced, and how simple are the means by which it is effected, we may take as an example a circular bed on a lawn, although the form of the bed signifies little as far as regards the object to be illustrated; plant a margin of some suitable evergreen shrubs, such as I shall presently enumerate as eligible for the purpose; then introduce the flowering-plants; when they have made some growth, let this bed be compared with one destitute of the edging; an artistic eye will readily detect the finish of the one, and the scanty meagreness of the other. This not only applies to flower-beds, but to masses of dwarf shrubs under gardening identical with that to which we have been more immediately referring. I may here observe by way of caution, that application of verges to masses of flowers and shrubs is not to be understood as indispensable in every case, or in every situation, because such a line of demarcation would destroy the character and intention of grounds planted in a natural and varied style, where the shrubs are intended to develope their individual contour by allowing their branches to rest upon the lawn, and enable them to display their various and peculiar outlines.

The kinds of shrubs suitable for edgings are much more numerous than is generally supposed. Let me conclude these remarks by appending the names of such as may be employed in garnishing the margins of flower-beds and shrubs. And let me also observe that these edgings may be contrasted with as much propriety and effect as the flowering-plants usually employed in furnishing geometrical flower gardens.

In the winter months such edgings give an increased interest and character which naked beds of soil do not possess.

if properly used in irrigation, will ere long render it the Eden of India. But in crossing the Punjab in different directions, the traveller may be led to very different conclusions as to its fertility. Crossing the river Sutlej at Phillore, and proceeding in a north-west direction, *viâ* Jullunder, Hoshiarpore, Deenanuggur, Sealkote, Wuzeerabad, and Goojrat, he would be led to believe that the country was both densely populated and highly cultivated up to the Salt range. Crossing the Sutlej at Hurree Ke-Ghat, and proceeding *viâ* Amritsir to Lahore, and thence on to the Salt range, by a route 40 miles to the south, viz. by Ramnuggur to Pinddadun-Khan, he would come to the conclusion that cultivation was only carried on to any extent in the first, or Baree Doab, and that two-thirds of the country beyond the Ravi was lying waste. Still further to the westward, and nearer the great desert, waste land in a greater proportion exists, and population is scanty in the extreme.

We have, therefore, three belts all of which show different results. The first showing high cultivation and a rich and densely populated country. The second partial cultivation, with, here and there, towns and villages, round which good cultivation exists, but the larger portion lying waste. And the third, a waste comparatively speaking with a few villages breaking up now and then the monotony of the Jhar (Zizyphus), Babul Acacia and Dhak (Butea) Jungle. But the changes which have been effected within the last four years in the Baree and Rechna Doabs are truly remarkable. When we visited the Punjab in 1841-42, extensive jungles existed in the neighbourhood of the very capital, giving cover to deer, wild hogs, &c., and affording sport to the late Maharajah and his nobles. In our late journey we looked for these jungles in vain, all having given way to the ploughshare, and presenting, in their room, rich fields of cultivation. Such, too, was the case with the Shikargah of Rajah Dhian Singh, on the right side of the Ravi, distant some ten miles from Lahore.

Traversing the country in a north and south direction we meet with bunds, or belts of lands the former beds of rivers, and showing that their courses have been altered. Thus the Sutlej, which formerly ran close to the town of Loodiana, is now seven miles to the westward. The Ravi, which twenty or thirty years ago washed the walls of the city of Lahore, runs in a channel three miles further west. The Chenab, which a few years ago ran close to the towns of Ramnuggur and Wuzeerabad, is now four miles distant, and the same applies to the Jhelum and Indus where not closed in by mountains.

Throughout the broad, flat plains of the Punjab no rocks are met with *in situ* until we reach the Salt range with the exception of, here and there, beds of Konkur, a compact marl, which is sometimes mixed with a small quantity of peroxide of iron, giving it a black or dark-brown colour, and clay. Near Jullunder large beds of it occur, and it is there dug and used in making roads, for which it is well adapted. The common kind of Konkur, too, is also here found in abundance. This formation has no doubt been deposited by springs which formerly existed, and appear to have prevailed, and still do so, to some extent throughout India.

By the divisions formed by the rivers, the Punjab has been divided into a series of Doabs, which we shall here notice, as it will be necessary for us to allude to them hereafter.

In crossing the Sutlej at Phillore we enter, as already stated, the Jullunder Doab, which is formed by the Sutlej and Beyas. In crossing the Beyas, we enter the Baree or Manjha Doab, consisting of that tract of land lying between the Beyas and Ravi, including the great cities of Amritsir and Lahore. This Doab is the great stronghold of the Sikh population. In crossing the Ravi we enter the Rechna Doab formed by the Ravi and Chenab. In crossing the Chenab, we reach the Jetch Doab, formed by that river and the Jhelum; and forming the Sind Sagur Doab, we have the rivers Jhelum and Indus. All these Doabs present magnificent broad, flat plains with a gradual declination to the south, and thus admirably adapted to irrigation. For this purpose, according to calculations made by my friend Lieut. Baird Smith, there is a supply of water now running waste to the sea equal to 12,000 cubic feet per second, which if properly applied would convert these, in many places, waste and barren plains into the Eden of India, and make them one sheet of the richest cultivation. To reap such a harvest capital and hands to guide alone are wanting. Well and correctly, too, has he remarked in his admirable digest of canal operations in the north of India conducted by the rulers of India, that the extraordinary facilities possessed by the land of the Five rivers in its abundant supply of water, its wide plains sloping gently from the base of the Himalayahs, and the natural fertility of its irrigated soil, would lead us to have anticipated the existence of canals dating from the period of the Mahommedan empire. Of the advantages and value of canal-irrigation to the Punjab there can be but one opinion. No country in India depends more on rain for its crops, and here, too, its fall is most uncertain. For several successive seasons it will occur scanty in the extreme; and on the other hand, for a like number of years it is abundant. Since the occupation of the country by the British government it has been well supplied with rain, which has rendered grain exceedingly cheap, and gone far to settle it in the quiet state in which it now reigns. Were canals intersecting the Doabs in all directions the elements would not be watched with anxious care by the Zemindars, as plenty would be diffused even without rain, and with it happiness and contentment throughout the length and breadth of the land. All the Doabs have their own peculiarities and distinguishing characters. The first and richest in cultivation is the Jullunder Doab, which almost throughout its length and breadth presents in the cold weather a sheet of the richest cultivation. The crops cultivated in the autumn are wheat, barley, chunna, (Cicer Arietinum), Torea, (Sinapis glauca), Tirra, (Brassica erucastrum), Bakla, (Faba vulgaris), Mithre, (Trigonella fœnum græcum), &c., Kussoomba, (Carthamus tinctorius), a well known dye. But the crop to which the Zemindars look forward to for the payment of their revenue is sugar, which is extensively cultivated throughout the Jullunder Doab. On an average one-fifth of the land may be said to be under cultivation with it, pointing out the richness of the soil and the industry * of the agricultural population. Most of the sugar is raised for exportation principally to Amritsir and Lahore, from whence it is sent to the south to Bhawulpore, and north to Cabul. In many places the soil of the Jullunder Doab consists of a rich black loam, and would, were irrigation available, be admirably adapted for the cultivation of cotton. At present cotton is there cultivated, but in small quantity and of an inferior kind; this applies to all the cottons in the Punjab examined by us; all were short stapled and of inferior quality. Wheat is also grown for home consumption, the markets of Lahore and Amritsir being principally supplied from the eastward and southward, as Amballa and Saharunpore districts, Futteh Ghur, &c. Partly for want of water and partly by its saline nature, (Shore Ke Zemin) there is an immense tract in the Kuppoorthulla Rajah's country lying waste. This belt is about ten miles long and three miles broad. In some places where the land had, as in the neighbourhood of Kuppoorthulla, been well broken up and irrigated,

* To obtain a good crop of Sugar-cane requires most careful cultivation, it being necessary to plough the land many times and manure it strongly.

said to be of a very superior description. The following trees also occur :—

Chumror or Chelah (Ehretia lævis).	Sissum (Dalbergia Sissoo).
Ceris (Acacia serissa).	Bukain (Melia Bukain).
Keekur (Acacia arabica).	Toot or Tootree (Morus parviflora).
Bhur (Ficus indica).	Lessora (Cordia Myxa).
Pepul (Ficus religiosa).	Dhaul Dawk (Erythrina stricta).

For making ploughs and sugar mills the Phulahi (Acacia dumosa), and the Chumror (Ehretia lævis), and Keekur (Acacia arabica), are extensively used and well adapted from their toughness for the purpose.

In this Doab the Mulberry grows with great luxuriance, and silk is a great article of trade at Jullunder. The introduction of the silk-worm might therefore, if properly conducted, be attended with success. The Morus multicaulis had been introduced from the Saharunpore Garden, and is growing with great vigour. The subject is, therefore, well worthy of attention, seeing that in the province itself there is a large demand for the raw material.

The *Baree or Manjha Doab*, though the densest populated Doab of the Punjab, is not nearly so highly cultivated, generally speaking, as the Jullunder Doab. In it generally the soil is light and sandy, and in many places highly saline; water, too, is very distant (80 feet from the surface), rendering it difficult and expensive to sink wells.

In this Doab the most characteristic plants are the Kureel (Capparis aphylla), which occurs in the form of low brushwood, seldom reaching to the size of a tree, as near Delhi its seeds are sold in the bazaars under the name of *Taint*, and eaten: the Madur (Calotropis Hamiltonii), Dawk (Butea frondosa), and Furas (Tamarix Furas), and Lycium, a small solanaceous and thorny shrub, presenting with its bright red berry a pretty appearance. Here, too, frequently hills formed by drifting sand are met with, giving cover to thousands of sand partridges; two species occur, the large and small Rock pigeon of sportsmen (Pterocles arenarius and P. furcatus) Jundialah, in this Doab, ten miles from Amritsir, is celebrated for its priests and its thieves ; we ought rather to say was, it having been the residence of the Sukh Gooroo ; the former, however, now make themselves scarce, but the latter still remain. Between Amritsir and Lahore there are large tracts of waste land, but as we approach the capital, cultivation presents itself, the principal crops being sugar and wheat. In the neighbourhood of the cities of Amritsir and Lahore, vegetables are cultivated on an extensive scale, such as Turnips, Carrots, Radishes, &c., and of great size, but very flavourless. Characterising the Baree or Manjha Doab we have the following plants:—

(Fagonia mysorensis).
Isbund Lahoree (Peganum Harmala).
Kureel (Capparis aphylla).
Jhand (Prosopis spicigera).
Soujna (Moringa pterygosperma).
„ (Lycium).
Khajoor (Phœnix sylvestris).
Bel (Ægle Marmelos).

In the country between Amritsir and Lahore, the Khajoor tree (Phœnix sylvestris) abounds, and stands out in bold relief, presenting a striking contrast to the otherwise woodless country. Here and there the Peeloo or Jhal (Salvadora indica) occurs, but though in the upper part of the Doab it is rare, towards the south it abounds. It is this tree which Colonel Mackeson thus notices in his Journal from Loodiana to Mittionkote:—"At Palra near Pak-Puttun, the face of the country varies little in appearance, being, day after day, the same succession of Tamarind Jungle, the dark green of which is here and there relieved by a shrub resembling the willow in leaf and which the natives call Jhall, and from the root of which the Miswaks or tooth-cleaners are made. This tree has been identified with the Mustard tree of Scripture by Captains Irby and Mangles. Leaves similar to those of Salvadora are sold in the bazaar under the name of Rai Sunna,* mustard-and-cress, which probably led them to this opinion, but which however is not correct, as the leaves belong to Barthe (Lotia lanceolata);† the seeds of the Peeloo are eaten.

Lahore is celebrated for its garden of Shalimar, but which was little more than dense jungle when we visited it in January, 1850; a third of the trees, or even more, might be cut down with great advantage to the others, as they would then get air and give better fruit, and the wood afford profits to cover all the expenses incurred in the necessary improvements and thinnings.

In the *Rechna Doab* cultivation is much more restricted, unless towards its northern end, than in the Baree Doab, but here the changes are very striking since 1841.

Crossing the Ravi river, extensive jungles formerly existed, which have in a measure given way to the plough, and now present good cultivation. Here the soil is very saline, and is covered

* The leaves are frequently used to adulterate Senna.
† Madden on the Plants met with in Kemaon.

with a species of Salicornia, characteristic of such soils. At Shadurrah we meet with a species of Pentatropis in abundance climbing over Mango trees. Species of this genus were first noticed by Brown in Salt's Abyssinia. In the Rechna Doab, the Jhand (Prosopis spicigera) is one of the most characteristic trees. In the upper part of the Doab forests of Sissoo (Dalbergia Sissoo) are met with, but the trees are allowed to grow so close, as to be almost useless, hundreds, though twenty and thirty feet high, not being thicker than a man's arm. The Jhand in this Doab takes the place of Tulahi in the Jullunder Doab. In this Doab, too, Juwassa or Juwansee (the Ooshturkar, or Camel-thorn), Alhagi Maurorum, a plant common in Egypt,* is very abundant. From this plant the Toorangbeen, a kind of Manna, is procured and used as a substitute for sugar, and is imported from Persia and Bokhara *viâ* Cabul.

The Punjab plants, and those met with throughout the north-western provinces, do not secrete Manna; but it is not uncommon in the vegetable kingdom to find plants giving secretions in one country or locality and not in another. The same is found to be the case with the Cannabis sativa or Bhang, which in the hills at altitudes of six and eight thousand feet secretes the gum-resin Cherrus, but does not do so in the plains. The Juwassa is frequently used for making tattees for tents, for which it is admirably adapted, giving out a delicious perfume when watered.

The following other plants are met with in the Rechna Doab:—

Ficus cordata (Kimri).
Acacia arabica (Keekur).
Phœnix sylvestris, abundant near Shadurrah.
Salvadora indica.
Mangifera indica.
Ricinus communis.
Spartium.
Fagonia mysorensis.
Morus parviflora.
Ficus indica.
Zizyphus vulgaris.
Zizyphus Napeca.
Zizyphus jambolana.
Cordia Myxa.
Anthericum indicum.
Dalbergia Sissoo.
Ficus religiosa.
Calotropis Hamiltonii.
Melia Bukain.
Peganum Harmala.
Sida graveolens.
Bauhinia variegata.
Pentatropis macrophylla.
Alhagi Maurorum.

Four miles after leaving Jemadar Ke Baoli, almost the only plant found in abundance in the cold weather is the Salicornia mentioned, until within a few miles of Kamoo, where we met

* The similarity of the botany of the north-western parts of India and Punjab with Egypt, has already been noticed by several authors, and will appear more apparent hereafter.

The principal tree of the Doab is the Keekur (Acacia arabica). The Jhand or crooked-spined Mimosa (Prosopis spicigera) is also common. This last is said by Royle, on authority of Burnes, not to extend beyond the Ravi; this, however, is a mistake. Associated with the Keekur and Jhand we have the following plants:—

Linum usitatissimum.	Ricinus communis.
Capparis aphylla.	Acacia arabica.
Butea frondosa.	Parkinsonia aculeata.
Cordia Myxa.	Calotropis Hamiltonii.
Fagonia mysorensis.	Ficus indica.
Phœnix sylvestris.*	„ religiosa.
Dalbergia Sissoo.	Heliotropium.
Zizyphus vulgaris.	Melia Bukain.
„ Napeca.	Acacia dumosa.
Morus parviflora.	

In the Baree and Jetch Doabs, viz., at Lahore and Amritsir in the former, and Jelalpore in the latter, and at Noorpore in the Kohistan, shawls are extensively manufactured, but all of an inferior description, owing to the whole of the best shawl-wool being monopolised by Rajah Goolab Singh. This ought not to be the case, seeing that the great breeding country of the shawl wool goat is in that tract of Chinese Tartary lying immediately to the north of the British passes in the Himalayahs, and the wool-traders, in order to obtain a market, are obliged to carry their wool several hundred miles to Cashmere. Were a little encouragement given to them, wools in large quantity and of the finest quality would be imported into the British provinces by the Mana, Neetee, Onuta, Dewra, and other passes. Several years ago the shawl-wool traders brought large quantities of wool to Sreenuggur through the Neetee pass, but finding no demand for it, they were obliged to sell it at a great loss. Since then the attempt to get a market has never been repeated.† But now that extensive shawl manufactories exist in British territory, it would be well worth while on the part of the authorities to re-open this trade, and supply the Punjab with fine wool. The shawl manufacturers of Lahore, Amritsir, Jelalpore, and Noorpore might, with a little encouragement, be induced to send their agents to Sreenuggur to purchase the wool, and on the traders being informed through means of the authori-

* At Mooltan a branched Palm occurs, which is probably identical with the species met with in Egypt.

† Annually small quantities of shawl-wool are brought for sale to the Baghesur fair.

ties, that there would be a good and ready market for their produce, they would willingly resort there in preference to making the circuitous journey to Cashmere. At least the trade is sufficiently important and extensive to be worthy of trial. To introduce the produce of the Trans-Himalayan States, nature has marked out that route *viâ* Neetee to Hurdwar, seeing that with capital, care, and trouble a carriage-road might be made, with an inclination of little more than 25 feet per mile, along the banks of the Aluknunda and Dowli rivers to Neetee, the frontier town in the British Himalayahs, and by it hackeries could travel almost to the limit of perpetual snow. Along the line of road proposed, the rocks, too, are generally of a soft nature, and easily worked; consisting principally of sandstone and clay, and mica slates. Towards Josimuth vast masses of large granular granites occur, which are again succeeded by slates which continue on to Neetee, and which, beyond Goulding, are succeeded by limestone abounding with belemnites. This fossiliferous limestone forms the great Neetee pass, in altitude 16,800 feet.

On leaving Goojrat and proceeding to the north-west, we pass over an undulating, and in many places low lying country, richly cultivated, and about four miles from the Jhelum, near Mookerian, first meet with hilly land, a spur of the Salt range, consisting of sandstones, clays, and red marls, with a considerable dip (15° to 20°) to the east-south-east. Through this small range the road runs for about six or seven miles over a bold raviney country, devoid of cultivation. We then descend gradually to the Jhelum, and, as we leave the sandstone ridge, get into fine wheat cultivation. This magnificent tract of cultivation extends for about forty miles along the Jhelum, and so rich is it as to allow the Zemindars to get three cuttings of green fodder prior to allowing it to come into ear. Across the river Jhelum, and opposite the town of that name, there is a swing bridge, consisting of three boats held together by strong hawsers. The river, in the cold weather, is about one hundred yards broad. Crossing the Jhelum we enter the Sind Sagur Doab, comparatively speaking a poor Doab when compared to the others, with, here and there, some fine cultivation. In this Doab the water is generally at a distance from the surface: in many places, as at Manikyala, at one hundred feet. The staple article of the Khureef crop is Bajra (Holcus spicatus) and Mucki, or Indian Corn (Zea mays), and of the Rubbee, Torea, Tirra, and Wheat. The former are cultivated for their oil, which is manufactured on an extensive scale, particularly in the upper and middle portion of this Doab. Running through this Doab we have the Salt range, which gives to it its distinguishing characters. The range has generally a north-east and south-westerly course, and sending out innumerable spurs of low elevation, and seldom rising above 2500 feet. Near to Jhelum there is one mountain in altitude about 4000 feet. In form the summits are generally round-backed, conical, or peaked, showing the soft nature of the rocks of which they consist. The middle of the Doab, particularly near Rawulpindee, is well cultivated, but the country raviney in the extreme, great cuts many feet in breadth, and twenty or thirty feet in depth, intersecting the country in all directions. This, too, is a characteristic mark of the Hazara country, and so much do ravines prevail, as to render it necessary to make a dètour of several miles, the road being winding in the extreme, in order to avoid them.

The country of the Salt range may, in general, be characterised as barren in the extreme, with, here and there, rich valleys. The hills are unfitted for cultivation of any kind, owing to their dry sterile character, and even Grasses grow with difficulty. Species of Salsola and Achyranthes prevail, and towards the middle and upper portion of the Doab, the Cowzeitun, or wild Olive (Olea?), a species of Dodonæa, and the Orthanthera viminea are characteristic of the hilly country. In the ravines and beds of small streams, the Oleander and Nerium odorum are common. In similar localities it occurs in the Swalik range, and Dr. Royle* mentions that it is found in water-courses in Syria, Egypt, and Barbary, and in the south of Spain. In the Himalayahs the same species occurs to an altitude of 6000 feet. The commonest shrubs of the open country are the Celastrus spinosus, Justicia adhatoda, and the Mimosa albispina, a mere variety of Acacia arabica, and so named on account of its white spines by Griffith. Associated with those plants we find the following:—

Asparagus.	Zizyphus vulgaris.
Barleria.	Acacia modesta.
Dalbergia Sissoo.	Phyllanthus.
Zizyphus Napeca. †	Buddleia Neemda.

* Royle's *Illustrations.*

† The leaves and fruit are extensively collected to feed cattle, and it is said that cows so fed give rich milk. By Sir H. Elliot it has been identified with the famous fruit of the Lotophagi (Howd. iv. p. 177), *Supp. Gloss.* by H. M. Elliot.

fertile and irrigated. Here the most important cultivation is Sugar cane, owing to the fine irrigation afforded by the Dore river, the sugar being manufactured for exportation to Cabul; an inferior kind of Cotton is cultivated in small quantity for home consumption. In upper Hazara the Cow or Zeitun-tree is very abundant, and of considerable dimensions; several trees measured being upwards of eight feet in diameter, three feet from the ground. Associated with it, we find a vegetation very similar to that of the Deyrah Dhoon. The soil, too, is filled with round stones or boulders. The country generally is cultivated, but little land lying waste, and the population appears to be dense. Here the Tea plant might be introduced with advantage. The following are some of the plants met with in Upper Hazara at Dumtour:—

Acacia Catechu.
Vitex acuminata.
Rubus floribundus.
Solanum verbascifolium.
Orthanthera viminea.
Alisma.
Salix babylonica.
Berberis asiatica.
Rottlera tinctoria.
Hedera Helix.
Asparagus.
Grewia oppositifolia.
Cissampelos hirsuta.
" tomentosa.
Phyllanthus.
Urtica salicifolia.
Nerium odorum.
Justicia paniculata.
Randia dumetorum.
Vallaris pergulana.
Olea? Cowzeitun.
Rosa Lyellii.
" floribunda.
Bombax heptaphyllum.
Dodonæa.
Ficus cordata.
Indigofera.
Ficus indica.
Justicia Adhatoda.
Barleria.
Melia Bukain.
Celastrus speciosus.
Acacia modesta.
" speciosa.
" Serissa.
Dalbergia Sissoo.
Zizyphus Napeca.
" vulgaris.
Morus alba.
" atro-purpurea.
" grandiflora.

In Hazara the Dore river is extensively used in irrigation, Cutcha canals crossing the upper portion of the valley in all directions; the soil is very rich, consisting in many places of a fine rich black loam. All the hills are more or less clad with the Cheer (Pinus longifolia), and on the higher ranges the Deodar (Cedrus Deodara) and Morinda (Abies Smithiana) abound. Though the general character of the Salt range is barrenness, yet in this Doab we meet with much fine cultivation, particularly near the rivers. Close to the Indus lies the Chuch valley, one of the finest cultivated plains to be met with in the country. To the fertilising properties of the residue of the waters of the river deposited after floods, in a great measure is the richness in many localities owing. Nowhere in India is manure more sparingly used than in the Punjab, and the reason is because the Zemindars are obliged to use all the manure procured from their cattle for the purposes of household economy. In every Doab, wood is scarce in the extreme, all that is required for architectural purposes being brought down the rivers from the Kohistan. For burning, the roots of the Dawk (Butea frondosa) are dug up, dried and sent to Lahore and Amritsir. In other quarters, at a distance from the jungles, or in the upper parts of most of the Doabs, that which ought to go to the support of the soil, the manure of cattle is dried and used; and we can assert, that throughout the length and breadth of this fine country, a few hundred good timber-trees are not to be met with. Formerly in Hazara fine forests of Sissoo existed, but these during the hard times of the former reign, were nearly all cut down by the ruthless hands of the conquerors, and the few left, swept away by the waters of the Indus during the great débouche in 1840.

To supply the demand for wood for burning purposes, which will ere long be immense, is a subject worthy of consideration on the part of government. In almost every Doab there are tracts lying waste which could with a little trouble and labour be formed into nurseries, from whence the Zemindars might be gradually induced to take trees to plant out. At every Thannah a small nursery of a few Beegus of land might be formed, and might be worked with prison labour, under the guidance of Mallees, and one would be sufficient to take charge of two or three nurseries, as it would not always be necessary for him to be present in one place. In addition to the value of rearing timber for burning purposes, the country would be greatly benefited, provided that planting was carried on on an extensive scale, by the additional moisture, which it is well known, trees attract. But to bring about this, planting would require to be carried out on a most comprehensive system. It is a well known fact that districts marked for their moisture have, when cleared of trees, become comparatively dry and arid; and others again, when planted, comparatively moist. By extensive planting in the Punjab two objects would therefore be gained; when the canals, now about to be dug, are commenced on, small nurseries ought to be formed every five or ten miles, from whence young trees could be procured to plant their banks. This being done, it would well repay the amount laid out in the increasing value of the wood, to appoint a person or persons to superintend the pruning and thinning of the trees. That this has not been done on the Doab canals, is much to be regretted, seeing that a great quantity of the wood there growing is now only useful as firewood, owing to the trees being allowed to grow so close to each other. A third of the trees now growing on the banks of that canal might be cut down with great advantage to the others; and the sooner that this is done the better. The canal forests have been valued at many lacs of rupees; and are, therefore, well worthy of more attention than they now receive. We do not state this to the discredit of the canal officers. On the contrary, their exertions in planting the banks of their canals with wood is highly to be commended. No one has done more than Colonel Cautley. But, to look after these works properly, mark out new lines of irrigation, &c., occupies fully their time and attention. For the forests on the canals therefore a regular forester, a man who is thoroughly acquainted with the method of pruning and thinning timber, ought to be appointed. That immediate return would, no doubt, not be exhibited, is evident, but the expense would be amply repaid by the increasing value of the timber.

The following list will show the timber-trees that are adapted for the climate of the Punjab, some at present growing there, and others that might be introduced with advantage. Some trees grow readily from seeds, others from cuttings, and others send out suckers in such vast numbers as to render cuttings unnecessary. Nor is the timber thus raised much inferior. I shall therefore briefly notice the manner in which each kind of timber-tree is raised, quality of the wood, &c.; as such remarks will be useful to the local officers desirous of introducing them into their districts.

Gen. Acacia.

A. speciosa. Serris.—Grows to a height of from forty to fifty feet; and very rapidly. Inner wood, dark reddish-brown, and very hard; outer wood, white and very soft, and liable to be attacked by insects. Owing to its rapidity of growth and immense foliage, this tree is well fitted to plant on the road-sides to give shade, and as a nursery-wood for burning.

Time of sowing seeds.—As soon after they are ripe as possible, though seeds kept for months will germinate. Before sowing, the beds ought to be well trenched and manured.

Syria, and has been imported into Saharunpoor, where it grows luxuriantly. Seeds. None of the plants have ripened their seeds at Saharunpoor.

Gen. Prosopis.

P. spicigera. Shoud.—Well adapted for dry tracts; grows to a very handsome shady tree. Seeds.

Gen. Cathartocarpus.

C. fistula. Ambuttas.—A handsome and showy tree, useful for its timber as firewood. Seeds.

Gen. Cassia, *Lin.*

C. sumatrana.—A fine timber-tree. Seeds.

C. arborea.—Grows to a height of 40 feet, and useful, owing to its rapid growth, as a timber for firewood. Seeds.

Gen. Pongamia.

P. glabra. Paphri.—This is a very valuable tree, owing to its umbrageous foliage and the hard close-grained nature of its wood, which is as compact as box. It does not grow to a very great height, the branches being thrown out laterally. Seeds. The seeds ought to be sown as soon after they are taken off the tree as possible.

Gen. Dalbergia.

D. Sissoo. Sissum.—This is one of the most useful trees in the North-west Provinces and Punjab, owing to its rapidity of growth and toughness of its inner wood. For spokes and naves of wheels it is generally used by the agricultural classes, but the outer, or external wood, is very liable to dry-rot: its inner wood is, generally, of a dark-brown colour. This timber-tree used to abound in the Deyrah Dhoon, but all the finer timbers have been exhausted. For building, and all architectural purposes, it is admirably adapted, and ought to be extensively cultivated on the waste lands. It is grown from seeds.

D. robusta.—This is also a valuable timber tree and of rapid growth. Seeds.

D. Ougeinensis. Geindun.—Grown from seeds.

Gen. Erythrina.

E. stricta. Doul Dawk.—A lofty timber-tree, useful as firewood. Seeds.

Gen. Butea.

B. frondosa. Dawk.—Useful as firewood. Seeds and cuttings.

Gen. Cordia.

C. Myxa. Lissora.—Seeds or cuttings.

Gen. Bombax.

B. heptaphyllum. Semull or Cotton Tree.—This tree grows to great dimensions. One at Teeree in Garwall being 30 feet in circumference including buttresses, 3 feet from the ground, and 80 feet high. Its wood is useful for burning, and where lightness is required; it being very light, soft and open in the grain. In growth it is rapid. Seeds.

Gen. Sterculia.

S. coccinea. Khundalla—S. villosa. Ghundana.—Both species are lofty trees, and easily raised from cuttings and seeds.

Gen. Tectona.

T. grandis. Sagoon.—The Teak is not only one of the hardest and best timber-trees known in the vegetable kingdom, but is also distinguished for its rapidity of growth. It was introduced by Mr. H. Vansittart into the Jullunder, where it is thriving well. In sowing the seeds a very shady place ought to be selected. If sown in the sun they will not germinate.

Gen. Gmelina.

G. arborea. Koowar.—A lofty and rapid-growing tree, and distinguished for its hard close-grained white wood. Seeds.

Gen. Bignonia.

B. suberosa.—A rapid-growing and lofty tree, easily reared from suckers or cuttings. It does not give seeds in the Saharunpore Garden. In the cold weather it flowers, presenting a very fine appearance. Its wood is soft and open-grained, and only fitted for burning, or where light wood is required.

Gen. Lagerstrœmia.

L. regina. Kaurie—L. parviflora. Adwaine.—Both trees grown from seeds, which require to be sown immediately after they are ripe and taken from the trees. The first is (the Amherstia and Asoca excepted) the finest flowering timber-tree in India, its great panicles of purple flowers presenting a fine appearance in the hot weather during the months of April and May.

Gen. Grewia.

G. oppositifolia. Bahul—G. elastica. Daunoo—G. lanceolata. Kareenkh—G. dulcis. Fulsa Lukree.—All grown from seeds, which require to be sown immediately after they ripen, and affording good wood.

Gen. Pterospermum.

P. acerifolium, P. lanceæfolium, P. semisagittatum.—All grown from seeds.

Gen. Kydia.

K. calycina. *Poola.* Seeds.

Gen. Bassia.

B. latifolia. *Mowah.*—Grown from seeds. From the flower a kind of arrack is distilled.

B. butyracea.—Worthy of introduction into the Kohistan for the oily principle which is yielded by its seeds.

Gen. Mimusops.

M. Elengi. *Mowlseree*—*M. Kauki.* *Kirnie.*—Both grown from seeds, which as soon as ripe require to be put into the ground. These trees are valued for their fruits by natives.

Gen. Terminalia.

T. Bellerica. *Baihara*—*T. chebula.* *Hurrh.*—Grown from seeds.

Gen. Pentaptera.

P. tomentosa—*Sym.*—Grown from cuttings.

Gen. Rottlera.

R. tinctoria. *Roonia.*—Grown from seeds as soon as ripe. From the seeds a red powder used in drying is procured, being brushed off them when ripe.

Gen. Phyllanthus.

P. Emblica. *Awola.*—From seeds. This is a highly ornamental tree, and grows to a great size.

Gen. Nageia.

N. Jeapota. *Jeapota.*—Seeds.

Gen. Ehretia.

E. aspera. *Chumroo.*—Grown from seeds. Wood very hard and compact, and used in making ploughs, &c.

Gen. Salvadora.

S. persica. *Shal or Peeloo.*—Seeds.

Gen. Artocarpus, *Lin.*

A. integrifolia. *Kutha or Jack*—*A. heterophylla.* *Burhul.*—Considerable sized trees, grown for their fruit. On the seeds ripening, it is necessary to place them immediately in the ground.

Gen. Nauclea.

N. cordifolia. *Huldoo*—*N. parviflora.* *Khyme.*—Both grown from cuttings; very lofty trees, and wood useful for burning. Grows rapidly.

Gen. Toona.

T. vulgaris. *Toon.*—Wood good and well adapted for household furniture; grown from seeds.

tectural purposes in upper India. It is grown from seeds, and if these are not put into the ground shortly after ripening, they will not vegetate. In sowing them it is necessary to be careful not to put them more than half-an-inch into the ground. On the Doab canal an attempt was made to grow them, but failed owing to the seeds being either too old or too much buried.

Gen. Morus. *Foot Tootri.*—All the species of Morus (Mulberries) easily strike by cuttings, and any quantity can be thus raised.

Gen. Ficus.

F. indica. Burr — F. religiosa. Pepul — F. venosa.— Pilkhum — F. elastica. — India-rubber Tree — F. glomerata. Goolur—F. lucida.—Most of the Fig tribe are easily grown from cuttings, and are highly useful in affording forage for camels, &c., and a good shade. For the first-mentioned purpose they are well worthy of being extensively introduced into the Punjab.

This list might be greatly enlarged, but I have only mentioned here such species as will certainly succeed in the Punjab. There are, in the upper and lower portions of the Doabs, we have no doubt, very different climates. But, generally speaking, unless on the very borders of the desert, the species here enumerated will succeed, provided that they are properly sown. Before sowing the seeds the land ought to be well trenched or ploughed, and then strongly manured, or at the rate of from three to four hundred maunds per acre. Frequently seeds do not germinate owing to the bad condition of the soil, and this in a new country like the Punjab (where so much waste arid land exists, and which will no doubt be selected as sites for forming plantations) requires to be particularly guarded against. Since writing the above, the admirable Minute of the Governor-general on the state of the timber cultivation in the Punjab has been published. In it almost every topic worthy of observation connected with the growth of timber in the newly acquired territory has been adverted to, and ably discussed; and the plan recommended for its extension is so excellent, as, if properly carried out by the district officers, must ultimately be attended with the greatest success. The Agri-Horticultural Society, too, has been established, and has already commenced operations in a vigorous manner. With its able president, active and energetic secretary, and a host of talented members, it cannot but be the means of conferring the most lasting benefits on the country of the Five waters. Nowhere could a society having as its object the improvement of the agricultural and horticultural resources of a country, have selected a finer field for operations than that of the Punjab, seeing that in it we have the greatest capabilities presented in rich soil, vast waste tracts, ample means of irrigation, and a pliant hard-working agricultural population. Of cultivation, finer examples could not be met with than in the upper parts of the Baree and Retcha Doabs, the country from Sealkote to Denanuggur *viâ* Zufferwal Noor-Ke-Kote, and Sehdial, being one field of the richest vegetation, proving the good characters of the natives as agriculturists, and the richness of the soil. But to examine this tract of country, a good rainy season must be selected, as on the elements the Zemindars entirely depend for water for their crops. We have traversed at all seasons of the year most of the finer portions of the North-western Provinces, but nowhere have we seen better and cleaner cultivation, and finer crops than in the tracts above-mentioned.

We have stated that, in proceeding to the north from Lahore, no rocks are met with *in situ* until we met the Salt range. Forming the northern boundary of the Jullunder, and other Doabs, we find a series of small ranges of hills, composed of sand, sandstone, conglomerate, and marls. These low ranges form the Kohistan of the Punjab, and may be considered as a mere continuation of the Sevalick range, met with between the Ganges and Jumna. Here, before reaching the range, we have to pass through a dense grass jungle thickly studded with trees. Not so in the Jullunder Doab; here no jungle exists; scarcely a tree, comparatively speaking, is to be seen even to the base of the hills. The hills themselves, rising to a height of from five to fifteen hundred feet above the level of the sea, are like the Sevalicks, bare and barren in the extreme, with, here and there, some dwarf Cheers (Pinus longifolia), Bastard Toon (Cedrela Ougeinensis), and other trees. Proceeding from Hooshiarpore to the north towards Kangra, we, after a march of about four miles, reach the first range of hills, and traverse it by a winding course through the bed of a small stream. This range is styled the Pamrai range, and is about six miles in breadth. In crossing it by a tedious winding course through the bed of a nullah, containing but little water, we find numerous sections, illustrating the nature of the formation of which the range consists. The range consists of beds of sand and sandstone, with boulders embedded and mixed up with red and green marls, showing that it has been formed from the decomposition of the older rocks on which it is found to rest. Here and there, masses of sandstone, much harder than the surrounding sand and conglomerate, stand out in bold relief, forming various grotesque appearances. On crossing the range, we enter the Juswunt valley, through which a small fordable stream runs; in this valley there is some good cultivation. In breadth it is about two to five miles, and forty miles in length. Following the road to Kangra, the encamping ground is at Amb, a native garden, now a jungle; in it there are some noble Cypress (Cupressus sempervirens), and Plane (Platanus orientalis) trees; shortly after Amb, and proceeding northward, we reach the Juswunt range, a range of hills seldom rising higher than 1200 feet; it forms the northern boundary of the Juswunt valley, and is much more covered with vegetation than the Pamrai range; Cheers, Sauls (Shorea robusta), and Toons, being abundant, and brushwood, consisting of a species of Dodonæa, Karounda (Carissa villosa), and Justicia adhatoda. The road through this range runs in the course of a stream, rendering it difficult to traverse during the rains. After proceeding some six miles by a winding road through small hills of sand and sandstone, with red and green marls, we ascend a ghaut; the road then crowns the hills, presenting a very barren and dry appearance, cultivation, from want of water, being rare and scanty in the extreme. Descending from the Chumba Ghaut, which may be considered as a portion of this range, we reach the Beyas river, which here is about eighty yards broad, and in depth from eight to twelve feet, with water of a fine clear green colour. The ferry is crossed by a large flat-bottomed boat. The sand-stone strata are well exposed on the banks of the river, dipping to the west and south, under an angle of 45°. The Ghaut is about eighty feet above the bed of the river, and covered with boulders, which are highly rounded and polished, showing that the river formerly flowed there. These boulders are found embedded in clay, which rests unconformably on the sandstones and marls. On crossing the river, we enter another valley, styled the Jowala Mookee valley, so named from the famed temple here situated. This valley is in many places covered with innumerable boulders of quartz rock, particularly near the banks of the river, but at an elevation of eighty and one hundred feet above the present level, showing how much its course had been altered. The Jowala Mookee valley is a fine open undulating plain, varying in breadth from eight to ten miles, and in length about fifty miles. To the north it has at its boundary the Jowala range of mountains,

Salt mine of Durang in Mundi	Sandstone and marl	58	61	2,200	8 A.M.	Saline.
Spring on the banks of the Beyas, 3 miles from Durang	Sandstone	60	50	2,000	,,	
Vingal Kenulla	Red marl	,,	47	2,200	10 A.M.	A small salt stream, whose waters run into the Beyas. This stream propels several mills for grinding corn. To the hand the water felt a little warm.
Spring on the banks of the Beyas, 3 miles from Mundi	Small granular granite	62	68	2,000	Noon.	
Spring on the banks of the Beyas, 1 mile further, or 2 miles from Mundi	Granite	,,	68½	.. ..	,,	A bowli.
Spring a mile from Peepul Kote	Limestone	72	64	.. ..	.. ..	
Spring near the village of Paeki	,,	88	85	.. ..	.. ..	At Hilung, 4 miles further on, the thermometer, when exposed to the sun, rose to 113 at 4 P.M.
Spring at Peepul Kote	Quartz rock	66	88	.. ..	.. ..	
Spring 4½ miles from Budrinath	Small granular granite	,,	42	9,000	8 A.M.	
Spring at Budrinath	Granite	37	125	9,900	6 ,,	
Spring 30 yards distance	,,	,,	79	.. ..	.. ..	
Spring 40 yards distance	,,	,,	50	.. ..	.. ..	
Stream running into the river close to Budrinath	,,	42	38	9,900	6 A.M.	
Spring 110 yards from the Temple of Budrinath	,,	,,	36	.. ..	,,	
Spring near the river		,,	42	.. ..	,,	
River close to the Temple	,,	,,	37	.. ..	,,	
1st spring ¼ of a mile beyond Tuppubund	Quartz	56	98	7,000	8 A.M.	
2nd spring	,,	,,	90	.. ..	,,	
3rd spring	,,	,,	126*	.. ..	,,	
Spring 300 yards further on, running into the river Dowlia	,,	,,	50	.. ..	,,	
Stream ¼ of a mile further beyond the former	,,	,,	66	.. ..	,,	
Spring ¼ of a mile further	,,	,,	71	.. ..	,,	
Spring at Mulare	Clay slate	54	52	.. ..	,,	Chalybeate.
Spring at Goting	,,	48	36	12,100	7 A.M.	River temp. 37; water very dirty, of a greyish-white colour. Spring clear as crystal.
Spring on the bed of a river near Goting	,,	,,	41	.. ..	,,	
Juma	Gneiss'	60	54	.. ..	,,	Near the tomb? (Jahangir according to Baron Hugel)
Husn Abdal	Compact limestone	,,	70	1,600	Noon.	This spring gushes out in several places from a limestone-rock, forming a small river, which supplies the town of Husn Abdal with water, and in which thousands of fish occur, which are daily fed by fakirs or holy men.
Husn Abdal	Limestone	,,	68	.. ..	,,	
Spring at Kote in Huzarah	Alluvium	41	47	.. ..	7 A.M.	
Wah, 2 miles from Husn Abdal, 1st spring	Compact limestone	,,	71	.. ..	,,	Limestone strata, highly inclined, and dip under an angle of 45 degrees. E.N. here several springs issue from the limestone-rock, all of an uniform temperature of 71.
,, ,, ,, 2nd spring	,, ,,	,,	,,	.. ..	,,	
,, ,, ,, 3rd spring	,, ,,	,,	,,	.. ..	,,	
Spring at Kulu-Ke-Kuttee	Sandstone	57	67	2,670	6 ,,	
Spring at Kohat	Fossiliferous limestone	34	84	.. ..	,,	

* Hot springs also occur at Jumnoutri and Gungantri, in Gurhwal, which are noted as places of pilgrimages. At Manikaun, in Kooloo, hot springs issue from quartz rock. Invariably where hot springs occur in the Himalayahs or Kohistan, there plutonian rocks are met with; and if neptunian rocks do occur, they are always much altered, showing their connection with plutonian agency. From Chinese Tartary pisiform limestone, in small specimens, is frequently brought to Almorah by the Bhotiahs, probably collected in the neighbourhood of gaseous springs which there exist. By the Bhotiahs, Mr. Batten informs me, the springs are said to occur in the bed of the Sutlej, in Thibet.

Turning the Jowala Mookee range at Ranee-ke-Tal, we proceed by an undulating, hilly, but good road to Kote Kangra, distant about fifteen miles. The town and far-famed fort of Kangra are situated on a small range of hills of conglomerate which rises to a height of some six hundred feet above the river Ban Gunga. The conglomerate dips under an angle of 15° to the east of north, and belongs to the medial-tertiary series.

The Kangra valley is about fifty miles long and ten miles broad, and divided into three parts: the western, or Valley of Rilloo; middle, Kangra; and the eastern, or Pahlum, separated from each other by spurs of mountains, with highly undulated, and richly cultivated plains dipping to the south and west, and with fine natural irrigation derived from innumerable streams which come from the Chumba range of mountains, which forms its northern boundary. This lovely valley, as, properly speaking, it forms but one valley, is admirably adapted for Tea cultivation, nearly throughout its length and breadth. At Holta there is a magnificent and gently inclined plane lying waste, and well adapted for Tea cultivation, and commanded by two considerable rivers, the Cura and the Nigul. At Nugrotah and Bobarnah, in the eastern part of the valley, two small Tea nurseries have been formed, and though the seedling plants were only planted two years ago, and not a particle of manure given to them, they are now between four and five feet in height, showing how admirably this valley is adapted to this purpose. Irrigation, too, to any extent is procurable.

Strewed over the valley, particularly the eastern portion which is highly terraced, vast boulders of granite occur, some of them upwards of a hundred feet in diameter, of a greyish white colour, and containing large crystals of white felspar, many of them six inches in length. This mineral appears, owing to the potash which it contains, to be easily decomposed, and possibly to the presence of this alkali the richness of the soil is in a great measure owing. The abundance of these boulders everywhere throughout this valley is highly characteristic. Numbers of streams are to be met with coming from the Chumba range, from which artificial irrigation-canals have been made by the inhabitants to irrigate their fields, and, though the fall is very great, the water rushing with the force of a mountain torrent, and though these canals have been running for more than one hundred and fifty years,* yet,

* See Barnes on the system of irrigation prevailing throughout the Kangra valley.

owing to their boulders which form the substratum, the levels have not been altered. Nowhere does the soil occur above a few feet deep, and on digging it is found to rest on the boulder formation.

The town of Kangra, situated in the middle and southern side of the valley, is elevated about 3000 feet, on the same altitude as Nugrotah, where the Tea nursery is formed; Bobarnah is 4000. Here the Tea-plant is thriving equally luxuriantly as at the former-mentioned place. Holta, which we have selected as a site for a Tea plantation, is a fine open and gently inclined (with a southern exposure) waste plain, of about four to five miles in length; and in altitude from 4000 to 5000 feet, and commanded by, as already stated, two considerable-sized rivers. The soil consists of a thin stratum of black mould, with a subsoil of a stiff but friable reddish clay, resting on boulders. Throughout this fine valley there are many tracts of waste land at altitudes varying from 3000 to 5000 feet, equally well adapted for Tea cultivation. In the adjoining province of Kooloo, a rugged and bold mountainous country, there are also many places well fitted for the Tea plant. But the Kangra valley, from the facilities of exportation and the advantages of water-communication to Bombay, is second to no place, the road to the plains being adapted for camels and bullocks, most of the grain there grown being thus exported. It has been asserted that Tea could not be cultivated on a sufficiently extensive scale in the North-western Provinces and the Kohistan of the Punjab to supply the home market, owing to the want of land. But this is a great mistake. Land there is in abundance in the British hill provinces, and much of it lying waste, and possibly the time is not far distant when this cultivation may be carried into the valley of Cashmeer and the lower valleys of Hazara, which will be found well adapted for the purpose. In Kumaon and Gurwahl vast quantities of waste land, admirably adapted to Tea cultivation, exist, and all that is wanted is capital to clear the jungles. Major Madden has stated, in his account of Kumaon, that the Zemindars give up their lands for the culture of Tea with difficulty, and that but little waste land exists. The latter assertion is erroneous, but the former, regarding the people of Bheemtal, is true. Not so with others in Gurwahl, and this I give not only on my own authority, but on that of a person* high in rank, who, on a late tour through Kumaon and Gurwahl, found the Zemindars most anxious and willing to undertake the cultivation of the Tea plant,

* Mr. Robinson, of the Revenue Board, N.W. Provinces.

the preceding report) without disturbing present possessions, and thus exciting more than the ordinary and normal native disgust at the novelty, the present generation may yet behold the now jealous occupants of rice and wheat fields, humble applicants for Tea seeds."*

Such, too, is the opinion of the District-officer, Captain Ramsay. This season Mr Batten informs me that in several districts, though the crops have been immense, yet the Zemindars find difficulty in paying their revenue, as the market is so glutted with the grain it will not pay the carriage.

If proofs were wanting, in order to show the advantages of Tea cultivation throughout the Kohistan and British hill provinces, stronger could not be brought forward than the facts here stated.

Here we have the agricultural population with grain lying on their hands as a perfect drug, and not worth carriage to the available markets, and at the same time complaining that owing to the abundant harvest prevailing throughout the country they cannot pay the revenue. Were the system prevailing in China (according to the statements of Mr. Fortune) introduced into the British Himalayahs, viz. a certain quantity of Tea cultivation in each village community, we could no longer hear the above complaints, as for tea-leaves there could always be a ready and remunerative market; moreover, the high rate at which they could be purchased at the manufactories, viz. 8 rupees per maund, could admit of their transport by the Zemindars from a great distance, even 60 or 70 miles, with profit. But one of the greatest obstacles to the cultivation of the Tea-plant by Zemindars is the dread that land so occupied will be charged at a higher rate than other produce, or resumed by government. To remove these prejudices steps are now being taken by the commissioner. Let these once be removed, and the agricultural population† convinced of the utility of Tea cultivation, and we shall no longer hear that there are no available lands.

Crops cultivated in the Kangra valley.—In the Kangra valley and in the Kohistan of the Punjab, we find the following crops.

The *Khurreef crop*, which is sown from February to April, and reaped in October to December.

Sanwuck or samuk (Panicum frumentaceum).

* Batten's Report, page 271.

† This season many Zemindars have applied for plants and seeds. For extension there will be upwards of three tons of seeds available.

Cheena or Cheenee, Millet seeds (Panicum miliaceum).
Kangeree or Korree (Panicum italicum) (Sorghum vulgare).
Dhan (Oryza sativa), several varieties; the two marked divisions are those sown in the upper lands, and not watered; and those which are sown in low hot valleys require much irrigation to bring them on. Most of the rice grown is exported to the plains—a third of the valley is devoted to this cultivation.
Mandooa, or Mundul (Eleusine coracana), three varieties cultivated.
Mukkee, or Chillee; Indian corn or Bhootah (zea, maize). The American variety introduced by me into the hills, is rapidly supplanting the kind of maize formerly cultivated. This maize gives a six-fold return, but is long in ripening.
Eek or Gunnah Komandi (Saccharum officinarum)—a small cane, but abounding in saccharine matter, is cultivated in the Kangra valley.
Chooa (Amaranthus anardaria; Amaranthus speciosus), two varieties, red and yellow, cultivated in Kooloo, &c.
Ogul or Buck wheat (Fagopyrum vulgare).
Baugma (Solanum melongena; Solanum tuberosum).
Ghweea Gundiale (Colocasia himalensis).
Koorsanee Pipulli (Capsicum frutescens).
Huldi nuswar (Curcuma longa).
Kuddoo (Cucurbita maxima).
Torai, Tori (Luffa acutangula).
Kukeera Kukri (Cucumis sativus).
Gheea Torie (Luffa pentandra).
Bhut (Soja hispida).
Koolut (Dolichos uniflorus)
Oord maha (Phaseolus radiatus).
Ghooroush (Phaseolus torosus).
Moong Dani (Phaseolus mungo).
Udruk (Zingiber officinale).

Rubbee crop.—Sown in October, November, and reaped in April and May.

Wheat (red and white), many varieties, divided into the awned and awnless.
Gehoo— Lal Gehoo or Kunnuck—(Triticum vulgare).
Jou or Barley (Hordeum hexastichon), several varieties.
Welaiti Jou or Joui or Oats (Avena sativa).

Ona Jowar, or Celestial Barley (Hordeum cœleste)—grown at great altitudes along with Phapur emarginatum—

Chunna—Chola—(Cicer arietinum).

Posk (Papaver somniferum), blue and white varieties, abundantly grown in Kooloo, a third of the land being cultivated with it. It is cultivated, and opium prepared for exportation to China, across the passes; and in return, Churrus from Yarkand is imported into India.

Mussoor (Ervum lens).

Grey Pea (Pisum arvense).

Rape (Sinapis erysimoides).

Burlai Rape (Sinapis ramosa).

Torea (Sinapis dichotoma?).

Sursoo (Sinapis rugosa).

Burga sursoo (Sinapis glauca?)

Agricultural Implements.—The agricultural implements used throughout the Punjab are similar to those met with generally in the North-west Provinces. In the Jullunder Doab, to crush the sugar-cane, a mill with wooden rollers, and propelled by a pair of bullocks, is used. The plough in use is very light, and seldom penetrates more than three or four inches into the ground. In Hazara it is even of a smaller and lighter description than that used in the Punjab.

Breed of Cattle.—In all the Doabs the cattle are very small, and generally of a black, brown, and red colour; miserably fed, and thus wretched, scraggy-looking animals, no attention whatever being paid to the breed. Not so, however, with their horses; Seikhs following the example of their late chief, Runjeet Sing, are fond of good horses, and they are (or were) extensively bred in the Sind Sagur Doab, in the district of Dani and Gheb in the Salt range. The horses there raised are, generally, very powerful and enduring, though far from handsome, and during the late campaigns proved their mettle. A few English or Arab stallions might be introduced, to cover the district mares, with advantage. Mules, too, are also extensively bred in the Sind Sagur Doab, and are frequently met with 14 hands high. For these high prices are asked, ranging from 250 to 450 rupees.

Before entering on the geological structure of the Punjab, &c., we shall make a few observations on the coniferous trees met with in the Kohistan and British Himalayahs.

Genus Cedrus.—The cedars are characterised by their nume-

the dimensions of some of those measured, four feet from the ground :—

1st Tree, 24 feet.	6th Tree, 20 feet.
2nd Tree, 23½ feet.	7th Tree, 22 feet.
3rd Tree, 20 feet.	8th Tree, 20 feet.
4th Tree, 24 feet.	9th Tree, 24½ feet.
5th Tree, 19 feet.	

Growing along with these were some Khursoo Oaks (Quercus semecarpifolia).

On the banks of the Jhelum we measured a timber which was 18 feet in circumference and 60 feet in length.

Near Mulari in Gurwahl, at an elevation of about 11,000 feet above the level of the sea, we measured two trees; one girded 26 feet three feet from the ground, the other 27 feet.

Localities.—We have already noticed some of the localities, but it would be needless to give a longer list. As a general remark, we may state that the Deodar is seldom found growing in a natural state below 6000 feet of altitude. The finest trees are generally found growing on the north sides of barren mountains in thin poor soils, formed from the decomposition of granite, gneiss, mica, or clay slates. Here, too, the character of the wood is different from those grown in southern aspects and in richer soil, it being more compact, harder, and of a deeper red colour. This is well known to the natives, and can easily be accounted for, viz , its slowness of growth. But if this distinction is characteristic in this species, it is much more so in others, which we shall afterwards notice, particularly the Cheer.

Genus PINUS.

2. *Pinus longifolia.*—If the Deodar is the characteristic coniferous tree of the middle regions of the Himalayahs, the Cheer marks the lower belts, occurring in all intermediate altitudes, from 1700 to 6000 feet above the sea level. It is the first tree that strongly reminds the traveller in ascending the Himalayahs that he has attained a different climate from that of the scorching plains of Hindostan, and that greets his eye with an European form. Ascending a little higher he meets with Oaks and Rhododendrons, showing that though European Pines are most prevalent, yet others tell that he is still within the tropics, or, rather, nearly so.

The Pinus longifolia is, from its diversity of climate and aspect, known under different names. In Hazara, and on the upper banks of the Jhelum, it is styled Anunder, and throughout Kangra and the eastern hills it is named Cheel or Cheer. Dr. Royle also mentions Gullar, Thansa, and Gurul, and states, on the authority of Colonel Cautley, that there is more than one species known under these names.

There are two varieties, one which has its woody fibres twisted, and therefore by the natives said to be Kutcha, the other in which the fibres are straight. The *Kutcha* trees have the wood of a white colour, and open in the grain; the *Pucka*, reddish white, and compact; but this character is not permanent, as sometimes the wood, though white, is Pucka, and straight-fibred. Invariably the reddish white wood is preferred by the natives, and on felling a tree, and on finding this, the remark is, "it is *Khoob Pucka.*" To make lathing this variety alone is adapted, and it is sold under the name of *Dadur*. In felling the Cheer wood for architectural purposes, it is of consequence to ascertain that the variety is the straight-fibred, as the other is so apt to warp and split.

In all places where the Cheer is found growing at an elevation of 5000 feet and upwards, with a northern aspect, and on poor soil, there the variety is invariably the straight-fibred, and the wood is good; again, in southern localities and lower down, it is twisted in the fibre, and of but little use in architecture. At Hawalbaugh, near Almorah, 4500 feet above the level of the sea, a forest of Cheer Pine occurs with a westerly exposure, hundreds of the trees being upwards of eighty and ninety feet in length, and eight and twelve feet in girth; but here all the timbers have twisted fibres, and are, therefore, useless. Distant from this about three miles to the northward, there are two forests, at about the same elevation, with northern exposure, and growing on poor soils, the *débris* of clay-slate, with all their timbers straight-fibred, and the wood excellent, and from these districts the wood used at the military station of Almorah is supplied.

This opinion regarding the value of sites where Pine trees are grown is not, we are aware, in accordance with those of many: but we here give facts, as exhibited in the Himalayahs. Matthew, in his treatise on naval timber, states that the Pinus sylvestris, if grown on good or rich soil, attains rapidly large dimensions and its best timber properties

Uses.—Like the Deodar the Cheer is extensively used for building boats on all the rivers in the Punjab, but particularly at Bhyrowal on the Beyas. Boats built of this wood do not last more than six or seven years. On the other rivers where Deodar is procurable this kind of wood is extensively used to line the inside of boats.

Cheer wood is extensively cut in the Kangra country on the jagheer of Sirdar Lena Sing Majeeta into timbers 20 feet long, $1\frac{1}{2}$ broad, and 6 to 8 inches thick, and exported, during the rains, by the small river Dipte to the Beyas, from whence they are floated to Bhyrowal.

As already stated, this timber is liable, if exposed to the weather, to rot; but on the other hand, if protected, it is well adapted to building purposes, and is extensively used, particularly in the western hills. I mention this circumstance, as this kind of wood is available in large quantity from the Kohistan of the Punjab, for the stations in the Punjab, Loodiana, Ferozepore, Scinde, &c.

For ship-building and for spars this wood is almost useless, as it resists so badly the corroding effects of the weather, and is so soft.

3. *Pinus Excelsa.*—This species, the Kuel or Koel * of the natives, is of more limited occurrence than the former, and it is only met with at much greater altitudes, viz. from 7000 feet to 13,000 feet. It is characterised by its lengthened tapering, drooping and persistent cones, long, thin and pointed leaves, which occur in bundles of two or three together in the same sheath. In appearance the foliage of this tree is much more open and drooping than that of the Cheer, and in colour of a more lively green, which at once distinguishes it. Towards the latter end of November, the cones shed their seeds, but remain for many months afterwards hanging to the branches.

Uses.—As the wood is very soft, it is seldom used for building purposes, when the other kinds are available. It, too, being seldom found in places where it can be used for practical purposes, it is unnecesary to notice it at length here. We may, however, state in reference to its geographical distribution, that it occurs throughout the Himalayahs at heights varying from 7000 to 13,000 feet. At Neetee in Gurwahl, it occurs at the limit of arboreal vegetation; viz. about 13,500 feet, and there it is dwarfish owing to the great altitude. In no locality to our knowledge in the Kohistan † of the Punjab is it met with, though at Khoti in Kooloo it is associated with Khursoo (Quercus semecarpifolia) and Mokoo Oaks (Quercus dilatata).

4. *Pinus Gerardiana.*—In noticing this other species of the Genus Pinus we may be equally brief, as it is but sparingly met with in the British Himalayahs. It is characterised by its

* It is probably the Beir or Banjeir of Hazara.

† The characters assigned to the Beir or Banjeir of Murrie, by Dr. Fleming, apply to this species. See Report of Agri-Horticultural Society.

Chenab, under the name of Rai, and used in building boats; but its wood is not prized, as it is so liable to decomposition by the action of the weather. Its wood, too, is soft and open-grained, and said by the native boat-builders, when converted into boats, not to last more than four or five years.

In Nepal another species is met with, distinguished from all other Himalayan species by its very small cones, which are not more than an inch in length: Abies brunoniana or dumosa.

Genus PICEA.

6. *P. Webbiana.*—This species is known under various names throughout the Kohistan of the Punjab and Himalayahs. In Kooloo and the Chumba range it is styled Tos,* in Gurwahl &c., Chilrow. It is characterised by its large bluish-black cone varying in size from 4 to 8 inches—of a conical form flattened at the upper end. Its leaves are of a dark-green colour above and silver-white beneath. It is distinguished from the next species by its much larger and thicker cones and larger leaves, which are, also, proportionally narrower.

The Chilrow is a noble tree, growing to a height of 80 and 100 feet, its dark sombre leaves contrasting well with the surrounding vegetation. From all the other Pines it can at once be distinguished by its much stiffer and upright conical form. In the Kohistan of the Punjab, as on the Chumba range, and on the Peer Panjal it is found in great abundance, at elevations of from 7000 to 10,000 feet above the level of the sea; and, as mentioned, is there known under the name of Tos. It is floated down both the Jhelum and Chenab, and used in boat-building, &c., but is not a wood of any value, as it is so easily decomposed by the weather: boats built of it do not last more than four or five years. In the Simla jurisdiction this tree is found forming extensive forests at Hattoo, Narkunda, &c.; also with the Row, and of great dimensions; hundreds of trees of 80 and 100 feet in height, and as straight as an arrow, there existing. By its dark-green colour, erect and stiff growth, and horizontal branches it can at once be distinguished from the Row (Abies Smithiana), and from the Deodar by its conical head and darker colour. In addition to the forests of the Kohistan and Simla district, it grows abundantly in Gurwahl and Kumaon, and four miles to the east of Mussoorie. On the great mountain of Dodicatowli, near Lobah, it occurs in great perfection When this species occurs associated with the

* In Hazara it is named Pelunda.

Deodar, it generally occupies a more elevated position. Thus, on the Jelowri Pass, in Kooloo, ascending from the Mundi side, we find Deodars and Morindas (Abies Smithiana) associated with the Mokroo Oak (Quercus dilatata), and Horse Chesnuts (Pavia indica). As we continue to ascend we find the Chilrow, some of them 19 feet in girth, at three feet from the ground, and associated with magnificent Khursoo Oaks (Quercus semecarpifolia). Still ascending, we leave the Chilrow, and find the Oaks associated with the Rhododendron campanulatum, which, when we crossed the pass in April, was in full blossom, and presenting a most striking and beautiful appearance, with its purple, pink, and white blossoms, (as it presented all these colours, in some plants only one colour, in others two blended, and in others all the shades mixing and blending with each other in great luxuriance.) The foreground was covered with Primulæ, Ranunculi, Anemone, Verbena Wallichiana, and Potentillæ. Associated with the Rhododendron were the dwarfish Khursoo Oaks, a small Berberis, and the Cratægus rupestris. The pass itself consists of clay-slate, and from its summit presents one of the most magnificent scenes anywhere to be met with in the wild, rugged, and bold country of Kooloo. On this lofty pass the Rajah formerly possessed a series of forts, which were destroyed by the Seikhs, and amongst the ruins of one of these we found tailless rats (Arctomys Roylei) running about. As we descend the pass, on the Sutlej side, we first pass through Khursoo Oaks, then Pindrow, and Morinda, or Row, to the village of Khote which is surrounded with Deodars. A little below the Deodar we meet with forests of Kuel (Pinus excelsa) and Mokroo Oaks, and still lower, forests of the Pinus longifolia, or Cheer, which we have before reaching Shumshale.

7. *P. Pindrow* Royle.—By Dr. Royle the P. Pindrow is considered a distinct species from the P. Webbiana; and is characterised by its much smaller and thinner cones, which, too, are of a deeper purple colour, and seldom exceed three and a half or four inches in length, and its shorter, broader, stiffer, and furcate leaves. But other characters there are none, and possibly it may be a mere variety. If, however, the cone is uniform in size and colour, it would form a very characteristic mark. I have in my possession a drawing taken from Dr. Royle's original specimen brought by him from Tyne Teba and deposited in the Mussoorie Garden. It is now 20 feet high, and the cones never exceed 4 inches in length. In P. Webbiana they are seldom met with under 7 inches. The furcation of the leaf, noticed as a

distinguishing character, is not characteristic, seeing that it is common to both. In its distribution the Pindrow is much more restricted, and is in general found on more elevated positions, as on the Chor and Tyne Teba, &c.

Uses.—Its wood is adapted for building purposes, but is of no particular value.

Gen. CUPRESSUS.—The most important species belonging to this genus met with in the Himalayahs, is the Cupressus torulosa, or Surroo and Surin of the natives. In the Kohistan of the Punjab it does not, as far as we are aware, occur, but is common in Kumaon and Gurwahl. Near Simla in the neighbourhood of temples, it is met with and is styled DEODAR. The Deodar, therefore, known to the natives of Simla is the Cupressus torulosa and not the Cedar, it being styled by them, as already noticed, Keleo. At Nynee Tal, trees of Surroo, of vast dimensions, occur, the largest girting upwards of 24 feet, and rising to the height of 80 feet. In Gurwahl, too, it is abundant, as near Kunnoor, and at Surin or Surroo Tota, the place taking its name from the tree. There it occurs in the very bed of the river Dowli, the largest and longest branch of the Ganges, which takes its rise from a snow bed at the summit of the Neetee Pass, and there it is so small that we stepped across it in June.

Uses.—As a building material the Surroo is admirably adapted, its wood being very hard, close-grained, tough, long-fibred, and of a dark-red colour. The gates of Constantinople made by Constantine, and said to have lasted 1100 years, were manufactured of wood belonging to a species of Cypress (C. sempervirens, *Lindley.*) The Himalayan Cypress seems to possess qualities almost equally good, and probably may even be equally durable; but nowhere in the Himalayahs are the forests of this wood in accessible places for removal to the plains.

Associated with the Cypress, between Malari and Bumpa, a species of Juniper, being a lofty fine tree, occurs, the Juniperus excelsa, and on the very verge of the snow, six miles beyond Neetee, a creeping species (Juniperus prostrata?) is found, probably the so-called European Juniper of Moorcroft. By some authors it is mentioned, and Webb quoted as an authority as occurring in the Neetee Pass. This is a mistake, as nowhere is it met with beyond Gildoung, the last halting-place on the British side of the Himalayahs, and some miles distant from Neetee Pass. Like the Surroo, the Juniper has only been, as yet, met with in inaccessible places.

XXIV.—Reminiscences of the Effects of the Winter of 1852-3 on Vegetation generally, and on certain Plants in particular. By Messrs. Standish & Noble, Bagshot.

(Communicated September 10th, 1853.)

The effects of the past winter, as exhibited on the same kind of plants, in different situations, but, apparently, subject to like conditions, were highly anomalous. Many species usually considered capable of enduring an ordinary winter suffered much; while, on the other hand, numerous plants that previous experience had indicated as doubtfully hardy, or decidedly tender, braved the varying severities of the season unharmed. The numerous reports recorded in the several horticultural periodicals, and more especially those in the *Gardeners' Chronicle*, abundantly confirm these assertions. And, at the same time, they offer many points worthy the serious consideration of all who are interested in the cultivation of out-door plants. Many facts are there recorded, which, in conjunction with our own opinions and observations, strongly confirm our previous convictions, that much caution is necessary before rejecting a plant as not hardy, even though evidence to that effect should be adduced from several localities. So apparently trifling is the difference between the circumstances that would, on the one hand, enable a given plant to withstand the effects of a severe winter, or, on the other, doom it to certain destruction; and so little are they, by the majority of planters, understood, or if understood, not appreciated, that we deem no apology necessary for alluding to them here.

Of the more important conditions that predispose plants, especially young ones,* to suffer from the contingencies which unavoidably accompany exposure to the open air, may be named the following,—a wet and cold situation, or one under the influence of a strong current of air, to which the plant is continually

* We say *young* plants, because the same contingencies that would destroy, or at least materially injure, a plant in that state, would influence an older plant but little, or not at all. The branches of a plant cannot be said to be perfectly matured till they are three or four years old; or, in other words, a branch three years old is much less susceptible of injury than one produced in the past season, or even the previous one. But, notwithstanding this, many plants are often condemned as not hardy, because, on being subject to a severe winter in a very young state, they have been lost. A winter that would merely kill the last shoots of an old plant, would in many instances wholly destroy a young one of the same species.

subjected during severe weather—planting under circumstances that induce growth at a season when the wood should be matured —planting late in the autumn, or in winter; using plants that have previously been under artificial treatment, and which have not been properly hardened off, and employing others altogether too young; besides many other contingencies, to each and all of which may be attributed the loss of many plants that are, nevertheless, perfectly hardy. Of the injury that plants receive under the influence of a strong draught, during severe weather, a notable instance occurred here. A number of plants of Cupressus Goveniana and C. thurifera elegans were placed together under a high hedge. Many of them, near one end of it, were for some time exposed to a strong current of frosty air, and so much were they injured, that they have since died, while those not so exposed, but otherwise under precisely similar circumstances, were not injured in the least. And the same kinds of plants in the open nursery, without any protection whatever, are also unaffected. And in looking at the effects produced on vegetation generally, during the past winter, it will, we think, be pretty evident, that to the continuance of parching winds, which visited us early in the year, much damage is to be attributed. The previous very mild weather not only did not check vegetation, but on the contrary excited it. So much, indeed, was this the case, that many plants were in an active growing state at midwinter. This was especially the case with many kinds of Juniper and analogous plants. From this cause Taxodium sempervirens, one of the hardiest of plants, has suffered more than anything else in our nursery. The past season's growth is in almost every case wholly destroyed, and in some instances, we fear, the plants are past recovery. To exemplify the fact that it was not London plants that alone suffered, the common Laurel has in many places sustained very great damage, the young shoots and leaves have been killed, and the older foliage scorched and blown off. And the same circumstances are observable in numerous other equally hardy plants, that were caught under similar circumstances, viz., in an active condition. Of course, considerable damage would have been sustained by plants in the condition above-named, under the influence of severe frost, and without the accompaniment of scorching winds, but it would have been in a much less degree. The evaporation from the leaves of plants, as well as from the young shoots, is very great when acted upon by a brisk drying wind, and when, as must be the case in winter, absorption by the roots, to compensate the loss, is comparatively feeble, the effects upon the health of the plant must be in the highest degree injurious. This was the case in the past season. Vegetation was active, very active, for winter; a sudden fall in the temperature arrested the circulation of the sap; scorching winds succeeded; and the tissues, at least all the succulent part, became dried up, and of course killed. To this may, with justice, be attributed the death of the leading shoots and points of the branches of many hardy plants, as well as the total death of some, and the injury sustained by vegetation in general.

We subjoin a list of plants, most of which are new, with notes illustrative of the manner in which they have passed the winter. We must, however, premise that any doubt that may arise as to their hardiness must be given in favour of the plants; first, because they have not occupied their present situation long enough to be established, having only been planted out late in the previous summer; secondly, most of them are very young; and thirdly, the situation is decidedly unfavourable. They are placed at regular distances, like a bed of cabbages, without any reference to advantage of situation, and we made our notes on all, at the same time. —May 10th. Abies Jezoensis, two small plants a few yards from each other, one about fifteen inches high, the other nine, are thus affected; the smaller one has lost about an inch of its top; the other has a few leaves slightly browned, and is now pushing a strong leading shoot and otherwise breaking well. Some older plants are not affected in the least. Though we hear that several persons have lost their young plants, it may be relied on as perfectly hardy. Azalea amœna is coming into bloom, it has not lost a leaf from the effects of frost, and looks in luxuriant health. A. vittata and its varieties are also quite hardy, and showing colour. Cephalotaxus Fortuni, both male and female, have retained their rich appearance. These plants are very hardy. Symplocos japonica, which in its young state seems a half evergreen, is breaking well from every branch. Quercus sclerophylla lost some of its leaves from the effect of a very high wind, but is quite hardy, as is also Q. inversa. Larix, a new species with very long leaves, is also untouched, and Ilex macrocarpa, furcata, and cornuta are all that could be desired as hardy evergreens. A new Walnut from Taintung is also quite hardy Juniperus sphærica is untouched by wind and frost, and Viburnum plicatum is in full leaf and loaded with heads of flowers. The two species of Buxus, viz., round and long-leaved, are also looking well, as is

NEW PLANTS, ETC., FROM THE SOCIETY'S GARDEN.

8. ALONSOA ACUTIFOLIA. *R. & P.—Bentham in D. C. Prodr.*, X. 250.

To this seems referable a half-shrubby Greenhouse plant, of which seeds from Bolivia were presented to the Society by J. B. Pentland, Esq. It is very like the old and well-known A. incisæfolia, from which it differs in having the anthers about equal in length to the filaments. The flowers are bright scarlet, and render it a species worth growing. Its stems are from 1½ to 2 feet high; the leaves pale-green, narrowly lanceolate, simply and sharply serrated. The flowers are in long, loose, terminal racemes.

9. ONCIDIUM HARTWEGI. *Lindl. in Pl. Hartw.* p. 151.

A plant presented to the Society by Mr. Skinner, under the name of O. micranthum, has proved to belong to this species, found by the collector whose name it bears on rocks near Loxa, in the month of July.

It is a straggling plant, with the habit of O. altissimum. The pseudobulbs are deeply and ruggedly grooved; the leaves are about 1½ inch long, broadly lanceolate, and very much shorter than the long, narrow, racemose panicle. The flowers are small, brownish, with some yellow spots, especially at the angles of the lip. The crest of the lip bristles with fine stiff white hairs, by which circumstance, among others, it is known from Oncidium deltoideum.

10. PHACELIA RAMOSISSIMA. *Bentham in Linn. Trans.* XVII. p. 280.

The Californian seeds purchased of Mr. Carter produced this annual, a rough hardy plant, covered with coarse hairs, and producing unattractive spikes of dirty white and violet rather ugly flowers. The statement in De Candolle's *Prodromus* that the ovary is smooth is a mistake. It is quite as hispid in this as in other species.

11. LEPTOSIPHON CILIATUM. *Bentham in Pl. Hartweg.* p. 325.

A rather pretty annual, with quite the habit of other Leptosiphons, but with very long, transparent, jointed hairs covering the deeply divided leaves. The owers are smaller than in L. densiflorum, with a slender brown hairy tube, a yellow throat, and a deep rose-coloured border. Not very pretty. The seeds were bought of Mr. Carter.

12. BAHIA LATIFOLIA.*

An annual, with erect branching woolly stems, the colour and size of Antennaria margaritacea. The lower leaves are opposite, somewhat pinnatifid or three-parted, and coarsely serrate above the middle, dull green, covered with cobweb-like down, the upper alternate, slightly pinnatifid, coarsely serrate, and entire, those next the flower-heads almost amplexicaul; all are strongly marked with deeply-impressed rib-like veins. The flower-heads are solitary at the end of long woolly erect stalks; their involucre is covered with cottony wool, except at the ends of the scales, where it sometimes disappears. The florets of the ray are about 12 or 14, broad, deep yellow, and handsome. The young achænia are silky, and surmounted by a pappus consisting of 8 membranous scales, four of which are alternately much smaller. Seeds of it were purchased from Mr. Carter, who obtained them from California.

Although related to B. lanata, this plant is assuredly different in its much greater stature and very broad leaves, with their deeply sunken veins, and divaricating segments.

13. SPECULARIA PERFOLIATA. *Alph. De Cand. Mon. Camp.* p. 551. —Campanula perfoliata *Linnæus.*

This annual has been raised in the Garden from seeds pur-

* B. *latifolia;* annua, erecta, ramosa, araneosa, pedunculis elongatis lanatis monocephalis, radiis 10-12, achæniis sericeis, pappi squamis 8 erosis alternè duplò minoribus, foliis subcostatis infimis oppositis lanceolatis supra medium pinnatifidis v. tripartitis laciniis divaricatis sensim acutis; superioribus alternis oblongis sensim in oblonga semi-amplexicaulia mutatis.—J. L.

chased of Mr. Carter, as a species from California, which country, in common with a large part of the American Continent, it inhabits. It is a weak glabrous plant, with long trailing stems, and cordate amplexicaul sharp-pointed crenato-dentate leaves. The flowers are axillary, sessile, deep violet, but small, fugitive, and unattractive. It has no importance in Horticulture.

14. SCHIZANTHUS VIOLACEUS *of the French Gardens.*

A handsome hardy annual, seeds of which were received in 1853, from Messrs. Vilmorin. It is a stout branching pale-green downy plant, from 2 to 3 feet high, with leaves like those of S. pinnatus, and a great abundance of violet-coloured flowers. They are deeply divided into irregular lobes, as is usual in the genus, and are only different from those of S. pinnatus in the upper lip being oblong-lanceolate and bifid, not oblong and entire, and in wholly wanting the yellow stain which is so characteristic of both S. pinnatus and Hookeri. Although apparently not distinct from S. pinnatus, it is quite sufficiently different to form a good addition to our hardy annuals.

15. MONARDELLA CANDICANS. *Bentham in Plant. Hartweg.* p. 330.

Seeds of two varieties of this were purchased of Mr. Carter in 1853. The one is rather hoary, with pale stems and white flowers; the other is much greener with purple flowers. Both are erect branching annuals, rather more than a foot high, with a very powerful and not disagreeable smell resembling that of peppermint. Their leaves are oblong, obtuse, with long slender stalks and no teeth; the under side is closely covered with glandular pits. The flowers grow in heads surrounded by ovate ribbed involucral leaves, the veins of which are bright deep green, while the interspaces are much paler. *The slender lobes of the little labiate corollas are very remarkable for a tendency to bear anthers at their points,* in which it is not uncommon even to find pollen. The calyxes have very short triangular teeth, in which respect the species is distinct from M. Douglasii. The two varieties are of little moment, except for their powerful odour. It appears from Hartweg's collection that the white form is that on which Mr. Bentham founded the species.

of equal size, and a less straggling habit. The leaves are narrowly lanceolate, tapering to the point, slightly serrated. The flowers usually appear in threes at the end of a rather slender short axillary peduncle. Their calyx is very unequal. The corolla has quite the form of G. anisophylla, is very pretty, pale violet, with dark violet herring-bone veins on the tube at the back of the lobes. The stamens are enclosed within the tube, stiff, erect, hairy on the outer side; the two larger anthers have hemispherical fleshy connectives, on which is planted a pair of deep lobes, one above the other, each opening towards the side of the corolla by a pair of valves; the smaller stamens are almost rudimentary, stand at the foot of the others and are firmly united to them, so that this plant is at once didynamous and diadelphous. The ovary is oval, tipped with glandular hairs, and seated in a fleshy toothed disk; each cell contains two superposed ascending ovules. The stigma forms one side of the end of an acuminate style, and is therefore perfectly simple.

17. Podolepis chrysantha. *Endlicher in Botan. Zeitung,* I. 458.

A half-hardy Australasian annual, very like Podolepis rugata, but with brighter yellow flowers, smaller and more panicled flower-heads, and a stem nearly free from the cobweb coating so conspicuous in that species. Its seeds were bought from Mr. Carter of Holborn. It is said to be wild on the South West Coast of New Holland.

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TO THE

SEVENTH AND EIGHTH VOLUMES OF THE JOURNAL OF THE HORTICULTURAL SOCIETY.

P.

LONDON:
BRADBURY AND EVANS, PRINTERS, WHITEFRIARS.

PROCEEDINGS AT MEETINGS OF THE SOCIETY.

October 19*th*, 1852. (Regent Street.)

I.—ELECTIONS.

Miss Boulton, Haseley, Oxfordshire; E. C. Seaman, Esq., Pancras Lane, and Hampton; J. Harris, Esq., 3, Princes Gate; W. J. Phelps, Esq., Chestal, near Dursley, Gloucestershire; Mr. J. F. Chater, Havershill, Suffolk.

II.—AWARDS.

Silver Knightian Medal:—

To Messrs. Standish and Noble, of Bagshot, for plants of Skimmia japonica, a new hardy evergreen shrub, which bears beautiful red berries resembling those of the Holly all through the autumn and winter months. It fruits in a very small state, and is altogether exceedingly attractive.

To Messrs. Lucombe, Pince, and Co. of Exeter, for a specimen of Vanda cærulea.

Banksian Medal:—

To Mr. Woolley, Gardener to H. B. Ker, Esq., of Cheshunt, for a smaller example of the last-named Orchid.

To Mr. Butcher, of Stratford-on-Avon, for a bunch of Black Barbarossa Grapes, weighing 3 lbs. 9 oz. Mr. Butcher stated that this variety never shanked, and that it was one of the very best late Grapes he had.

To Mr. Robertson, Gardener to A. Dunbar, Esq., of Duffus House, Elgin, for a collection of Pears, consisting of Winter Nelis, Sinclair, Marie Louise, Easter Beurré, extraordinary specimens of Grosse Calebasse, each fruit measuring at least seven inches in length; Thompson's, very large; Duchesse d'Angoulême, and Glout Morceau.

To Mr. Lewis Solomon, of Covent Garden, for the following Pears of foreign growth, viz., Chaumontel, Passe Colmar, Mons. le Curé, Duchesse d'Angoulême, Uvedale's St. Germain, and Belle Erme.

Certificate of Merit:—

To Mr. Anderson, Gardener to the Earl of Stair, at Oxenford Castle, Dalkeith, near Edinburgh, for a collection of Pears, comprising Marie Louise, Louis Bonne, Gansel's Bergamot, Autumn Bergamot, Autumn Bon Chrétien, and "a new variety of Marie Louise."

To Mr. Davis, of Oak Hill, East Barnet, for fourteen bunches of Muscat of Alexandria Grapes.

To Mr. Hargen, Gardener to R. W. Edgell, Esq., Milton Place, near Egham, for examples of Stillwell's Sweet-water Grapes.

To Mr. Spary, of the Queen's Graperies, Brighton, for a dish of Black Hamburgh Grapes, grown without fire-heat.

To Mr. Burns, of Chevening, for an exhibition of Knight's Marrow Peas, in the best possible condition, being young, tender, and in every respect excellent.

To Mr. Glendinning, F.H.S., for a beautiful hybrid Gesnera, with bright cherry-coloured flowers, having a pale throat. It appeared to be a cross between G. discolor and purpurea.

III.—MISCELLANEOUS SUBJECTS OF EXHIBITION.

Mr. Evershed, Market Gardener, Godalming, sent a dish of Peas, called Long Junquil, a little known sort, but apparently one of first-rate quality, the pods being large and well filled. Mr. E. stated that he obtained it from the neighbourhood of Bath, and that although he had cultivated all the best sorts of Peas for years past, he considered this the best he ever grew.

Mr. Smith, Gardener to Mrs. Reay, also contributed excellent early Warwick Peas from Wanstead.*

From the Rev. P. V. Robinson, of Landewednach Rectory, Helston, Cornwall, came a large-podded Pea, called Great

* This exhibition, as well as that of Mr. Evershed, was of such very good quality that their receiving some mark of recognition was referred to the Council for consideration; and afterwards distinguished by a Certificate of Merit.

Mr. Francis furnished cut flowers of the following Roses from his nursery in Hertford, viz., Bourbon Queen, Jacques Lafitte, Mrs. Bosanquet, La Reine, Devoniensis, Géant des Batailles, Bougère, Belle Allemande, Rambuteau, Elise Sauvage, Dr. Marx, Marquis of Ailsa, Saffranot, Comte de Paris, Souvenir de la Malmaison, Baronne Prevost, Standard of Marengo, Marquis Boccella, Cloth of Gold, and Dupetit Thouars.

A bouquet of Hardy Annuals was contributed by Mr. Wrench, of London Bridge.

Mr. Mills sent a half-ripened Cucumber, about a yard in length, and three inches in diameter.

IV.—NOVELTIES FROM THE SOCIETY'S GARDEN.

The Golden Lachenalia (L. aurea), a very handsome species, producing spikes of long bright yellow tubular flowers; two Billbergia bifrons, a red and a white variety, from M. de Jonghe, of Brussels; and a cut flower-spike of the Peruvian-bark plant (Cinchona Calisaya), whose blossoming in the garden, for the first time in Europe, has excited so much interest.

The following proposed alteration in the bye-laws, which had been read at two previous meetings, was on this occasion read a third time, viz.: "The Council hereby give notice that they propose to substitute for chap. viii., article 1, of the present bye-laws, namely: the number of honorary members shall not at any time exceed five; the following words—the number of honorary members shall not at any time exceed ten." This alteration was then balloted for, carried unanimously, and became a law of the Society.

V.—BOOKS PRESENTED.

Transactions of the Linnean Society, Volume XXI. Part 1, and Proceedings of the Linnean Society, No. 45, 46, and 47, from the Society.
Mémoires de la Société de Physique et d'Histoire Naturelle de Génève, Vol. XIII., Part 1, from the Society.
Acta Academiæ Naturæ Curiosorum, Vol. XXIII., from the Academy.
The Garden Companion, Part X., from the Publishers.
The Athenæum for June, July, August, and September, from the Editor.
Transactions of the Horticultural Society of Berlin, Part XLII. from the Society.
Smithsonian Contributions to Knowledge, Volumes III. and IV. from the Smithsonian Institution.

November 2nd, 1852. (Regent Street.)

I.—AWARDS.

Knightian Medal:—

To Mr. Ivery, of Peckham, for a collection of Pompone Chrysanthemums, consisting of the following sorts:—Autumnus, buff, with a brown centre; Sacramento, a very handsome variety—bright yellow, with a brown eye; Minon, delicate pink, with a brown centre; Hendersonii, pure yellow; Argentine, white; and Surprise, pink, with a brownish centre.

To Messrs. Lucombe, Pince, and Co., of Exeter, for a group of twelve young plants of Æschynanthus splendidus, a variety very much in the way of Æ. speciosus. Their clusters of brilliant fiery-red flowers, numbering from eight to ten in a head on each plant, produced a striking effect. They appeared to have been the flowering tops taken off early in autumn, struck, and grown in three-inch pots.

Banksian Medal:—

To Messrs. Veitch, of Exeter, for Calanthe vestita, a late-flowering species, with large white blossoms, having a red eye; also, for Vanda cærulea. Accompanying these were the following memoranda:—"We find the Vandas vary in colour according to the amount of heat they are exposed to; we have had many flower this season, some opening in the hottest or East India end of our Orchid-house,and others in the cooler parts. The difference is striking, the colour becoming lighter and lighter as it receives more heat and moisture. Of the Calanthe, there are two varieties, the one with the fine crimson eye, as the plant sent represents; the other is without the coloured spot, and instead of it has a yellowish eye. We need not say that the plant is much more striking with the crimson than without it."

To Mr. Chapman, Gardener to J. B. Glegg, Esq., F.H.S., for a dish of White Alpine Strawberries, concerning which it was stated that they were sown on two aspects, south and west; that on the former they are the first Strawberries ripe in summer, and that on the latter they hold out till the frost cuts them down, affording a constant dish between June and

October. It was also mentioned that the white sort was preferred, that being less attractive to birds than the red kind.

To Mr. Pyper, Gardener to E. St. Vincent Digby, Esq., F.H.S., of Minterne, Dorchester, for an exhibition, consisting of Mandarin Oranges, the produce of a second crop this year, the first being ripe in August last; some very large Madras Citrons; a sweet Lime; and fruit of the Cédratier de Salo, a thick-rinded Citron, which is not eatable, but which is valuable for its perfume and preserving.

Certificate of Merit:—

To Mr. Chapman, Gardener to J. B. Glegg, Esq., for three heads of the Withington Red Celery. "It is considered here (Mr. Glegg's) a good kind, twisted and solid, sweet, and kernelly. I don't know that it is out of the common way; but we have had the sort for above thirty years, the seed being raised annually in this garden, having been originally brought from Somersetshire."

II.—MISCELLANEOUS SUBJECTS OF EXHIBITION.

Mr. E. G. Henderson, of St. John's Wood, had an exhibition of Pompone Chrysanthemums, in which the most remarkable were Solfaterre, a kind resembling Sacramento, but larger; Rénoncule, pink; and a brown kind, named La Lilliputienne.

In a group of Pompones from Messrs. Chandler, of Vauxhall, (not sent for competition) was one named Le Nain Bé-Bé, a small pink sort, and very pretty; the chief peculiarity, however, about it was its having a faint scent, like that of violets.

Of Orchids, Messrs. Weeks and Co. sent Maxillaria picta, Zygopetalum crinitum, and the Bird's-bill Oncid (O. ornithorhynchum).

Mr. Dodds, Gardener to Sir John Cathcart, Bart., F.H.S., produced two beautifully-ripened Queen Pine-apples, each weighing 4 lbs. 6 oz.

Mr. Fleming, Gardener to the Duke of Sutherland, F.H.S., at Trentham, also sent three fruit of the same kind of Pine, weighing respectively 4 lbs. 14 oz., 4 lbs. 6 oz., and 4 lbs. 6 oz.—all finely-formed fruit, with small crowns.

Mr. Chapman, Gardener to J. B. Glegg, Esq., furnished a

Castle, in Yorkshire, showed fifty pods of Knight's Dwarf Marrow Peas, in good condition. They had been sown on the 19th of July, on a piece of ground which had just been cleared of Early Potatoes. The ground had no other preparation after taking up the Potatoes than common flat digging, and Mr. Harley says, "I am certain that at the present moment, if required to do so, I could gather three bushels of Peas such as those sent. I have gathered a dish for the table every other day since the 29th of September, from a sowing made on the 1st of July. I have sixteen rows, twenty yards long, of the same sort now produced; and I can, without fear of contradiction, say that they are as healthy in foliage, bloom, and pod, as any crop of Peas could be in June or July."

A drawing of Hibiscus Rosa sinensis, executed by Miss Elizabeth Stone, of 66, East Street, Brighton, was shown by the Duke of Marlborough.

III.—ARTICLES FROM THE SOCIETY'S GARDEN.

Veronica Andersonii, one of the most useful of winter-flowering greenhouse plants; and a bright-red coloured hybrid Begonia, raised between manicata and cinnabarina. Along with these also came fruit of the Duchesse d'Angoulême, Styrian, Beurré Diel, and Belmont Pears; and the following vegetables, viz., Walls' Early White Celery, which was better than any of the other sorts exhibited; Early Ulm Savoy, an excellent sort, now pretty well known; two specimens of the Blue Winter Kohl Rabi, a good garden kind; Flanders and Lettuce-leaved Spinach, both excellent winter sorts of nearly equal merit; and ripe examples of the large Spanish Capsicum, a sort somewhat resembling a Tomato, and sweet and agreeable, being devoid of nearly all that pungency which is peculiar to other Capsicums. They had been ripened in Mr. Ewing's glass walls, where the plants had been for the last two months.

IV.—BOOKS PRESENTED.

Flora Batava, No. 169. From His Majesty the King of Holland.
The Athenæum for October. From the Editor.
Proceedings of the Royal Society, Vol. VI., Nos. 86, 87, 88, and 89. From the Society.
Journal of the Royal Agricultural Society, Vol. XIII., Part 1. From the Society.
Journal of the Royal Geographical Society, Vol. XXI. From the Society.
The Quarterly Journal of the Geological Society, No. 31. From the Society.
Fifth Annual Report of the Board of Regents of the Smithsonian Institution; On the Recent Improvements in the Chemical Arts; and American Zoological, Botanical, and Geological Bibliography for 1851. From the Smithsonian Institution.

December 7th, 1852. (REGENT STREET.)

I.—ELECTIONS.

Rev. H. Cooke, Sandy, Biggleswade, Bedfordshire; Mr. Francis E. Staff, Lawson Street, Great Dover Road; Thomas E. Moss, Esq., Raby Hall, Liverpool; Mr. Alfred Chandler, Nurseryman, Wandsworth Road.

II.—AWARDS.

Knightian Medal:—

To Mr. E. G. Henderson, Wellington Road, for the following six Pompone Chrysanthemums, viz., Solfaterre, Ninon, Geralda, La Fiancée, Madam Lemichez, and Vestitum.

To Messrs. Veitch, of Exeter, for plants of Vanda suavis and Limatodes rosea, the latter an extremely pretty Calanthe-like terrestrial Orchid, from Moulmein.

Banksian Medal:—

To Mr. Ivery, of Peckham, for six Pompone Chrysanthemums, consisting of Colibrella, Perfectum, Solfaterre, Geralda, Nelly, and La Sapagou (?).

To Mr. Hill, Gardener to R. Sneyd, Esq., F.H.S., Newcastle, Staffordshire, for well-ripened specimens of the following Pears:—Colmar d'Aremberg, Passe Colmar, Beurré Diel, Glout Morceau, Old Crassane, and Beurré Rance.

To Mr. Lewis Solomon, of Covent Garden, for the following foreign Pears:—Beurré Rance, Glout Morceau, Uvedale's St. Germain, Jean de Witte, Chaumontel, and Bon Chrétien.

To Mr. Ingram, Gardener to Her Majesty, at Frogmore, for two examples of smooth-leaved Cayenne Pine-apple, weighing respectively 7 lbs. 8 oz. and 6 lbs. 4 oz.

To Mr. Davis, of Oak Hill, East Barnet, for a dish of Oldaker's West's St. Peter's Grapes, fresh, plump, and black.

To Mr. Lewis Solomon, for an exhibition of French Seakale, Endive, Lettuces, Horn Carrots, and White and Green Asparagus, the green being what is called "sprew."

Certificate of Merit:—

To Mr. Errington, Gardener to Sir Philip de Malpas Grey Egerton, Bart., F.H.S., Oulton Park, near Tarporley, Cheshire, for a collection of Pears, consisting of Beurré Diel, Duchesse d'Angoulême, Doyenné d'Hiver, Beurré Rance, and Marie Louise.

To Mr. Chapman, Gardener to J. B. Glegg, Esq., F.H.S., Withington Hall, near Congleton, Cheshire, for examples of Colmar, Forelle or Trout Pear, Glout Morceau, Winter Nelis, Beurré d'Aremberg, and Passe Colmar.

To Mr. Snow, Gardener to Earl de Grey, F.H.S., Wrest Park, Bedfordshire, for beautiful dishes of the true old Golden Pippin Apple. They had been grown on trees trained on an east wall, from which it was stated fine healthy crops are annually gathered, while from Standards of this variety in the same garden, the fruit is cankered and bad, from which it was inferred that instead of the Golden Pippin wearing out, as is commonly said, it is in reality too tender for our climate.

To Mr. Paver, Taunton, for a capital small-crowned Queen Pine-apple, weighing 5 lbs. 4 oz.

To Mr. Hoare, Gardener to Sir J. Bailey, Bart., M.P., for a Ripley Queen, 5 lbs. 10 oz., and for a Black Jamaica, 4 lbs. 14 oz.

To Mr. Wortley, Gardener to Mrs. Maubert, of Norwood, for three bunches of Muscat Grapes, beautifully swelled and coloured.

To T. Lockyer, Esq., of South Wembury House, Plymouth, for a dish of large fine-looking Lemons, of good quality, which had been grown in the open air. It was stated that Lemons had been cultivated against a south wall in Mr. Lockyer's garden for these last thirty years, the principal care required being merely to protect them from wet, from which they suffer more than from cold. This is readily effected by covering them in wet periods with straw protectors or glass. It was added that good dressings of sheep-droppings to their roots had kept them in a high state of luxuriance.

To Mr. Edmonds, Gardener to the Duke of Devonshire, F.H.S., at Chiswick House, for a very fine specimen in a square tub of Daphne indica rubra.

Crassane, Aston Town, Knight's Monarch, and Hacon's Incomparable, the latter beautiful fruit of this excellent variety from Earl Grey's garden at Howick. "Howick Gardens," Mr. Moore stated, "are situated about three quarters of a mile from the sea, and I find it necessary to grow all the late sorts of Table Pears upon a south wall. But most of the autumn kinds ripen well on either a west or east aspect."

An interesting trayful of Apples was contributed by Mr. Errington, Gardener to Sir Philip de Malpas Grey Egerton, Bt., F.H.S.

A capitally ripened smooth-leaved Cayenne Pine-apple came from Mr. Dods, Gardener to Col. Baker at Salisbury.

Mr. Davis, of Oak Hill, sent an Enville, 4 lbs. 2 oz.

A Providence Pine, 6 lbs. 12 oz., was shown by Mr. Fleming, Gardener to the Duke of Sutherland, F.H.S., at Trentham. The same establishment also furnished three large and fine bunches of Muscat Grapes.

Black Hamburgh and Cannon Hall Muscats came from Mr. Spary, of Brighton.

Mr. Taylor, jun., Oakley, Beds, sent three bunches of what he called Red Hamburgh Grapes.

A basket of Muscats came from J. G. Nash, Esq., of Bishop's Stortford, much too late for competition.

From Mr. Smith, Gardener to F. Newdigate, Esq., of Blackheath, came a plant of Amaryllis reticulata.

Messrs. Standish and Noble again sent the new Evergreen shrub Skimmia japonica, covered with Holly-like berries, even more brilliant than before.

J. Allnutt, Esq., of Clapham, furnished a plant of Camellia Donkelaeri in bloom.

Messrs. Lucombe, Pince, and Co., of Exeter, sent two Conifers, one named Biota glauca, which appeared to be a variety of the Chinese Arbor-vitæ, with a peculiar blue hue; the other was a potted plant of either a Cypress or a Juniper, but in so young a state that it was impossible to say which.

Mr. Carson, Gardener to W. F. G. Farmer, Esq., F.H.S., sent handsome cut specimens of Cattleya guttata, and of three varieties of Zygopetalum.

Messrs. W. P. Ayres and Co. furnished flowers of Tropæolum Triomphe de Gand, which is identical with Baumann's beautiful variety of T. Lobbianum; also examples of T. Hockerianum, a handsome kind with yellow flowers, spotted on each petal with red. Accompanying these were the following remarks:—"At the October meeting of the Society, some cut flowers of Tropæolum Lobbianum were much admired. We now beg to call attention to our improved variety of Lobbianum, now called "Triomphe de Gand," which, we believe, originated with M. Van Houtte, of Ghent. It will be perceived that the flowers are much larger and more brilliant in colour, while as a *winter*-blooming plant it is equally profuse. We received two plants from the continent under this name; one was the brilliant thing we have sent, and the other a dirty yellow, and quite worthless; and we have reason to know there is much of the spurious variety about.

"We also send another very pretty variety, T. Hockerianum, and for the sake of comparison, a bunch of T. Lobbianum. For winter blooming we know no finer plants, and from this time until March next our plants will yield us from 700 to 1000 plants."

The Hon. W. F. Strangways sent a highly interesting collection of cut specimens of winter-flowering plants, which are hardy in the mild climate of Dorsetshire, but which mostly require the protection of a greenhouse about London. Among them were the handsome Chilian Azara integrifolia, which lives in the open garden at Chiswick, but does not flower; the beautiful Lithospermum rosmarinifolium, Convolvulus Cneorum, the red Brugmansia, the Anderson Speedwell, and Protea mellifera, which was stated to succeed there perfectly, forming a beautiful flowering bush; but owing to the want of bright weather, its blossoms had not yet opened this year.

Specimens illustrative of the transition of Ægilops ovata into the Tonzelle Wheat of the south of France were exhibited. It was stated that the circumstances connected with this transformation, which was worked out by M. Esprit Fabre, are as follows:—It is well known that there grows in the S. of Europe, in abundance, a wild grass, called by botanists Ægilops ovata, the grain of which is much like that of starved Wheat, but whose floral organs are of a very different character, and whose ears naturally fall to pieces by a separation of the joints when ripe. This kind of grain is said to have borne the name of Blé du diable; the plant which produced it was even called by Cæsalpinus Triticum sylvestre.

Nevertheless naturalists appear, with one accord, to have treated the notion of Wheat coming from Ægilops ovata as an absurdity, with the exception of two French observers, whose experiments arrived at no known result. About the year 1824, the late Mr. Requien, a zealous French botanist, residing at Avignon, observed in the neighbourhood of that city a (to him) new kind of Ægilops, which he called triticoides, because of its resemblance to Wheat; and Signor Bertoloni, who introduced it into his Italian Flora, states that it has also been found in Sicily, by Professors Gussone and Tenore. There is also in the south of France another Ægilops, called triaristata, supposed to be a distinct species. Thus, according to botanists, there are three different kinds of this genus in the south of Europe, and these have been each the subject of M. Esprit Fabre's experiments. The first point established by this observer was that both Ægilops ovata and triaristata would produce what Requien called triticoides. It would therefore seem, that the three supposed species were all forms of the same species. In fact, the very same ear which yields either ovata or triaristata also yields triticoides. Nevertheless, M. Fabre calls them perfectly distinct from each other, and is of opinion, that when Æ. ovata runs to triticoides, it gives rise to the small grained smooth Wheats which the French call Seissette and Tonzelle; while, on the other hand, when Æ. triaristata runs into triticoides, it gives birth to the coarser Wheats with downy ears, known in lower Languedoc under the name of Fourmen and Pétanielle, among which Egyptian Wheat is included. Be that as it may, and M. Fabre offers the statement merely as an hypothesis, it is certain that Ægilops triticoides, when once produced, if raised from seed year after year, goes on changing, until at last it becomes mere Wheat. This, at least, was the result of M. Fabre's experiment, which was spread over a series of twelve years. Season after season, the change went on —but slowly. Little by little, one part altered or another. The wretched hungry grain grew plumper; the flour in it increased; its size augmented. The starved ears soon formed other spikelets; the spikelets at first containing but two flowers, at last became capable of yielding four or five. The straw stiffened, the leaves widened, the ears lengthened, the corn softened and augmented, till at last wheat itself stood revealed, and of such quality, that it was not excelled on the neighbouring farms.

From Mr. Grey, Gardener to W. Cuthbert, Esq., of Beaufort, Hexham, came fruit of the Houghton, or Raby Castle Currant, a

claim no merit for this experiment as a novelty, for there is a report of a somewhat similar process in the 'Prize Essays' of the Highland Agricultural Society, vol. iii.; the only difference being, that, in that instance, the Swedes had been transplanted. I would add that it is there shown, besides, that on analysis, as compared with Swedes treated in the common way, the root only suffered in value to the extent of containing a small per centage more of water, the quantity of solid matter being displaced in the same proportion, while the quality of the food remained uninjured.

IV.—NOVELTIES FROM THE SOCIETY'S GARDEN.

Sonerila orbicularis, described in another page, and Malva umbellata, a large purple-flowered species from New Grenada, long lost sight of in gardens, but now coming again into notice. Its blossoms are very persistent; and in summer it makes an exceedingly handsome showy bush.

V.—BOOKS PRESENTED.

Journal of the Royal Asiatic Society, Vol. XIII. Part 2. From the Society.
Flora Batava, No. 170. From His Majesty the King of Holland.
The Athenæum for November. From the Editor.
Versuch einer Monographie der Stachelbeeren, by the late Dr. Lorenz v. Pansner, edited by Mr Heinrich Maurer. From the Editor.
Industrial Instruction on the Continent (being the Introductory Lecture of the Session 1852-3, at the Museum of Practical Geology) by Dr. Lyon Playfair. From the Author.

large red variety, which is excellent for late use. It was stated, that when grown against a north wall, and protected from birds, rain, and frost, it will continue good till the latter end of December.

Two large purple-topped Swedes, from the Rev. Mr. Smith, of Lois Weedon, were exhibited. They were extremely solid, firm, and good, and weighed respectively 9 lbs., and 9 lbs. 4 oz. They were sent as examples of Mr. Smith's peculiar system of management, which he has stated to be as follows:—The land, a heavy clay, with a staple originally of five or six inches, has been gradually brought, by trenching and horse-hoeing, to a pulverised state eighteen or twenty inches deep. In the autumn I buried the manure (made by cows and swine, fed on Swedes and bran, with the other useful fodder) within two or three inches of the bottom of the rows intended for my plant; and in April, over that manure, and within five or six inches of the surface, I stirred 1 cwt. of guano. The first week in May I drilled my seed together with a sprinkling of superphosphate, in single rows five feet apart. The result was, as it always has been under the same system, pursued for several years, that at the beginning of September, the leaves of the plant met across the five feet intervals, and that I am promised a yield equal, perhaps, to the measured produce of last year, which amounted to twenty-seven tons. It will be understood, by those who know the constituents and the properties of clay made friable to the depth I have described, how the continuous and inexhaustible supply of moisture in such a soil saves the plant from mildew, the common result of early sowing in shallow ground, but from which I have never suffered, even in the driest season. Now for the peculiar point of my management, viz.,—disleafing the roots, which I find to increase in bulk in the absence of leaves. Early in September, when the roots had reached their state of complete organisation, when the tops had grown from two and a half to three feet in height, the lower leaves generally extending five feet wide, I began to cut the tops as they were wanted, about an inch from the crown; and from that time to this (Nov. 6), the bulbs have been proved, by measurement, to continue to grow, and are throwing out, all round the crown, a fresh supply of luxuriant leaves for another feed. From this source, the bulk of keep for my cattle has been enormous; and the importance of such a supply at a time when, in common seasons, the Grass begins to fail, is beyond a doubt, especially for growing stock, since it has been proved that the leaves of the Turnip contain more of the bone-making material than even the bulb itself. I claim no merit for this experiment as a novelty, for there is a report of a somewhat similar process in the 'Prize Essays' of the Highland Agricultural Society, vol. iii.; the only difference being, that, in that instance, the Swedes had been transplanted. I would add that it is there shown, besides, that on analysis, as compared with Swedes treated in the common way, the root only suffered in value to the extent of containing a small per centage more of water, the quantity of solid matter being displaced in the same proportion, while the quality of the food remained uninjured.

IV.—NOVELTIES FROM THE SOCIETY'S GARDEN.

Sonerila orbicularis, described in another page, and Malva umbellata, a large purple-flowered species from New Grenada, long lost sight of in gardens, but now coming again into notice. Its blossoms are very persistent; and in summer it makes an exceedingly handsome showy bush.

V.—BOOKS PRESENTED.

Journal of the Royal Asiatic Society, Vol. XIII. Part 2. From the Society
Flora Batava, No. 170. From His Majesty the King of Holland.
The Athenæum for November. From the Editor.
Versuch einer Monographie der Stachelbeeren, by the late Dr. Lorenz v. Pansner, edited by Mr. Heinrich Maurer. From the Editor.
Industrial Instruction on the Continent (being the Introductory Lecture of the Session 1852-3, at the Museum of Practical Geology) by Dr. Lyon Playfair. From the Author.

January 18*th*, 1853. (Regent Street.)

I.—AWARDS.

Banksian Medal:—

To the Hon. William Fox Strangways, F.H.S., of Abbotsbury, for the following cut specimens of winter flowering plants which are found to be hardy in the mild climate of Dorsetshire, viz.:—Fuchsia cordata, beautifully coloured; Pittosporum Tobira, Epimedium macranthum, Pernettya mucronata, Yuccas, Edwardsia macrocarpa, Symphytum

but they were from greenhouse plants, and therefore not eligible to compete for a prize, the Society having offered rewards on this occasion for flowers from the open ground only.

Mr. Allport, Gardener to H. Ackroyd, Esq., sent bunches of Black Hamburgh and West's St. Peter's Grapes.

From Mr. Watson, Gardener to J. Dent, Esq., of Ribston Hall, Yorkshire, came Black Hamburgh Grapes, the produce of the present year. "The Vine from which they were cut is planted inside of a pine stove, the top being annually laid outside to rest. In 1852, grapes were cut from it on the 7th of February; in 1851, about a month later. This year (1853), the first fruit was cut from it on Monday, the 10th of January, when two bunches weighed respectively ½ lb. and 1¼ lb. It was laid out to rest in the first week in June, and put in again to force on the 21st of August last. The number of bunches on it this year is eighteen."

Mr. Forbes, Gardener to the Duke of Bedford at Woburn Abbey, sent examples of Black Hamburgh Grapes, grown in 1852, and a small bunch, this year's produce, quite ripe and well coloured, from Vines which were started in September last. These arrived much too late for competition.

A very good Enville Pine-apple, weighing 4 lbs. 6 oz., was shown by Mr. Bailey, Shardeloes Gardens, Amersham.

A new Dendrobium was contributed by Mr. Summerfield, Gardener to J. S. Venn, Esq., of Highbury Park. Its flowers were white, like Orange blossom, and almost as sweet-scented.

Messrs. Veitch sent the new Neilgherry Sonerila orbicularis, "grown cool, and therefore well coloured."

A box of Camellia blooms was shown by Mr. Chapman, Gardener to J. B. Glegg, Esq., F.H.S., of Withington Hall, Cheshire.

III.—ARTICLES FROM THE SOCIETY'S GARDEN.

Selago distans; Siphocampylus microstomus, and the brighter variety of it called ruber; Echeveria retusa; and Cochlearia acaulis.

The Garden also furnished the following cut flowers, all gathered from the open ground, viz., Chimonanthus fragrans, grandiflorus, and parviflorus; Jasminum nudiflorum, one of the very gayest hardy winter shrubs; Nuttalia cerasiformis, the red and white varieties of Pyrus japonica, Lonicera fragrantissima, a pretty evergreen bush, and sweet-scented; Arabis alpina, Erica carnea, Ceanothus azureus and its pale variety called pallidus, Vinca minor, Helleborus olympiens and odorus, which flower later than the common Christmas Rose; Arbutus Unedo and schizopetala, Phillyrea obliqua, the grey-leaved Cotoneaster denticulata, Eranthis hyemalis, Elæagnus argentea, Cornus mascula, the common Laurustinus, and a variety called stricta, which, in addition to blossoms, had also a crop of beautiful blue fruit; Geum triflorum, Stenactis speciosa, Berberis aquifolium, Ribes malvaceum, Clematis calycina, China Roses, Stocks, Erysimum Perofskianum, Limnanthes Douglassii, Escallonia rubra and montevidensis, Calendula officinalis, Iberis Gibraltarica and I. amara, Garrya elliptica (the male kind), common single red Camellia, which grows and flowers every year well behind a north wall in the garden; Aubrietia deltoidea, Nemophila atomaria and maculata, Coriaria nepalensis, Vaccinium ovatum, Andromeda floribunda, Polygala chamæbuxus, and Collinsia bicolor.

The Kitchen Garden department likewise contributed a large and varied salad, consisting of Chicorée fine d'Eté and sauvage améliorée, Scarole à fleur blanche, Lettuce, Mache d'Italie, very succulent and tender; Mache ronde, Picridium, Celeri court hâtif and gros violet de Tours, Early White Winter Radish; Castelnandari, Sutton's Dark-Red, and Atkin's Crimson-Red Beet; Mustard and Cress, Normandy Cress, American Cress, Burnet, French Sorrel, common Garden Sorrel, Broad-leaved Sorrel, and Oseille de Belleville, which is decidedly the best of all the Sorrels, being less fleshy, and not near so coarse as the common garden kinds; Chervil, and Deptford Onion, making in all twenty-four varieties belonging to sixteen species.

IV.—BOOKS PRESENTED.

Flora Batava, No. 171. From His Majesty the King of Holland.

Wegweiser fur die Besucher des K. Botanischen Gartens in Munchen, by Professor C. von Martius. From the Author.

Quarterly Journal of the Geological Society, No. 32 From the Society.

Journal of the Royal Geographical Society, Vol. XXII. From the Society

The Athenæum for December. From the Editor.

Reports of the Juries of the Exhibition of 1851, and First and Second Reports of the Commissioners for the Exhibition of 1851. From the Royal Commission.

February 15*th*, 1853. (Regent Street.)

I.—ELECTIONS.

J. Praxedes P. Pacheco, Esq., Rio de Janeiro; David Henry, Esq., Forty Hill, Enfield; John Wilson, Esq., Shirley, near Southampton; and P. Carthew, Esq., St. Mary Abbott's Terrace, Kensington.

II.—AWARDS.

Banksian Medal:—

To Mr. Snow, Gardener to Earl de Grey, West Park, Beds, for a collection of Pears, consisting of Old Colmar, Glout Morceau, Beurré Rance, Ne Plus Meuris, Easter Beurré, and specimens of a small Brown sort, called Bezi de Caissoy (Nutmeg of some), an excellent table fruit, and an enormous bearer; with the Warden, or Black Pear of Worcester, in addition.

Certificate of Merit:—

To the same, for Snow's Matchless Green Cos Lettuces, grown at the bottom of a south wall.

To Mr. Ingram, of the Royal Gardens, Frogmore, for 100 heads of excellent Asparagus, weighing (the bundle) 11 lbs. 4 oz. It was stated to have been produced in brick pits exclusively devoted to the purpose, and sunk in the ground to the depth of four feet. Between each pit exists a space traversed by hot-water pipes, which spring from a central boiler; the divisional spaces are covered securely with York stone, and the beds have a tight-fitting wooden span roof.

To Mr. Butcher, Gardener to W. Leaf, Esq., of Streatham, for three bunches of Muscat Grapes, beautifully ripened, and exhibiting no symptoms of shrivelling.

To Mr. Dodds, Gardener to Colonel Baker, of Salisbury, for a well-formed Providence Pine-apple, weighing 9 lbs.

To Mr. Glendinning, of the Chiswick Nursery, Turnham Green, for Rogiera amœna, a stove plant of considerable beauty, introduced into this country through the German gardens.

built in the end wall with as much of the dome inside as possible, leaving an opening outside (to which a door is affixed) for introducing the gas-burner which is to heat the apparatus. It was stated that if it is possible (which Mr. Cuthill is confident it is) to render the joints sufficiently tight to prevent leakage, this invention might be found useful, near places having gas laid on, in heating window gardens and small houses, which it is very difficult otherwise to warm without over-heating. Mr. Cuthill stated that a contrivance of this description, in a greenhouse twelve feet by eight feet, has been found to work satisfactorily with a gentleman in the Old Kent Road, and that a heat of 45° could be maintained with ease when there were 12° of frost outside. With reference to the joints of the pipes, Mr. Hood, of Iron Wharf, Blackfriars, says:—"I consider they will be perfectly secure when a little red and white lead are put into the socket, and that no leakage of gas can occur. As soon as ever the pipes become warm, the gases inside them are more rarified than the external air; consequently the pressure will be inwards and not outwards—the air trying to get in and not the gas to get out. I think, therefore, no disagreeable results are likely to occur from the escape of gas through the joints of the pipes. As regards the thickness of the pipes, I do not see that any improvement can be made. If thin sheet-iron pipes were used they would soon be destroyed, as the products of the combustion of carburetted hydrogen gas act very rapidly on wrought-iron, so much so, that a sheet-iron pipe would not last many months. The loss of heat through a cast-iron pipe of the thickness of those used with the gas-stove is almost or quite inappreciable; and, therefore, even if the question of durability did not arise, there would be no advantage whatever in using thin sheet-iron pipes for the purpose."

IV.—ARTICLES FROM THE SOCIETY'S GARDEN.

Acacia ixiophylla and linifolia, Rhynchospermum jasminoides (frost-bitten on its way to the Meeting in a covered van, the thermometer on the night previous indicating no less than 14°), Corræa Goodii, three varieties of Epacris, Echeveria rosea and retusa, three Camellias, cut flowers of Luculia gratissima, which has blossomed beautifully in the great conservatory; a good example of Cardoon (Cardon de Tours) and Lettuces: Laitue chou de Naples, from the south slope of a ridge, and Romaine vert d'Hiver, both excellent sorts for winter cultivation.

V.—BOOKS PRESENTED.

Flora Batava, No. 172. From His Majesty the King of Holland.
Journal of the Royal Agricultural Society, Vol XIII. Part 2. From the Society
The Athenæum for January. From the Editor.
Quarterly Journal of the Geological Society, No. 33. From the Society.
Memorias de la Real Academia de Ciencias de Madrid, and Resumen de las Actas, &c. From the Academy.
Le Bon Jardinier for 1853, and Album Vilmorin, No. 185. From M. Vilmorin.

March 1*st*, 1853. (REGENT STREET.)

I.—ELECTIONS.

D. D. Heath, Esq., Kitlands, Dorking, Surrey; H. G. Bohn, Esq., North End House, Twickenham; John Crowley, Esq., Stockwood, Luton, Bedfordshire; M. Auguste Van Geert, Ghent; Rev. Lord John Thynne, Hawnes Park, Bedford; and Mrs. Barchard, Putney Heath, Surrey.

II.—AWARDS.

Knightian Medal:—

To Mr. Forbes, Gardener to the Duke of Bedford, F.H.S., at Woburn, for bunches of new Black Hamburgh Grapes, not very large, but well coloured and covered with a fine bloom.

Banksian Medal:—

To Mr. Lewis Solomon, of Covent Garden Market, for a collection of Vegetables, consisting of bundles of white Asparagus and green "Sprew" from Paris, excellent green Peas from Toulouse, Ash-leaved Kidney Potatoes, and Horn Carrots from Paris, and Globe Artichokes from Avignon. Also Cos and Cabbage Lettuces, Endive, and Radishes, all from the neighbourhood of Paris.

To Mr. Barnes, of the Camden Nursery, Camberwell, for six plants of Orchis longicornu, a terrestrial Orchid of great beauty, the cultivation of which is described at p. 30 of this volume of the Journal.

To Mr. Gaines, of Battersea, for Camellia Wilderii (rose), and Mrs. Abbey Wilder (white), two medium-sized varieties of American origin and very pretty, being both nicely cupped and otherwise well formed.

Certificate of Merit:—

To Mr. Gill, of Westbourne Grove, Bayswater, for a bright rose-coloured Pelargonium, named Queen of February.

To Messrs. Henderson, of Pine Apple Place, for a plant of the Sikkim Rhododendron ciliare, which flowered so freely at Chatsworth and other places last year. It was stated to be quite as cultivable as a Chinese Azalea, and when grown in little heat the blooms are well coloured; but in the present instance the plant had been kept in a hothouse, and therefore they were paler than they otherwise should have been.

III.—MISCELLANEOUS SUBJECTS OF EXHIBITION.

Mr. Young, of Milford, showed three plants of Cupressus Goveniana, two bearing quantities of ripe cones, and one in full flower.

Two Pine-apples, a Black Antigua, weighing 3 lbs. 5 oz., and a Queen, 2½ lbs., were produced by Mr. Davis, of Oak Hill, East Barnet.

Some Tea-seed furnished by H. Winch, Esq., F.H.S., of Seacombe, Cheshire, was distributed to such Fellows as wished to receive it. It was stated to have been sent to this country by Dr. Bowring, and that if it came from the north of China (as it was believed it did), the produce would be about as hardy as a Camellia.

The Hon. W. F. Strangways again furnished examples of the mild climate of Dorsetshire, in the shape of cut specimens of Primula Palinuri (which is supposed to be the parent of our garden Auricula), the rare Helleborus abchasicus, Euphorbia mellifera, the blue Lithospermum rosmarinifolium (a shrub well worth a place in a greenhouse when it will not flower out of doors), the fragrant Iris reticulata, and other interesting plants in blossom in the open garden at Abbotsbury.

IV.—ARTICLES FROM THE SOCIETY'S GARDEN.

Plants of the fringed white, single white, double white, fringed red, single red, and cut-petalled red varieties of Chinese Primulas, Rogeria Roezlii; Centradenia floribunda and rosea, the former

II.—AWARDS.

Banksian Medal:—

To Mr. Burns, Gardener to Earl Stanhope, F.H.S., at Chevening Park, for a varied and very excellent Salad, consisting of the following articles, all in first-rate condition, viz., blanched Chicory (the entire-leafed sort), Curled and Batavian Endive, Bath Cos and hardy green Lettuce; American, Normandy, Golden, Curled, and Water Cresses; Italian Corn Salad, a much better kind than the common sort; white Mustard, common garden Sorrel, Burnet, Red Beet, Chervil, Cole's Dwarf Red Celery, perfectly sound and solid, and beautifully blanched; Tarragon, early frame Radishes, Chives, and Tripoli Onions.

To Mr. Bailey, Shardeloes Gardens, Amersham, for a Prickly Cayenne Pine-apple, weighing 5 lbs. 8 oz. It was remarked that this variety ought to be more commonly cultivated than it is, possessing, as it does, all the good qualities of an Enville, without any of the bad ones of that variety.

To Mr. Butcher, Gardener to W. Leaf, Esq., of Park Hill, Streatham, for a bunch of Black Barbarossa Grapes, which, although of last year's produce, were as plump and fresh as the best new Grapes could possibly be. It was stated that four sorts of Grapes had been grown by Mr. Butcher in one late house, viz.:—the Muscat of Alexandria, Cannon Hall Muscat, West's St. Peter's, and Black Barbarossa; and that the longest keeper of the white kinds, by six weeks, was found to be the Muscat of Alexandria; and of the black sorts, the Barbarossa, even surpassing, in this respect, the well-known West's St. Peter's.

"The Barbarossa produces a large bunch; it is a good setter, has a large berry and thin skin, with sweet flesh, and altogether is decidedly one of the best late grapes grown."

Certificate of Merit:—

To Messrs. Weeks & Co., of King's Road, Chelsea, for an example of Puya longifolia, a handsome Pitcairnia-like plant, fastened on a block of wood like an Orchid. Its long scarlet flowers and drooping grass-like leaves had a very striking effect. It is a stove plant, from Tropical America, and it was mentioned that, in addition to its other qualities, the blossoms, owing to the hardness of their skin, keep long in perfection.

III.—MISCELLANEOUS SUBJECTS OF EXHIBITION.

Bark and wood of Fitz-Roya patagonica were shown from Messrs. Standish & Noble, of Bagshot. The wood bore considerable resemblance to Cedar, being red, smooth, and beautiful; the bark was thick and spongy, and appeared destined by nature to protect the tree from cold, furnishing additional reason for supposing that it will turn out to be hardy in this country.

A collection of varieties of Indian Corn was exhibited by G. T. Davy, Esq., of Sussex Square, Hyde Park. They were from Cusco, and consisted of very fine large kinds little known in this country, but unfortunately too tender for our climate. It was hinted, however, that they might be found worth a trial in some of the colonies, whose summers are longer and warmer than our own. It was stated that this Cusco Corn was quite different from the Indian Corn of North America.

An imported cone of the New Holland Araucaria Bidwillii was contributed by Lieut.-Colonel Sir Thomas Mitchell. It is the Bunya-Bunya of the natives about Moreton Bay, who feed on its large bean-like seeds.

IV.—ARTICLES FROM THE SOCIETY'S GARDEN.

Oncidium barbatum, the fine variety of Dendrobium nobile, called Blandyanum, Ceanothus rigidus, the true Acacia celastrifolia, two Heaths and Epacrises, Trymalium odoratissimum, Cytisus racemosus, and Polygala Dalmaisiana.

The Garden also supplied the following varieties of Salad vegetables, viz., Lettuces, Scarole à fleur blanche, Chicorée fine d'Eté and Sauvage améliorée panachée, Mustard; American, Normandy, and other Cress; Celeri gros violet de Tours, Early White Winter Radish, Deptford Onion, Burnet, common garden Sorrel, Broad-leaved ditto, French ditto, and Oseille de Belleville, by far the best sort; also Chervil, Atkins' Crimson and Sutton's fine Dark Red Beet, Mache Ronde and M. d'Italie, the latter evidently in this, as in all other cases, the best of the Corn-Salads.

Cuttings of the following fruit-trees were distributed, viz., Dunmore Plum, a variety raised by the late Mr. Knight, and described in the Society's Transactions. It is a good-sized oval fruit—yellow, although it sprang from a seed of the Purple Impératrice and pollen of Coe's Golden Drop. The flesh adheres to the stone, is yellowish, extremely rich and sugary, so much so that it shrivels and dries up like a preserved Prune. The tree is hardy, and bears well as a standard, ripening later than Coe's Golden Drop. It is not much in cultivation, but is highly approved of by all who have fruited it.

Beadnell's Seedling Pear. This is a middle-sized sort, so melting and juicy that it is scarcely possible for any Pear to be more so. It ripens in the end of September or beginning of October. The tree is vigorous and bears very abundantly.

Nouveau Poiteau and Colmar tardif Pears. These were received from M. Van Houtte as new and good sorts; they have not, however, as yet fruited in the Garden.

V.—BOOKS PRESENTED.

The Athenæum for February. From the Editor.
Archives du Muséum d'Histoire Naturelle. Tome VI., livraisons 3 & 4. From the Museum.

Cuttings of the following fruit-trees were distributed, viz., Dunmore Plum, a variety raised by the late Mr. Knight, and described in the Society's Transactions. It is a good-sized oval fruit—yellow, although it sprang from a seed of the Purple Impératrice and pollen of Coe's Golden Drop. The flesh adheres to the stone, is yellowish, extremely rich and sugary, so much so that it shrivels and dries up like a preserved Prune. The tree is hardy, and bears well as a standard, ripening later than Coe's Golden Drop. It is not much in cultivation, but is highly approved of by all who have fruited it.

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V.—BOOKS PRESENTED.

The Athenæum for February. From the Editor.
Archives du Muséum d'Histoire Naturelle. Tome VI., livraisons 3 & 4. From the Museum.

April 5th, 1853. (Regent Street.)

I.—ELECTIONS.

H.R.H. Prince Albert, His Majesty the King of Prussia, His Imperial Majesty the Emperor of Russia, His Majesty the King of Wurtemberg, and His Imperial Highness the Archduke John of Russia, who had been previously Fellows of the Society, were on this occasion elected Honorary Members.

The Right Honourable Lord Wenlock, Mrs. Long, S. Rickards, Esq., were elected Fellows.

II.—AWARDS.

Large Silver Medal:—

To Mrs. Lawrence, F.H.S., for a collection of Orchids, consisting of Arpophyllum giganteum, Dendrobium macrophyllum, and its closely allied species anosmum; Vanda suavis, V. tricolor; Oncidium sarcodes, Chysis bractescens, and two other smaller plants.

Banksian Medal:—

To Mr. Lovejoy, butler to J. Thorne, Esq., Mawbey House, South Lambeth, for the following bottled fruits preserved without sugar or vinegar, viz., Damsons, Greengage Plums, Gooseberries, Rhubarb, Cherries, Black and Red Currants, Raspberries, and Mulberries. The receipt for this mode of preserving is in Mr. Lovejoy's own words as follows:—"Pick the fruit from the stalks; put them into the bottles. Put one drachm of alum into four gallons of boiling water; let it stand till it is cold. Then fill the bottles; bung them tight; then put them into a copper of cold water, and heat it to 176 degrees. Then tie them over with bladder and seal them." The Raspberries and Mulberries preserved in this manner were as plump and transparent as when first gathered. The other fruit was equally fine.

To Mr. Ingram, Gardener to Her Majesty at Frogmore, for a dish of his new seedling Strawberry, called Ingram's Prince of Wales. It is a large variety, and in the present instance somewhat coarse; but this is not its character when grown under natural circumstances. It was stated to have been raised from the British Queen, crossed with Keens' seedling, and that for forcing it was superior even to both its parents, being a very sure setter. As regards flavour it was said to be preferred to all others at the Royal table. It was mentioned that if after forcing the plants are turned out, and such flowers as appear removed up to the beginning of September, the plants will produce an abundance of fruit in autumn when its coarseness will be found to have disappeared.

To Messrs. Henderson, of Pine Apple Place, for a collection of Hyacinths.

To Mr. Carson, Gardener to W. F. G. Farmer, Esq., F.H.S., for Arpophyllum giganteum, producing several flower-spikes.

To Messrs. Lane, of Great Berkhampstead, for a beautiful collection of cut Roses.

Certificate of Merit:—

To Mr. Summerfield, Gardener to J. S. Venn, Esq., for a Dendrobium in the way of D. Wallichi, but smaller.

To Mr. Loddiges, F.H.S., for Lælia grandis, a new Brazilian species with sepals and petals of a peculiar cinnamon colour, the lip being lilac, becoming darker towards the point.

To Mr. Gaines, of Battersea, for three neatly spotted delicate pink Rhododendrons, called Unique, Elegans, and Roseum maculatum.

To the same for Rogieria thyrsiflora, a plant with rosy Rondeletia-like flowers, from Central America.

To Elizabeth Chaddish, for the following fruits preserved without sugar or vinegar, viz.: Mussel and Damson Plums, (both of 1851 and 1852, the one being about as sound as the other), Bilberries, Cherries, and Gooseberries.

To Mr. Allport, Gardener to H. Akroyd, Esq., Nantwich, Cheshire, for Black Hamburgh Grapes.

To Mr. Munro, Gardener to the Earl of Clarendon, at the Grove, Watford, for unusually large fruit of Cuthill's Black Prince Strawberry.

To Mr. Bates, Manor House, East Moulsey, for seven heads of an unnamed Broccoli, in very good condition, considering the severity of the past winter.

III.—MISCELLANEOUS SUBJECTS OF EXHIBITION.

Mr. Dennis, of the King's Road, Chelsea, sent a small plant of Forsythia viridissima.

Messrs. Henderson had a pretty hybrid Rhododendron called campanulatum superbum, but apparently with very little of campanulatum in it.

Mr. Gaines sent a seedling Cineraria, called Reine des Fleurs, which promised to be a first-class sort.

Mr. Mitchell produced a large-flowered Cineraria, called Fairbrother's Mary Elizabeth.

From Mr. Moore, of the Apothecaries' Garden, Chelsea, came a cut specimen of Melastoma corymbosum.

Certificate of Merit:—

To Mr. Loddiges, F.H.S., for Cattleya lobata, a fine deep lilac-flowered sort, streaked on the lip with purple, as were also the margins of the petals.

To Mr. Myatt, of Deptford, for six pots of Cyclamens, all varieties of C. persicum.

To Mr. Davis, of Oak Hill, East Barnet, for three very good bunches of Black Hamburgh Grapes.

To Mr. Todman, Gardener to Mrs. Buckmaster, of Clapham Park, for three heads of Miller's Late White, and a similar number of Dixon's Waterloo Broccolies.

To Mr. Lewis Solomon, for foreign produce, in the shape of Green Peas, White Asparagus, and Green Sprew, new Kidney Potatoes, Artichokes, French Horn Carrots, Tomatoes, and a Salad, consisting of Cos and Cabbage Lettuces, as firm and good as at the best season of the year, excellent curled Endive, and White and Red Turnip-rooted Radishes, the former much the better of the two. The Tomatoes came from Algiers, where they are said to have been grown in the open air; they were certainly as fine as could be produced in this country in September or October. The Carrots were also very fine, short and crisp, with a very slender tap-root; and the Potatoes equalled those of the best English growth.

III.—MISCELLANEOUS SUBJECTS OF EXHIBITION.

Mr. Fish, Gardener to Colonel Sowerby, of Putteridge Bury, near Luton, Beds, sent a dish of Keens' Seedling Strawberries. They were stated to be examples of what had been gathered at Putteridge Bury rather liberally ever since the last week in February. It was mentioned that, owing to press of other matters, the fruit had not been thinned, or the individual berries would have been better. After trying various plans, Mr. Fish has found the following to answer best for Keens' Seedling. As soon as runners can be obtained they are fixed in 3-inch pots; when rooted they are separated from the parent plants, and re-potted singly in 5 and 6-inch pots—the first for early work, the last for the general crop. In potting, two things are made of much consequence, viz., keeping the crown of the plant well up in the centre of the pot, and packing the soil round it as firmly as possible. They are put in a shady situation for a few days, and then placed on hard ground, where they can obtain as much light as possible. This, with attention to watering, sheltering from heavy rains and severe frost in winter, and starting the plants in a low temperature, seem to be the chief essentials to success, especially when fruit is gathered in the beginning of March.

IV.—NOVELTIES FROM THE SOCIETY'S GARDEN.

The extremely handsome Berberis Darwini, ornamented with a profusion of little clusters of orange blossoms. The plant had been wintered under glass, but it was mentioned that this fine Berberry is perfectly hardy, surviving the winter unhurt, even where its roots are partially under water. Indeed it was stated to have been found wild in wet and boggy places. Along with it was the white-blossomed Deutzia gracilis, a useful plant for forcing. It was stated, however, that there are two plants sold under this name in the trade, one much handsomer than the other, and that therefore purchasers should take care not to buy the spurious one. Dielytra spectabilis was also contributed. It was mentioned that, owing to the unusual wetness of the Society's Garden, the roots of this handsome Fumewort in the open ground had all rotted this season, but that in well-drained gardens, and places sheltered from wet, it had survived.

V.—BOOKS PRESENTED

Catalogue descriptif des Arbres fruitiers, &c., by M. André Leroy. From M. Leroy.
Mémoire sur Les Rafflesias Rochussenii et Patma, by Professor W. H. De Vriese. From the Author.

May, 2, 1853. (REGENT STREET.—ANNIVERSARY.)

The following Fellows of the Society were removed, viz.:—

Lord Ashburton,
Sir C. Lemon, Bart.
W. W. Salmon, Esq.

The following were elected new Members of Council in their room, viz.:—

The Duke of Northumberland,
Rt. Honble. L. Sulivan,
J. Gadesden, Esq.

The following Fellows of the Society were elected Officers for the ensuing year, viz. :—

The Duke of Devonshire, President;
J. R. Gowen, Esq., Treasurer;
Dr. Royle, Secretary.
Mr. Charlwood, } Auditors.
Mr. Stevens, }

The Annual Report from the Council and Auditors was read and adopted. (See the body of this volume.)

May 14, 1853. (Garden Exhibition.)

The weather on this occasion was propitious, but cold; the sun being brilliant, but the wind biting. The exhibition itself was magnificent; such Roses, notwithstanding the very unfavourable spring, were never seen before; such Orchids may have perhaps been witnessed in former years; but on no occasion were they displayed with greater skill, were they more varied, or was there a greater absence of mediocrity. Azaleas too were as brilliant as ever; though scarcely, perhaps, so numerous. Stove and Greenhouse Plants and Cape Heaths were also all that could be wished, and there was a fair display of fruit. The number of visitors was 2381, exclusive of exhibitors and persons officially employed.

I.—AWARDS.

The Large Gold Medal:—

To Mr. May, Gardener to Mrs. Lawrence, F.H.S., for a collection of twenty Stove and Greenhouse Plants.

The Gold Knightian Medal:—

To Messrs. Fraser, of Lea Bridge Road, Essex, for a collection of twenty Stove and Greenhouse Plants.

To Mr. Franklin, Gardener to Mrs. Lawrence, F.H.S., for twenty species of Exotic Orchids.

To Mr. Ivison, Gardener to the Duke of Northumberland, F.H.S., at Sion, for a collection of Indian Rhododendrons.
To Mr. Roser, Gardener to J. Bradbury, Esq , of Streatham, for ten varieties of Cape Heaths in 11-inch pots.
To the same for six varieties of Fancy Pelargoniums in 8-inch pots.
To Messrs. Veitch and Son for Lilium giganteum.
To Mr. Dobson, of Isleworth, for twelve varieties of Pelargoniums in 8-inch pots.
To Mr. Turner, of Slough, for six varieties of Fancy Pelargoniums in 8-inch pots.

The Certificate of Excellence:—

To Mr. Speed, of Edmonton, for a collection of fifteen Stove and Greenhouse Plants.
To Mr. Taylor, Gardener to J. Coster, Esq., of Streatham, for a collection of six Stove and Greenhouse Plants in 13-inch pots.
To the same for six varieties of Cape Heaths in 8-inch pots.
To Mr. Woolley, Gardener to H. B. Ker, Esq., of Cheshunt, for ten species of Exotic Orchids.
To Mr. O'Brien, Gardener to G. Reed, Esq., F.H.S., for six species of Exotic Orchids.
To the same for ten varieties of Cape Heaths.
To Messrs. Rollisson, of Tooting, for six of the newer kinds of Greenhouse Azaleas in 8-inch pots.
To the same for a collection of Variegated Plants.
To Messrs. Fraser, of Lea Bridge Road, for six distinct varieties of Greenhouse Azaleas.
To Mr. Francis, of Hertford, for twelve varieties of Roses in pots.
To Mr. Gaines, of Battersea, for a collection of Indian Rhododendrons.
To Mr. Jarvis, Gardener to J. Ruck, Esq., of Croydon, for ten varieties of Cape Heaths in 11-inch pots.
To Mr. Roser, Gardener to J. Bradbury, Esq., of Streatham, for twelve varieties of Pelargoniums in 8-inch pots.
To Mr. Westwood, of Acton Lane, for the same.
To Mr. Robinson, Gardener to J. Simpson, Esq., of Thames Bank, Pimlico, for six varieties of Fancy Pelargoniums in 8-inch pots.

To Mr. Ayres, of Blackheath, for the same.

To Mr. Constantine, Gardener to C. Mills, Esq., of Hillingdon, for six varieties of Calceolarias in 8-inch pots.

To Mr. Hoare, Gardener to Sir J. Bailey, Bart., F.H.S., for a Lemon Queen Pine-apple, weighing 5 lbs. 4 oz.

To Mr. Bray, Gardener to E. Lousada, Esq., of Peak House, Sidmouth, for a Prickly Cayenne Pine Apple, weighing 4 lbs. 1 oz.

To Mr. Bradley, Gardener to S. M. Peto, Esq., F.H.S., for Black Hamburgh Grapes.

To Mr. Jennings, Gardener to the Earl of Derby at Knowlsey, for Sweetwater Grapes.

To Mr. Martin, Gardener to Sir H. Fleetwood, Bart., F.H.S., for Black Frontignan Grapes.

To Mr. O'Brien, Gardener to G. Reed, Esq., F.H.S., for a collection of fifteen Stove and Greenhouse Plants.

To Mr. Over, Gardener to W. McMullen, Esq., of Clapham, for a collection of six Stove and Greenhouse Plants in 13-inch pots.

To the same for ten varieties of Cape Heaths in 11-inch pots.

To Mr. Carson, Gardener to W. F. G. Farmer, Esq., F.H.S., for ten species of Exotic Orchids.

To Mr. Ivison, Gardener to the Duke of Northumberland, F.H.S., at Sion, for six species of Exotic Orchids.

To the same for specimens of Carica Papaya.

To Mr. Taylor, Gardener to J. Coster, Esq., of Streatham, for a collection of Helichrysums.

To Messrs. Lane, of Great Berkhampstead, for six of the newer kinds of Greenhouse Azaleas, in 8-inch pots.

To the same for six distinct varieties of Greenhouse Azaleas.

To the same for a collection of Indian Rhododendrons.

To Mr. Dods, Gardener to Sir J. Cathcart, Bart., F.H.S, for six varieties of Cape Heaths in 8-inch pots.

To Messrs. Fairbairn, of Clapham, for a single specimen of Erica Cavendishi.

To Mr. Woolley, Gardener to H. B. Ker, Esq., of Cheshunt, for a collection of Hothouse Ferns.

To Mr. Turner, of Slough, for a collection of Auriculas.

To Mr. May, Gardener to Mrs. Lawrence, F.H.S., for Pultenæa ericifolia.

To Mr. Green, Gardener to Sir E. Antrobus, Bart., F.H.S., for Tetratheca ericifolia.

To Mr. Gaines, of Battersea, for six varieties of Fancy Pelargoniums in 8-inch pots.
To Mr. Pestridge, Gardener to W. Newnham, Esq., of Englefield Green, for six varieties of Calceolarias in 8-inch pots.
To Mr. Davis, of Oak Hill, East Barnet, for a Black Jamaica Pine-apple, weighing 3 lbs. 2 oz.
To the same, for Black Hamburgh Grapes.
To the same, for Sweetwater Grapes.
To Mr. Bradley, Gardener to S. M. Peto, Esq., F.H.S., for Grizzly Frontignan Grapes.
To Mr. Fleming, Gardener to the Duke of Sutherland, F.H.S., at Trentham, for six Murray Nectarines.

The Silver Knightian Medal:—

To Mr. Jarvis, Gardener to J. Ruck, Esq., of Croydon, for a collection of six Stove and Greenhouse Plants in 13-inch pots.
To Mr. Dods, Gardener to Sir J. Cathcart, Bart., F.H.S., for ten species of Exotic Orchids.
To Mr. Kinghorn, Gardener to the Earl of Kilmorey, F.H.S., for six species of Exotic Orchids.
To Mr. Stuart, Gardener to T. Huggins, Esq., of Streatham, for a collection of Helichrysums.
To Mr. Falconer, Gardener to A. Palmer, Esq., of Cheam, for six distinct varieties of Greenhouse Azaleas.
To Mr. Speed, of Edmonton, for six varieties of Cape Heaths in 8-inch pots.
To Messrs. Veitch and Son, for a single specimen of Hexacentris mysorensis.
To the same, for Cattleya Mossiæ.
To Mr. Willmer, of Sunbury, for a collection of Auriculas.
To Mr. Turner, of Slough, for twelve varieties of Pansies in 8-inch pots.
To the same, for six varieties of Cinerarias in 8-inch pots.
To Mr. Turnbull, Gardener to the Duke of Marlborough, at Blenheim, for a Smooth Cayenne Pine-apple, weighing 3 lbs. 5 oz.
To the same, for Keens' Seedling Strawberries.
To Mr. Jennings, Gardener to the Earl of Derby, at Knowlsey, for Black Hamburgh Grapes.
To the same, for May Duke Cherries.

To Messrs. J. and C. Lee, of Hammersmith, for Friesia peduncularis.

To Mr. Moore, Botanic Garden, Chelsea, for Tritoma Rooperi.

To Mr. Fleming, Gardener to the Duke of Sutherland, F.H.S., at Trentham, for fruit of Musa Cavendishi.

To the same, for six Brown Ischia Figs.

To Mr. Dobson, of Isleworth, for twelve varieties of Pansies in 8-inch pots.

To the same, for six varieties of Cinerarias in 8-inch pots.

To Mr. Wiggins, Gardener to E. Beck, Esq., F.H.S., for the same.

To Mr. Dew, of Ham, for Keens' Seedling Strawberries.

May 24th, 1853. (Regent Street.)

I.—ELECTIONS.

The Marquis of Sligo; William Hanbury Jones, Esq., 7, St. George's Road, Eccleston Square; Richard Naylor, Esq., Hooton Park, Chester; Lieutenant-Colonel Gold, Aston Hall, Rotherham; Henry Smith, Esq., Chiswick; Thomas Devas, Esq., Mount Ararat, Wimbledon; and Thomas Smith, Esq., 21, Hyde Park Square.

II.—AWARDS.

Large Silver Medal:—

To Messrs. Lucombe, Pince, & Co., of Exeter, for a very fine variety of Cattleya Mossiæ, having more orange in the lip than common, and for a collection of new hybrid Cape Heaths, consisting of Lindleyana, Exoniensis, pulcherrima, insignis, exquisita, and metulæflora superba; all fine kinds, possessing large bold flowers and bright clear colours; they were stated to have been raised from Massoni, ampullacea, Sprengeli, Hartnelli, and aristata, all, it will be seen, good parents.

Knightian Medal:—

To Mr. Burns, Gardener to Earl Stanhope, F.H.S, at Chevening, for a collection of Vegetables, consisting of Willcove and

Miller's dwarf Broccoli, Fulmer's dwarf Kidney Bean, Horse-radish; Celeriac, a vegetable used in soups, but not now very often seen; Seakale; Jerusalem Artichokes, Asparagus, Red Beet, Cattell's Reliance Cabbage, young silver-skinned and Strasburg Onions, old Potatoes, London Leeks, Mushrooms both large and in the button state, Jerusalem Kale, Victoria, Giant, Linnæus, and another kind of Rhubarb; white and red Turnip Radishes, and a salmon-coloured variety, apparently a good long kind; Walker's white-spined Cucumber, curled and Normandy Cress, Mustard, Chicory, Celery, knotted Marjoram; common and Lemon Thyme, hardy green, white, and Bath Cos Lettuces; Sweet Basil, Fennel, red, common, and variegated Sage; Tarragon, summer and winter Savory, Batavian Endive, Chervil, fine double and giant Parsley, Sorrel, Watercresses, Burnet, round and prickly Spinach, and Italian Corn Salad.

Banksian Medal:—

To Mr. Spivey, Gardener to J. A. Houblon, F.H.S., Esq. of Hallingbury, for a second collection of Vegetables, consisting of new Potatoes, young Carrots, Broccoli; Cabbages, Spinach; Leeks, Asparagus, Seakale considerably past its best, Myatt's Victoria Rhubarb, and Mushrooms. It will be seen that fifty-six varieties came from Chevening, and only ten from Hallingbury; but if the prizes had been offered for anything except collections the case would have been reversed, for upon the whole Mr. Spivey's were best grown; in particular, his Leeks and Broccoli and young Potatoes were very good; but he had no Lettuces; his Asparagus was inferior, and even his Broccoli, though fine, was not first-rate.

To Mr. Lewis Solomon, of Covent Garden, for foreign produce in the shape of a salad consisting of very good Curled Endive, Paris Cos Lettuces as large and fine as they could possibly be produced about London at any season, and red Turnip Radishes.

To Messrs. Lucombe, Pince, & Co., for Andromeda formosa, a charming new white-blossomed evergreen shrub, from Nepal, which has been found to be hardy at Exeter.

Certificate of Merit:—

To Mr. Glendinning, F.H.S., Chiswick Nursery, Turnham Green, for a New Holland plant called Dianella cœrulea, producing a great tuft of Grass-like leaves, from among which issue tall flower-stems, terminating in fine panicles of blue blossoms.

III.—MISCELLANEOUS SUBJECTS OF EXHIBITION.

Messrs. Lucombe, Pince, and Co. contributed the brilliant large-flowered, orange-scarlet Begonia Prestoniensis grown in a greenhouse; Acacia hispidissima, a new kind, with large bright yellow flowers, and apparently sufficiently shrubby to be suitable for pot culture; Viburnum plicatum; and a Calceolaria called Ajax (yellow with brown blotch), which promised to be a good bedding plant.

Messrs. Henderson sent a little shrub (called a Pultenæa), from Swan River.

Mr. Burns, of Chevening, had half-a-dozen White Ischia Figs.

IV.—ARTICLES FROM THE SOCIETY'S GARDEN.

Medinilla magnifica, two species of Begonia, Æschynanthus speciosus and a collection of Vegetables, consisting of round Summer Spinach, and the following Cabbages:—Wheeler's Nonpareil, Early Plaw, Tiley's Early Marrow, the best very early kind, being sweet and tender, with no waste; Early Battersea, alias Fulham or Vanack, the best for a general crop; London Market, a large sort, but a little coarse; Sutton's Early Coomb, Early Nonpareil, and Brown's Early. The same collection likewise contained Linnæus, Victoria, Prince Albert, and Prince of Wales Rhubarb, the latter a short, deep red sort; Cock's Hardy White Cos Lettuce, Victory of Bath and Galway's Victory Cucumbers, and the Virginian Poke (Phytolacca decandra), a plant indigenous to the United States. The leaves of the latter are unwholesome; but the young shoots, which lose this quality by boiling in water, are eaten in North America as Asparagus, These shoots, which make their appearance very early in spring, are cut when about six or eight inches long; they are then scalded with boiling water, and afterwards boiled for twenty minutes in water, with a little salt in it; when dished up a small portion of butter is added. Dressed in this manner, it is considered in America quite as good and delicate as Asparagus.

To the same for ten distinct varieties of Cape Heaths.
To Mr. Williams, Gardener to C. B. Warner, Esq , F.H.S., for twenty species of Exotic Orchids.
To Messrs. Rollisson, of Tooting, for fifteen species of Exotic Orchids.
To Mr. Terry, Gardener to Lady Puller, of Youngsbury, Herts, for twelve varieties of Roses in 13-inch pots.
To Messrs. Lane and Son, of Great Berkhampstead, for the same.
To Mr. Holder, Gardener to the Rev. E. Coleridge, of Eton College, for twelve varieties of Pelargoniums in 8-inch pots.
To Mr. Turner, of Slough, for the same.

The Large Silver-Gilt Medal :—

To Mr. Speed, of Edmonton, for a collection of twenty Stove and Greenhouse Plants.
To Mr. Dods, Gardener to Sir John Cathcart, Bart., F.H.S , for a collection of fifteen Stove and Greenhouse Plants.
To Mr. Taylor, Gardener to J. Coster, Esq., of Streatham, for a collection of six Stove and Greenhouse Plants in 13-inch pots.
To the same for six of the newer kinds of Greenhouse Azaleas in 8-inch pots.
To Messrs. Veitch and Son, of Exeter, for fifteen species of Exotic Orchids.
To the same for Philesia buxifolia.
To Mr. Blake, Gardener to J. H. Schröder, Esq , F.H S., for ten species of Exotic Orchids.
To Mr. May, Gardener to Mrs. Lawrence, F.H.S., for six distinct varieties of Greenhouse Azaleas.
To Messrs Rollisson, for ten distinct varieties of Cape Heaths.
To Mr. Roser, Gardener to J. Bradbury, Esq., F.H S , for ten distinct varieties of Cape Heaths in 11-inch pots.
To A. Rowland, Esq , F.H S., for twelve varieties of Roses in 13-inch pots.
To Mr. Francis, of Hertford, for the same
To Mr. Carrigan, Gardener to E. Lawrence, Esq., of Kentish Town, for twelve varieties of Pelargoniums in 8-inch pots.
To Mr. Dobson, of Isleworth, for the same.
To Mr. Smith, Gardener to F. Newdigate, Esq., of Black-

heath, for six varieties of Fancy Pelargoniums in 8-inch pots.
To Mr. Turner, of Slough, for the same.

The Certificate of Excellence :—

To Mr. Kinghorn, Gardener to the Earl of Kilmorey, F.H S., for a collection of six Stove and Greenhouse Plants in 13-inch pots.
To the same for six of the newer kinds of Greenhouse Azaleas in 8-inch pots.
To Mr. Carson, Gardener to W. F. G. Farmer, Esq., F.H.S., for ten species of Exotic Orchids.
To Mr. Woolley, Gardener to H. B. Ker, Esq., of Cheshunt, for six species of Exotic Orchids.
To Mr. Green, Gardener to Sir E. Antrobus, Bart., F.H S., for six distinct varieties of Greenhouse Azaleas.
To the same for six distinct varieties of Tall Cacti.
To Messrs. Fairbairn, of Clapham, for ten distinct varieties of Cape Heaths.
To Mr. Watson, Gardener to Mrs. Tredwell, of St. John's Lodge, Norwood, for ten distinct varieties of Cape Heaths in 11-inch pots.
To Mr. Taylor, Gardener to J. Coster, Esq., of Streatham, for six distinct varieties of Cape Heaths in 8-inch pots.
To Messrs. Paul, of Cheshunt, for twelve varieties of Roses in 13-inch pots.
To Messrs. Rollisson, for a collection of Variegated Plants.
To Mr. Robinson, Gardener to J. Simpson, Esq., of Thames Bank, Pimlico, for twelve varieties of Pelargoniums in 8-inch pots.
To Mr. Westwood, of Acton Lane, for the same.
To Mr. Miller, Gardener to R. Moseley, Esq., of Pine Apple Place, Maida Hill, for six varieties of Fancy Pelargoniums in 8-inch pots.
To Mr. Ambrose, of Battersea, for the same.
To Mr. Constantine, Gardener to C. Mills, Esq , of Hillingdon, for six varieties of Calceolarias in 8-inch pots.
To Mr. Turnbull, Gardener to the Duke of Marlborough, at Blenheim, for a Queen Pine-apple weighing 3 lbs. 2½ oz.
To the same for an Antigua Queen Pine-apple, weighing 4 lbs.

To Mr. Dodds, Gardener to Col. Baker, F.H.S., for a Providence Pine-apple, weighing 6 lbs. 15 oz.
To Mr. Meredith, Gardener to the Duke of Sutherland, F.H.S., at Cliveden, for Grapes in pots.
To Mr. Frost, Gardener to E. L. Betts, Esq., F.H.S., for Black Hamburgh Grapes.
To Mr. Lushey, Gardener to J. Hill, Esq., of Streatham, for Black Prince Grapes.
To Mr. Rust, Gardener to J. Maclaren, Esq., F.H.S., for Muscadine Grapes.
To Mr Bradley, Gardener to S. M. Peto, Esq., F.H.S., for Muscat Grapes.
To Mr. Henderson, Gardener to Sir G. Beaumont, Bart., Cole-Orton Hall, Ashby-de-la-Zouch, for Grizzly Frontignan Grapes.

The Large Silver Medal:—

1. To Mr. Watson, Gardener to Mrs. Tredwell, of St. John's Lodge, Norwood, for a collection of six Stove and Greenhouse Plants, in 13-inch pots.
To Mr. Ivison, Gardener to the Duke of Northumberland, F.H.S., at Sion, for six species of Exotic Orchids.
To Mr. May, Gardener to Mrs. Lawrence, F.H.S., for a collection of Helichrysums.
To the same for a single specimen of Ixora alba.
To Mr. Taylor, Gardener to J. Coster, Esq., of Streatham, for six distinct varieties of Greenhouse Azaleas.
To the same for Muscadine Grapes.
To Mr. Woolley, Gardener to H. B. Ker, Esq., of Cheshunt, for a collection of Hothouse Ferns.
To Messrs. Pamplin, of Lea Bridge Road, Essex, for ten distinct varieties of Cape Heaths, in 11-inch pots.
To Mr. Smith, of The Cottage, Streatham, for six distinct varieties of Cape Heaths, in 8-inch pots.
To Mr. Terry, Gardener to Lady Puller, of Youngsbury, Herts, for twenty-five varieties of cut Roses.
To Mr. Williams, Gardener to C. B. Warner, Esq., F.H.S , for a collection of Variegated Orchids.
To the same for fruits of Oranges, Citrons, and Lemons.
To Messrs. Osborne, of Fulham, for a species of Oxylobium.
To Mr. Robinson, Gardener to J. Simpson, Esq., of Thames

To Mr. Turner, of Slough, for twelve varieties of Pansies in 8-inch pots.

To Mr. Jackson, Gardener to G Beaufoy, Esq., of South Lambeth, for Grapes in pots.

To Mr. Spivey, Gardener to J. A. Houblon, Esq., F.H.S., for Black Hamburgh Grapes.

To Mr. Hill, Gardener to R. Sneyd, Esq., F.H.S , for Black Prince Grapes.

To the same, for six Elruge Nectarines.

To Mr. Allport, Gardener to H. Akroyd, Esq., of Nantwich, Cheshire, for Muscat Grapes.

To Mr. Fleming, Gardener to the Duke of Sutherland, F.H S., at Trentham, for Noblesse Peaches

To Mr Smith, of Twickenham, for British Queen Strawberries in pots.

To the same, for a dish of British Queen Strawberries.

To Mr. Harrison, of Oatlands Palace Gardens, Weybridge, for a dish of Keens' Seedling Strawberries.

To Mr. Tegg, Gardener to A. Pryor, Esq., F.H S., for a King's Green-fleshed Melon.

The Silver Banksian Medal:—

To Mr. Green, Gardener to Sir E. Antrobus, Bart., F.H S., for six species of Exotic Orchids.

To Mr Taylor, Gardener to J. Coster, Esq , of Streatham, for a collection of Helichrysums.

To Mr. Watson, Gardener to Mrs. Tredwell, of St. John's Lodge, Norwood, for a single specimen of Erica Cavendishi.

To Mr. Carson, Gardener to W. F. G. Farmer, Esq., F.H.S., for Leschenaultia formosa.

To Mr. Turner, of Southgate, for twelve Alpine plants.

To Messrs. E. G Henderson, of St. John's Wood, for Dictyanthus Pavoni

To Mr. Ivison, Gardener to the Duke of Northumberland, F.H.S., at Sion, for Tropical Fruits.

To Mr. Willmer, of Sunbury, for twelve varieties of Pinks in 8-inch pots.

To Mr. Bragg, of Slough, for twelve varieties of Pansies in 8-inch pots.

To Mr. Constantine, Gardener to C. Mills, Esq., of Hillingdon, for Black Prince Grapes.

To Mr. Bucktrout, Gardener to W. L. Gower, Esq., F.H.S., for Muscat Grapes.

To Mr. Hill, Gardener to R. Sneyd, Esq., F.H.S., for Noblesse Peaches.

To Mr. Fleming, Gardener to the Duke of Sutherland, F.H.S., at Trentham, for six Elruge Nectarines.

To Mr. Ironmonger, Gardener to S. R. Heseltine, Esq., F.H.S., for a dish of British Queen Strawberries.

To Mr. Mann, of Isleworth, for a dish of Keens' Seedling Strawberries.

To Mr. Robertson, Gardener to Lady Emily Foley, of Stoke Edith Park, Hereford, for a Golden Queen Melon.

The Certificate of Merit:—

To Mr. Busby, Gardener to J. Crawley, Esq., F.H.S , for six species of Exotic Orchids.

To Messrs. Veitch, for a collection of Helichrysums.

To the same, for a single specimen of Cattleya Mossiæ.

To Messrs. Pamplin, for Epiphyllum cœruleum elegans.

To Mr. Carson, Gardener to W. F. G. Farmer, Esq., F.H.S., for Warrea discolor.

To Mr. Woolley, Gardener to H. B. Ker, Esq., of Cheshunt, for Cypripedium humile.

To Mr. Dobson, of Isleworth, for twelve varieties of Pansies in 8-inch pots.

To Mr. Constantine, Gardener to C. Mills, Esq., of Hillingdon, for a dish of British Queen Strawberries.

June 28*th*, 1853. (Regent Street.)

(The proceedings of this day will be given in the next Number of the Journal.)

July 9, 1853. (GARDEN EXHIBITION.)

On this occasion, as usual, His Grace, the President, gratified the visitors by opening to them his delightful grounds. The morning was wet, but the weather became fair at 11, and remained so, with slight interruption, for the remainder of the day. The Exhibition was excellent for July, and more varied than it was ever before seen in that month. Variegated plants and Orchids in particular were plentiful, and the fruit generally was good. The number of visitors was 7225, exclusive of exhibitors and persons officially employed.

I.—AWARDS.

The Large Gold Medal:—

To Mr. May, Gardener to Mrs. Lawrence, F.H.S., for a collection of twenty Stove and Greenhouse Plants.

The Gold Knightian Medal:—

To Mr. Green, Gardener to Sir E. Antrobus, Bart., F.H.S., for a collection of twenty Stove and Greenhouse Plants.

To Mr. Franklin, Gardener to Mrs. Lawrence, F.H.S., for twenty species of Exotic Orchids.

The Gold Banksian Medal:—

To Messrs. Fraser, of Lea Bridge Road, Essex, for a collection of twenty Stove and Greenhouse Plants.

To Mr. Carson, Gardener to W. F. G. Farmer, Esq., F.H.S., of Nonsuch Park, for a collection of fifteen Stove and Greenhouse Plants.

To Mr. May, Gardener to Mrs. Lawrence, F.H.S., for a collection of six Stove and Greenhouse Plants in 20-inch pots.

To Mr. Williams, Gardener to C. B. Warner, Esq., F.H.S., for twenty species of Exotic Orchids.

To Messrs. Rollisson, Tooting, for fifteen species of Exotic Orchids.

To Mr. Smith, Gardener to W. Quilter, Esq., of Norwood, for ten varieties of Cape Heaths.

To Mr. Bonham, Gardener to Mrs. Maddeford, of Staines, for twelve varieties of Pelargoniums in 8-inch pots.

To Mr. Turner, of Slough, for the same.

To Mr. Bousie, Gardener to the Right Hon. H. Labouchere, Stoke Park, Slough, for six varieties of Fuchsias.

To Messrs. Lane, of Great Berkhampstead, for fifty varieties of cut Roses.

To Messrs. Rollisson, Tooting, for a collection of Variegated Plants.

To Mr. Judd, Gardener to C. P. Lochner, Esq., of Harrow, for twelve varieties of Pelargoniums in 8-inch pots.

To Mr. Gaines, of Battersea, for the same.

To Mr. Miller, Gardener to R. Moseley, Esq., of Pine Apple Place, Maida Hill, for six varieties of Fancy Pelargoniums in 8-inch pots.

To Mr. Gaines, of Battersea, for the same.

To Mrs. Conway, of Earl's Court, Brompton, for six varieties of Scarlet Pelargoniums.

To Messrs. Veitch, of Exeter, for Ceratostema longiflorum.

To Mr. Barron, Gardener to J. H. Vivian, Esq., F.H.S., for a Queen Pine-apple, weighing 4 lbs. 10 oz.

To Lady Bridport, F.H.S., for a Black Prince Pine-apple, weighing 6 lbs. 14 oz.

To Mr. Brown, Gardener to W. Ormsby Gore, Esq , for a Providence Pine-apple, weighing 8 lbs. 15 oz.

To Mr. Bonsie, Gardener to the Right Hon. H. Labouchere, of Stoke Park, Slough, for three specimens of Black Hamburgh Grapes, growing in pots.

To Mr. Henderson, Gardener to Sir G. Beaumont, Bart., of Cole-Orton Hall, Ashby-de-la-Zouch, for Black Hamburgh Grapes.

To Mr. Lushey, Gardener to J. Hill, Esq., Streatham, for Black Prince Grapes.

To Mr. Mitchell, of Brighton, for new Dutch Sweetwater Grapes.

To Mr. Frost, Gardener to Lady Grenville, F H.S., for Muscat Grapes.

To Mr. Allport, Gardener to H. Akroyd, Esq., of Doddington Park, Nantwich, for Black Frontignan Grapes.

The Large Silver Medal:—

To Mr. Kinghorn, Gardener to the Earl of Kilmorey, F.H.S., for a collection of six Stove and Greenhouse Plants in 13-inch pots.

To Mr. Ivison, Gardener to the Duke of Northumberland, F.H.S., for six species of Exotic Orchids.
To Mr. Wiggins, Gardener to E. Beck, Esq., F.H.S., for six varieties of Achimenes.
To Mr. Green, Gardener to Sir E. Antrobus, Bart., F.H.S., for a collection of Helichrysums.
To Mr. Taylor, Gardener to J. Coster, Esq., Streatham, for a collection of Calosanths.
To Messrs. Fraser, of Lea Bridge Road, for ten varieties of Cape Heaths.
To Mr. Over, Gardener to W. M'Mullen, Esq., of Clapham, for ten varieties of Cape Heaths in 11-inch pots.
To Mr. Clarke, of Streatham Place, Brixton Hill, for six varieties of Cape Heaths in 8-inch pots.
To Mr. Salter, F.H.S., for a collection of Fuchsias.
To Messrs Paul, of Cheshunt, for fifty varieties of cut Roses.
To Mr. Terry, Gardener to Lady Puller, of Youngsbury, Herts, for twenty-five varieties of cut Roses.
To Mr. Ambrose, of Battersea, for six varieties of fancy Pelargoniums.
To Mr. Selkirk, of Porters, near Barnet, Herts, for Lapageria rosea.
To Messrs. Veitch, F.H.S., for Aerides quinquevulnera.
To Mr. Ivison, Gardener to the Duke of Northumberland, F.H.S., for a collection of Hothouse Ferns.
To Messrs Lee, of Hammersmith, for a collection of variegated Stove and Greenhouse Plants.
To Mr. Jones, Gardener to the Lady Guest, of Dowlais, for a Queen Pine-apple weighing 4 lbs. 10 oz.
To Mr. Bailey, Gardener to T. Drake, Esq., Shardeloes, Bucks, for an Enville Pine-apple, weighing 5 lbs. 9 oz.
To Mr. Ingram, Gardener to Her Majesty, at Frogmore, for a Providence Pine-apple, weighing 8 lbs. 8 oz.
To Mr. Forbes, Gardener to the Duke of Bedford, F.H.S., for Black Hamburgh Grapes.
To Mr. M'Qualter, Gardener to Col. Challoner, F H.S., for Black Prince Grapes.
To Mr. Stanley, Gardener to J. J. Blandy, Esq., F.H S., for Sweetwater Grapes.
To Mr. Bucktrout, Gardener to W. Leveson Gower, Esq., F.H.S., for Muscat Grapes.
To Mr. Henderson, Gardener to Sir G. Beaumont, Bart., Cole-Orton Hall, for Grizzly Frontignan Grapes.

To Mr. Snow, Gardener to Earl de Grey, F.H.S., for Violette Hâtive Peaches.

To Mr. Brown, Gardener to W. Cartwright, Esq., Aynhoe Park, for Violette Hâtive Nectarines.

The Silver Knightian Medal:—

To Mr. Over, Gardener to W. M'Mullen, Esq., of Clapham, for a collection of six Stove and Greenhouse Plants, in 13-inch pots.

To Mr. Kinghorn, Gardener to the Earl of Kilmorey, F.H.S., for six species of Exotic Orchids.

To Mr. Uzzell, Gardener to the Duchess Dowager of Northumberland, F.H.S., for six varieties of Achimenes.

To Mr. Taylor, Gardener to J. Coster, Esq., of Streatham, for a collection of Helichrysums.

To Messrs. Fraser, of Lea Bridge Road, for six varieties of Calosanths.

To Mr. Wiggins, Gardener to E. Beck, Esq., F.H S., for six varieties of Fuchsia.

To Mr. Francis, of Hertford, for fifty varieties of cut Roses.

To Mr. Evans, Gardener to C. N. Newdegate, Esq., of Arbury, Warwickshire, for twenty-five varieties of cut Roses.

To Mr. Hume, Gardener to R. Hanbury, Esq., F.H.S., for Disa grandiflora.

To Mr. Smith, Gardener to W. Quilter, Esq., of Norwood, for Erica tricolor Alfordi.

To Mr. Woolley, Gardener to H. B. Ker, Esq., of Cheshunt, for a collection of Hothouse Ferns.

To Messrs. Rollisson, for a Nepenthes called Hookeriana.

To Mr. Williams, Gardener to C. B. Warner, Esq , F.H.S., for a collection of variegated Plants.

To Mr. Floud, Gardener to C. Bailey, Esq., for a Black Jamaica Pine-apple, weighing 3 lbs. 13 oz.

To the same, for a Queen Pine-apple, weighing 4 lbs. 10 oz.

To Mr. Chapman, Gardener to J. B. Glegg, Esq., F.H.S., for a Providence Pine-apple, weighing 7 lbs. 12 oz.

To Mr. Frost, Gardener to Lady Grenville, F.H.S., for Black Hamburgh Grapes.

To Mr. Hill, Gardener to R. Sneyd, Esq., F.H.S., for Black Prince Grapes.

To Mr. Wood, Gardener to C. R. S. Murray, Esq , F.H.S., for Muscadine Grapes.

To Mr. Henderson, Gardener to Sir G. Beaumont, Bart., Cole-Orton Hall, for Muscat Grapes.
To Mr. R. Davies, Gardener to J. Dixon, Esq., Astle Park, Knutsford, for six Peaches.
To Mr. Turnbull, Gardener to the Duke of Marlborough, Blenheim, for six Elruge Nectarines.
To Mr. Eastham, Gardener to A. Toy, Esq., East Acton, for Black Eagle Cherries.
To Mr. Jones, of Ealing, for Bigarreau Cherries.
To Mr. Jones, of Old Brentford, for British Queen Strawberries.
To Mr. Fleming, Gardener to the Duke of Sutherland, F.H.S., for Trentham Hybrid Melon.
To M. Daragon, Gardener to H.R.H. the Duc d'Aumale, Orleans House, Twickenham, for a Rock Cantaloupe Melon.

The Certificate of Merit:—

To Mr. Godfrey, Gardener to R. Dawson, Esq., Tottenham, for six varieties of Achimenes.
To Mr. Marsh, Gardener to H. Lee, Esq., Clapham, for the same.
To Mr. Wilkinson, of Ealing, for fifty varieties of cut Roses.
To Mr. Sage, Gardener to W. R. Robinson, Esq., Hill House, Acton, for twenty-five varieties of cut Roses.
To Mr. Munro, Gardener to the Earl of Clarendon, Watford, for the same.
To Mr. Watson, Gardener to Mrs. Tredwell, Norwood, for Calosanthes coccinea.
To Messrs. Lee, Hammersmith, for Mitraria coccinea.
To Mr. Ivison, Gardener to the Duke of Northumberland, F.H.S., for Mimosa pudica.
To Mr. Fleming, Gardener to the Duke of Sutherland, F.H.S., for Muscat de Jesu Grapes.
To Mr. S. Jones, of Ealing, for Black Circassian Cherries.
To Mr. Myers, of Brentford, for Bigarreau Cherries.
To Mr. May, Gardener to J. Watney, Esq., F.H.S., for British Queen Strawberries.
To Mr. Ivison, Gardener to the Duke of Northumberland, F.H.S., for ripe fruit of Vanilla and Allspice.