JOURNAL

OF

THE PROCEEDINGS

OF

THE LINNEAN SOCIETY.

BOTANY.

VOL. I.

LONDON:
LONGMAN, BROWN, GREEN, LONGMANS & ROBERTS,
AND
WILLIAMS AND NORGATE.
1857.

every part except the very sutures, as in *G. Andrewsii*, *G. crinita*, &c. Examining some other genera, we found this to occur also in *Bartonia*, Muhl. (*Centaurella*, Michx.); equally so in both species, *B. tenella* and *B. verna*. In the former species, in which, as in *Obolaria*, four re-entering angles render the cell cruciform, the resemblance to *Obolaria* is striking and complete, as you will see from the enclosed sketch of a transverse section of the ovary of *B. tenella*. The only anomaly of *Obolaria* as a true *Gentianea* which remains, is the imbricative (instead of convolutive) æstivation of its corolla;—of which no parallel instance is known, so far as I am aware. It may however be expected to occur; for useful and reliable as the æstivation of the corolla often is, as an ordinal mark, it is seldom altogether constant.

I think I once mentioned to you an exception of this sort, or rather a variation, which occurs in a family in the arrangement of which you have employed æstivation of the corolla to great advantage, viz. the *Scrophulariaceæ*, in characterizing the *suborders* (as I would suggest they ought not to be called) *Antirrhinideæ* and *Rhinanthideæ*. The same accurate observer, Mr. Clark, long ago showed me that this character occasionally failed in *Mimulus*, especially in *M. ringens* and *M. moschatus*, which almost as frequently present the æstivation of the *Rhinanthideæ* (*i. e.* have some part of the lower lip exterior) as that of the *Antirrhinideæ*, to which the genus belongs. Last summer I noticed a second exception of the kind in a *Pentstemon* (*P. heterandrum*, Torr. & Gray, in Beckwith's Report of a Pacific Railroad Survey), which besides the anomaly of having the fifth stamen sometimes antheriferous and sometimes sterile, had also, in about half of the flowers examined, the lateral lobes of the corolla external in the bud, and covering the two posterior lobes as well as the anterior one.

On the Action of Sea-water on the Germination of Seeds. By Charles Darwin, Esq., Vice-Pres. R.S., F.L.S. &c.

[Read May 6th, 1856.]

During the spring of last year it occurred to me that it would be worth while, in relation to the distribution of plants, to test how long seeds could endure immersion in sea-water, and yet retain their vitality. As far as I knew, this had not been tried by bota-

nists, who would have been far more capable of doing it efficiently than myself; and I now find that M. Alph. DeCandolle, in his admirable work, "Géographie Botanique," regrets that such experiments have not been tried; I think, that had he known even the few facts here to be recorded, some of his opinions on the means of distribution of particular families would have been slightly modified. The Rev. M. J. Berkeley has likewise tested fifty-three different kinds of seeds, and has published a report in the "Gardener's Chronicle*," to which periodical I have also sent two brief notices on the same subject†. I intend here to give, with Mr. Berkeley's kind permission, an account of our joint experiments. I may premise, that not knowing, at first, whether the seeds would endure even a week's immersion, I selected a few by simple chance, taking, however, the seeds of different families; subsequently I have been aided by suggestions from Dr. Hooker.

I must briefly describe how my experiments were tried: the seeds were placed in small bottles, each holding two or three ounces of salt water, carefully made according to Schweitzer's analysis: as both *algæ* and marine animals have, as is well known, long survived in water thus made, there can be no doubt that the experiment was thus fairly tried. Mr. Berkeley sent his seeds to Ramsgate, tied up in little bags and placed in the sea-water, daily renewed; and they were thus immersed for three weeks, and when partially dried, but still damp, were sent off, but by accident were not unpacked for four days subsequently, so that their total immersion "was equivalent to one of more than a month." Some of my bottles were put out of doors in the shade, and were exposed to an average weekly temperature of from 35° to 57°; the other bottles were kept in my cellar, and were exposed to much less variation of temperature, viz. to a daily mean average of from 46° to 56°. Further, to test the effect of temperature, I immersed eighteen different sorts of seeds in salt water, in a tank, which, from containing much snow, was for six weeks at the temperature of 32°, slowly rising for the next six weeks to 44°; but the seeds thus tested did not seem to withstand the injurious effect of the salt water better than those exposed to a higher but variable temperature. I may remark, that amongst the eighteen kinds of seeds immersed in the cold salt water, there were seeds of a somewhat tender constitution, as capsicum and vegetable marrow, but the exposure to the cold in no degree injured their germination. In the case of some of the seeds which I first tried,

* Sept. 1st, 1855. † May 26th and Nov. 24th, 1855.

and which were put out of doors, I did not change the salt water for fifty-six days, and it became putrid and smelt offensively to a quite surprising degree, especially the water with the cabbage, radish, cress and onion seed, which also gave out strongly the odour of each kind; so that I thought the putridity would infallibly have been communicated to the seeds; but judging from the seeds of some of the same plants (but not actually from the same lot of seed) placed in salt water often renewed, and likewise kept in the cellar under a less variable temperature, neither the putridity of the water nor the changing temperature had any marked effect on their vitality. Cress seed (*Lepidium sativum*) and that of *Phalaris Canariensis*, after twenty-two days' immersion, were thoroughly dried for a week and then planted; they germinated pretty well, but the seeds themselves of this particular lot were not very good. At first I tried the seeds after each successive week's immersion, and they germinated at the same period as did seeds of the same kind which had not been salted; celery and rhubarb seed, however, were somewhat accelerated in their germination. Some kinds of seeds, as of *Trifolium incarnatum*, *Sinapis nigra*, peas, kidney and common beans, swelled much in the salt water, and they generally were killed by a short immersion; but the swollen seeds of *Lupinus polyphyllus* germinated better than those which did not swell. I was surprised to observe that most of the seeds of *Convolvulus tricolor* germinated after seven days under the salt water and lived for some time in it; as did likewise the fresh seed of *Tussilago farfara* after 9 days; after 25 days I took out some of the young plants of the *Tussilago* and planted them, and one of them grew: some of the seeds of the garden orache (*Atriplex*) also germinated under water after 56 days' immersion, but I failed in raising the seedlings; the other seeds of the same lot of the orache germinated excellently after 100 days' immersion.

The total number of seeds tried by Mr. Berkeley and myself amount only to 87, for unfortunately we happened to select some of the same kinds; in one respect, however, this has been fortunate, for we have thus tested each other's results, and they accord perfectly as far as they go; the seed of the tomato, however, germinated better after a month's immersion with Mr. Berkeley than after only 22 days with me; but my seed appeared to be old. And this leads me to remark, that I suspect that fresh seed withstands the salt water better than old, but yet good seed; this was the case with *Trifolium incarnatum*, *Phlox Drummondii*,

and I believe with *Sinapis nigra*. Of the genus *Godetia*, Mr. Berkeley found one species was killed by, and another survived, a month's immersion: but a far more curious case is presented by the varieties of the cabbage; for I found that good seed of the "Mammoth white broccoli" germinated after 11 days' immersion, but was killed by 22 days; seed of the "early cauliflower" survived 22 days, but was killed by 36 days; "Cattell's cabbage" germinated excellently after 36 days, but was killed by 50 days; and lastly, fresh seed of the wild cabbage from Tenby germinated excellently after 50 days, very well after 110 days, and two seeds out of some hundreds germinated after 133 days' immersion.

Of the 87 kinds of seeds tried, 23 or more than one quarter did not endure 28 days' immersion: capsicum has endured the trial best, for 30 out of 56 seeds germinated well after 137 days' immersion: of celery seed after the same period of 137 days, only 6 out of several hundreds germinated. The worst germinators have been dwarf kidney beans and *Hibiscus manihot*, both killed by 11 days' immersion; common peas were killed by 14 days'; *Tussilago farfara* germinated under water after 9 days, but the young plants kept alive for some time: the next worse germinators have been *Phlox Drummondii*, *Trifolium incarnatum*, *Linum usitatissimum*, and *Sinapis nigra*, very few of which survived 15 days' immersion.

From such scanty materials it is, perhaps, rash to draw any sort of deduction in regard to the power of resistance to salt water in the different divisions of the vegetable kingdom; but a few remarks may be permitted. Three out of the 17 Endogens and 20 out of the 70 Exogens were killed by a month or 28 days' immersion: this fact, together with the marked power of endurance in the *Atriplex*, *Beta*, *Spinacea*, and *Rheum*, lowly organized exogens, accords with, and is perhaps connected with, the fact, insisted on so much by M. A. DeCandolle, of the wider range of the Endogens and of the lowly organized Exogens, than of the higher Exogens*. The four *Solanaceæ* and two *Umbelliferæ* endured the salt water very well, and each included the longest survivor of all the species tried. Ten *Compositæ* were tried, and only one was killed by a month's immersion, that is excepting the *Tussilago* which germinated under water. Eight *Cruciferæ* were tried, and all withstood the influence well, excepting *Sinapis nigra*, which

* Godron in his "Florula Juvenalis," p. 16, states that the seeds of some plants, as of *Atriplex* and certain *Gramineæ*, germinate perfectly in salt-marshes, where they have been immersed during all the winter under salt water.

was killed by 25 days' immersion; three of the *Cruciferæ* survived 85 days: this power of endurance in the seeds of this family is, perhaps, surprising, considering the oil in their seeds. Nine *Leguminosæ* were tried; these all resisted the salt water badly, with the exception of the hard thin seeds of *Mimosa sensitiva*, which germinated pretty well after 50 days; three species of Lupine seemed just able occasionally to withstand about 36 days' immersion; the seeds of the other *Leguminosæ* having all been killed by much shorter periods. I suspect that it is the water, and not the salt, which kills the *Leguminosæ*; at least I found that a lot of fresh "Thurston Reliance" peas were all killed by 13 days' immersion in pure water*; and I have been assured that a much shorter immersion will kill kidney beans. Lastly, seven species of the allied families of *Hydrophyllaceæ* and *Polemoniaceæ* (six having been selected by Mr. Berkeley) were killed by a month's immersion, and so great a proportion can hardly be accidental.

From the great difference in the powers of resistance to the sea-water in the different families just specified, and even in the varieties of the same species; and from the *Leguminosæ* being apparently in this respect the tenderest, whereas they are generally believed to keep longer than any other seeds in a dry state, I think we may learn a lesson of caution, not to infer with too much certainty which seeds will endure longest when naturally buried in damp earth, from knowing what kinds will keep best in an artificial state.

I had intended trying many more seeds, as I at one time thought that these experiments would have thrown more light on the dispersal of plants than I now think they do. I soon became aware that most seeds, in accordance with the common experience of gardeners, sink in water; at least I have found this to be the case, after a few days, with the 51 kinds of seeds which I have myself tried; so that such seeds could not possibly be transported by sea-currents beyond a very short distance. Some few seeds, however, do float, as I have tried with some of those cast by the Gulf Stream on the coast of Norway. From knowing that timber is often cast on the shores of oceanic islands far from the mainland, and from having met with accounts of floating vege-

* Loiseleur-Deslongchamps says (Consid. sur les Céréales, Part ii. p. 234) that in wheat put into water the embryo comes out in the course of two days; as Mr. Berkeley's wheat survived after 30 days' immersion in sea-water, one may suspect that in this case, the seed would survive longer under sea-water than under fresh water.

table rubbish off estuaries, I assumed that plants, with ripe seeds, washed into the sea by rivers, landslips, &c., might be drifted by sea-currents during a period of some weeks. The closing of the capsules, pods, and heads of the *Compositæ*, &c., when wetted, and their re-opening when cast on shore and dried, the seeds being thus allowed to be driven inland by the first stormy winds, seemed to favour such means of transport. But in putting 34 plants of different orders, with ripe fruit, into salt water, one alone, the *Euonymus*, floated for a month, being buoyed up by its fruit; the others all sunk in 21 days, some in 5, and several in 7, 9, and 11 days. But I am not sure that I have made the trial fairly, for I kept the floating plants in too warm and dark a place, which might have favoured their decay. Finally I may remark, that the seeds of very few species are, as far as we yet know, all killed by 10 days' immersion,—that some plants will float for this period,—that the average rate of the ten currents in the Atlantic Ocean, given in Johnston's "Physical Atlas," is 33 miles per diem (the main Equatorial current running at the rate of 60 miles, and the Cape Stream at 80 miles per diem); and therefore I conclude, under the existing extremely scanty materials for forming any opinion, that some plants might under favourable conditions be transported over arms of the sea 300 or even more miles in breadth; and if cast on the shore of an island not well stocked with species, might become naturalized.

In the following list, to save repetition, I have marked the plants tried by Mr. Berkeley, and which germinated after a month's immersion, with †; when they did not germinate, this is expressly stated. The "cold water" refers to the seeds placed in salt water in the tank with snow.

I have arranged the families in accordance with Lindley's "Vegetable Kingdom."

ENDOGENS.

(Gramineæ.)

Avena (common oats): after 85 days' immersion germinated excellently; after 100 days some germinated; after 120 days some half-germinated.

Hordeum (common barley): germinated well after 28 days, but none after 42 days; in the cold water well after 30 days (†).

†*Triticum* (wheat).

Phalaris Canariensis: after 70 days nearly all germinated; in

another lot after 85, most of the seeds germinated, but the seedlings died off; after 100 and likewise after 120 days' immersion, in each case, a single seedling came up.

Holcus saccharatus: after 36 days germinated fairly; after 50 days all died.

†*Zea Mays*: none germinated after a month's immersion.

†*Arum maculatum.*

†*Anomatheca cruenta.*

†*Babiana plicata.*

†*Trichonema pudicum.*

†*Sisyrinchium iridifolium.*

Canna Indica: after 50 days several germinated, but not very strongly.

†*Colchicum autumnale*: did not germinate.

Allium cepa: after 56 days' immersion, 3 out of 15 germinated; after 82 days in the cold water, most of the seeds grew well; after 100 days, 2 or 3 grew out of about 25 planted (†).

†*Bulbine annua.*

†*Asphodelus luteus.*

†*Uropetalum serotinum*: did not germinate.

EXOGENS.

Ricinus communis (*var. major* and *minor*): both germinated after 36 days.

Cucurbita Melopepo (vegetable marrow): germinated after 100 days; of 4 seeds immersed in the cold water for 82 days, 2 germinated.

†*Cucumis Melo* (melon).

Cistus (mixed shrubby garden varieties): germinated well after 36 days, and some germinated after 70 days.

(CRUCIFERÆ.)

Lepidium sativum: after 85 days' immersion only one out of many germinated; after 56 days $\frac{6}{57}$ grew: in the cold water, after 65 days, $\frac{4}{60}$ grew. (†*var.*, golden cress.) These seeds gave out an astonishing quantity of slime in the salt water.

Brassica oleracea, var. "Mammoth white Broccoli:" germinated after 11 days' immersion, but after 22 days all died.

——— ———, *var.* "Early Cauliflower:" after 22 days, 5 out of 100 germinated; after 36 days all dead.

Brassica oleracea, var. "Cattell's Cabbage:" germinated excellently after 36 days; all dead after 50 days.

——— ———, *var.* growing wild on the Castle Rocks of Tenby; fresh seeds, after 50 days germinated excellently; after 110 days germinated very well; after 133 days only two out of some hundreds germinated (†).

†*Brassica Rapa* (*var.* yellow turnip).

Raphanus sativus: after 85 days, $\frac{2}{3}$ germinated; the cold water seemed to be injurious to these seeds, for after only 30 or 50 days all the seeds were dead (*var.* black radish) (†).

Erysimum Perowskianum: after 36 days germinated well; after 50 only one seed; after 70 days all dead (†).

Matthiola annua: germinated after 28 days; all dead after 54 days.

Sinapis nigra: seeds much swollen; germinated after 11 days; all dead after 22 days: *fresh* seed germinated pretty well after 15 days, but were all killed by 25 days' immersion.

Crambe maritima: after 37 days germinated well.

Tropæolum majus: after 37 days nearly all germinated, but after 50 days none did.

†*Limnanthes Douglasii.*

Hibiscus Manihot: all were killed by 11 days' immersion (†).

†*Malope grandiflora.*

Papaver somniferum: germinated well after 28 days; was killed by 54 days.

Argemone Mexicana: came up excellently after 50 days, and pretty well after 70 days.

†*Chryseis crocea* (germinated very imperfectly after the month).

Linum usitatissimum: after 7 and after 14 days only two or three seeds, out of very many, germinated; after 28 only one seed came up; after 42 days not one germinated. These seeds gave out much slime.

†*Silene compacta.*

Rheum Rhaponticum: germinated well after 82 days.

Atriplex (garden orache): some of the seed germinated under water after 56 days' immersion; the remaining seed germinated excellently after 100 days.

Beta vulgaris: excellently after 100 days (†).

Spinacea oleracea: excellently after 70 days; a few after 120 days; all killed by 137 days (†).

(LEGUMINOSÆ.)

Vicia Faba (*var.* "Johnston's Wonder"): two out of six lived

after 11 days' immersion; one half-germinated after 14 days; after 22 days all dead: many of these beans swelled greatly. I tried sixty after 28 days and found all dead. None survived 30 days in the cold water.

Pisum sativum: after 11 days some germinated; none survived 14 days; none survived 30 days in the cold water. Another lot of *fresh* seed ("Thurston's Reliance") all died after 12 days; none survived 30 days in the cold water. I found 13 days' immersion in pure water killed these latter fresh peas. (†None germinated.)

Phaseolus vulgaris (*var.* "early frame dwarf"): all died after 11 days' immersion; after 28 days' immersion, 80 were planted, but all dead. I tried another lot of *fresh* seed, but none of them resisted even 10 days' immersion; nor did they resist 30 days in the cold water: many of these seeds swelled much (†).

Trifolium incarnatum: all died after 11 days' immersion, and after 30 in the cold water. *Fresh* seed germinated excellently after 5 days' immersion, well after 12 days, and one single seed out of some hundreds germinated after 20 days. These seeds swelled much.

Ulex europæus: after 11 days germinated well; after 14 days two germinated; after 28 days all dead.

Lupinus polyphyllus: after 22 days, out of seven swollen seeds three germinated; seven others did not swell and were all dead; after 36 days' immersion one began to germinate and then died.

Lupinus luteus (pale *var.*): after 22 days $\frac{4}{12}$ lived; after 36 days' immersion $\frac{3}{18}$ germinated; after 50 days all dead.

†*Lupinus pubescens* germinated after a month, but Mr. Berkeley says the greater number were rotten.

Mimosa sensitiva: germinated excellently after 36 days' immersion, and pretty well after 50 days.

Geum coccineum (*var. splendens*): after 36 days germinated well, and after 70 days one single seed germinated.

Saxifraga incurvifolia: did not germinate after 30 days' immersion.

——— *aizoides*, nor did this species, but the seed was not very good.

(SOLANACEÆ.)

Capsicum annuum: after 137 days' immersion, 30, out of 56 planted, germinated well (†).

Solanum tuberosum: germinated excellently after 70 days, well after 100; all dead after 120 days.

——— *lycopersicum* (common tomato): one seed germinated after 22 days' immersion, the rest were killed by 36 and 50 days' immersion. († But Mr. Berkeley found that they germinated after a month.)

†——— *melongena.*

Convolvulus tricolor: after having been 7 days in the salt water, many of the seeds germinated, and the embryos came out of the husks: of those which did not germinate under water, one germinated after 36 days' immersion.

(POLEMONIACEÆ and HYDROPHYLLACEÆ.)

Gilia tricolor († was killed by a month's immersion).

Phlox Drummondii: of old seed none germinated after 11 days; but of fresh seed, 3 out of many germinated after 15 days, and none after 25 days' immersion.

Eutoca viscida.
Nemophila insignis.
——— *atomaria.*
——— *maculata.*
——— *discoidalis.*

† None of these were found by Mr. Berkeley to germinate after a month's immersion.

Borago officinalis: a few came up after 14 days' immersion, one after 28 days, and none after 42 days.

†*Nolana grandiflora.*

Satureja (common savory): after 42 days, 3 seeds out of many germinated.

Campanula Pentagonia († did not germinate after a month's immersion).

†*Fedia graciliflora.*

†*Fedia* (corn salad).

(COMPOSITÆ.)

Lactuca sativa (common lettuce): after 56 days' immersion $\frac{7}{10}$ of the seed came up; after 85 days only one out of several germinated. Cold water had no marked effect, but after 65 days they germinated rather better than the others (†).

†*Cichorium Endivia.*

Galinsoga trilobata: germinated after 22 days.

Aster Chinensis (mixed German varietes): germinated after 28 days; all dead after 54 days' immersion.

Ageratum Mexicanum: after 100 days, one seed out of many germinated; at much shorter periods these seeds did not germinate well.

Leontodon Taraxacum: germinated excellently after 61 days' immersion; the seeds were fresh.

Tussilago Farfara: fresh seeds being placed in the salt water, after 9 days, many of them germinated under water. After 25 days, I took out some of the young plants and planted them: one grew. The germination of these seeds is the more remarkable, as this is not a sea-side plant.

†*Monolopia Californica.*

†*Cenia turbinata.*

†*Cosmos luteus*: did not germinate after a month's immersion.

Clarkia pulchella: germinated well after 28 days; was killed by 54 days' immersion.

†*Godetia rubicunda.*

†——— *Lindleyana* was killed by a month's immersion.

Apium graveolens (*var.* "Cattell's white"): after 137 days only 6 seeds out of some hundreds germinated; after 85 days the seeds germinated excellently; they did not appear to germinate quite so well after 82 days in the cold water (†).

Daucus carota: a very few germinated after 85 days; after only 56 days $\frac{3}{50}$ grew (†).

On the Vitality of Seeds after prolonged Submersion in the Sea.

By James Salter, Esq., M.D., F.L.S. &c.

[Read May 6th, 1856.]

I should not have thought the observations which are the subject of this little communication of sufficient importance to occupy the attention of the Linnean Society, had it not come to my knowledge that one of our most distinguished British naturalists is at present engaged in investigating experimentally the question of the vitality of seeds after prolonged submersion in sea-water, especially in reference to the influence which that circumstance would have in explaining some of the problems of geographical vegetable distribution.

The facts which I am about to detail, and which came accidentally under my notice some years since, bear directly upon this subject, and while, as it seems to me, they establish the doctrine

that certain seeds *do* retain their vitality after submersion in the sea, probably for a considerable period, they suggest also, as far as these instances themselves are concerned, an explanation of the mode in which the seeds may have passed from one locality to another. The facts to which I refer are briefly these:—

In the year 1843, the authorities of Poole in Dorsetshire determined to deepen the channels of Poole Harbour to facilitate navigation. For this purpose a large number of ballast-lighter-barges were employed to scrape the mud from the bottom of the channels and convey it to the shore, where it was deposited in large quantities. During the winter sufficient mud was thus obtained to cover an area of some hundred square yards several feet in thickness, and this was accumulated to such an extent, that a quay was made of the hardened mud on the edge of the shore.

The quay however was never used, nor its surface disturbed.

Early in the following spring I was surprised to see that the surface of this harbour-mud exhibited abundant vegetation, of a character totally distinct from that of the neighbouring shore; and as the season advanced, and the species were recognized, the flora of this mud quay was not only found totally distinct from the littoral vegetation which surrounded it, but it contained plants which did not grow within many miles of the spot, and one which was probably foreign to the county. Immediately surrounding the mud quay was the ordinary vegetation of our southern harbour shores, *Statice*, *Salicornia*, *Atriplex*, *Carices*, &c., whilst on this exposed mud itself not one of them was to be seen; but instead of these there sprung up a large crop of oats and barley, some plants of *Lysimachia vulgaris*, one plant of *Centaurea calcitrapa*, and multitudes of *Epilobium hirsutum*; and besides these there were other plants which I did not recognize, or whose names I have forgotten.

To my mind it appeared conclusive, that the seeds which produced this crop of vegetation must have been in the mud at the time it was deposited on the shore by the lighters.

Taking the plants I have named as constituting part of the vegetation of this new-made land,—they none of them grew in its neighbourhood. The cereals, which constituted the most numerous of the plants, were not cultivated within a mile of the spot. This mud quay was made at the extremity of the peninsula upon which the town of Poole is built, and the nearest field upon which cereals are cultivated is on the other side of the town, and at least a mile from the shore.

Lysimachia vulgaris does not grow within four or six miles of the spot; *Epilobium hirsutum* two or three miles; and *Centaurea calcitrapa* is scarcely known in the county, and certainly not within ten miles of Poole.

Now remembering that none of these plants grew either on the shore around the spot, nor even within miles distant; remembering too that they were the sole occupants of this new-made land, and that the ordinary shore plants, growing in abundance only a few feet from its edges, were not to be seen on it, and further, that this abnormal vegetation showed itself the very next spring, even only a few weeks after it was completed, it must, I think, be conceded, that the seeds were in the mud at the time it was spread upon the shore; and that idea is still further sustained because a very possible explanation suggests itself, which would sufficiently account for the presence of the seeds of the plants named, in the situation from which the mud was obtained. The mud was collected in the main channel about midway between the head and the mouth of the harbour. At the head of the harbour two rivers pour their waters into it, the river Frome and the river Piddle. These rivers take their origin in the western parts of the county of Dorset, and in their course pass through districts having every variety of soil and capable of furnishing vegetation of great diversity; on their banks, moreover, two of the species I have mentioned (*Lysimachia* and *Epilobium*) grow in profusion.

Is it too much to suppose that the seeds from which these plants sprung had fallen into the rivers in various parts of their course, had gone with their waters into the harbour, and ultimately reached the position from which the mud and they had been collected? That explanation appears to me to be very probably correct; but whether it be received or not, the more important point,—that a variety of seeds had been for a period, probably considerable, at the bottom of Poole Harbour, soaking in water as salt as that of the ocean, had retained their vitality till brought under the influence of air and rain and warmth, and had then produced healthy vegetation—that is a point which I think cannot be disputed.