Does Sea-Water Kill Seeds?[1]

As you have done me the honour to notice favourably my wish to ascertain experimentally the power of resistance in seeds to the injurious action of sea-water, you may perhaps like to have a report. As such experiments might naturally appear childish to many, I may be permitted to premise that they have a direct bearing on a very interesting problem, which has lately, especially in America, attracted much attention, namely, whether the same organic being has been created at one point or on several on the face of our globe. As geologist I feel a special interest on the possibility of plants being transported by sea to distant islands, owing to the great influence which it is very obvious the views of the late ever-lamented Edward Forbes[2] have had on the subsequent writings of botanists and zoologists. Forbes, as is well known, boldly supposed that the north coast of Spain had formerly been directly continuous with Ireland, and he extended the continent of Europe as far as and beyond the Azores. To imagine such enormous geological changes within the period of the existence of now living beings, on no other ground but to account for their distribution, seems to me, in our present state of ignorance on the means of transportal, an almost retrograde step in science—it cuts the knot instead of untying it. Weighty objections might, I think, be urged against Forbes' hypothesis as applied in the above and many other cases, but this is not the proper place to discuss such a question. As I had not the least notion when I began, whether or not the seeds would be all killed by a single week's immersion, I at first took only a few, selecting them almost by chance from the different great natural families; but I am now trying a set chosen on philosophical principles by the kindness of Dr. Hooker.

The sea-water has been made artificially with salt procured from Mr. Bolton, 146, Holborn Bars, which has been tested by better chemists than men, namely, by numerous sea animals and algae having lived in it for more than a year. The seeds were placed in separate bottles, holding from 2 to 4 oz. each, out of doors in the shade: the mean temperature has during the period been about 44º, rising during one week to a mean of nearly 48º. Most of the seeds swelled in the water, and some of them slightly coloured it, and each kind gave to it its own peculiar and strong odour. The water in which the Cabbage and Radish seeds were placed became putrid, and smelt offensively in a quite extraordinary degree; and it is surprising that any seeds, as was the case with the Radish, could have resisted so contaminating an influence; as the water became putrid before I had thought of this contingency, it was not, and has never been, renewed. I also placed seeds in a quart bottle in a tank filled with snow and water, to ascertain whether the seeds kept at the temperature of 32º would better resist the salt water; this water, like that in the small bottles, to my surprise became turbid and smelt rather offensively. In the following list I have no reason to suppose, except in the cases where so stated, that the seeds have endured their full time.

(1) Seeds of common Cress (Lepidium sativum) have germinated well after 42 days' immersion; they give out a surprising quantity of slime so as to cohere in a mass. (2) Radishes have germinated less well after the same period. (3) Cabbage seed: after 14 days' immersion only one seed out of many came up; I think this is rather strange considering that the Cabbage is a sea-side plant; in the ice-cold salt water, however, several have come up after 30 days' immersion. (4) Lettuce seed has grown well after 42 days; (5) of Onion seed only a few have germinated after the same period; (6) Carrot and (7) Celery seed well after the 42 days; (8) Borago officinalis, (9) Capsicum, (10) Cucurbita ovifera, have germinated well after 28 days' immersion; the two latter, rather tender kinds, were also tried in the ice-cold water, and have germinated after 30 days' immersion. (11) Savory, or Satureja, has grown somewhat less well after 28 days. (12) Linum usitatissimum: only one seed out of a mass of seeds (which gave out much slime) came up after the 28 days, and the same thing happened after 14 days; and only three seeds came up after the first seven days' immersion, yet the seed was very good. (13) Rhubarb, (14) Beet, (15) Oracle, or Atriplex, (16) Oats, (17) Barley, (18) Phalaris canariensis, have all germinated excellently after 28 days; likewise these six latter after 30 days in the ice-cold water. (19) Beans and (20) Furze, or Ulex: of these a few survived with difficulty 14 days; the Beans were all killed by 30 days in the ice-cold water. (21) Peas germinated after seven days, but were all dead after 14 days' immersion out of doors, and likewise after 30 days in the ice-cold water. (22) Trifolium incarnatum is the only plant of which every seed has been killed by seven days' immersion; nor did it withstand 30 days in the ice-cold salt water. (23) Kidney Beans have been tried only in the latter water, and all were dead after the 30 days.

As out of these 23 kinds of seed, selected almost at hap-hazard, the five Leguminosae alone have as yet been killed (with the exception of the Cabbage seed, and these have survived in the ice-cold water), one is tempted to infer that the seeds of this family must generally withstand salt water much worse than the seeds of the other great natural families; yet from remarks in botanical works, I had expected that these would have survived longest. It has been really curious to observe how uniform, even to a day, the germination has been in almost every kind of seed, when taken week after week out of the salt water, and likewise when compared with the same seeds not salted—all of course having been grown under the same circumstances, namely, in glasses on my chimneypiece, so that the seeds from the day of being planted have been always under my eye. The germination of the Rhubarb and Celery alone has been in a marked degree altered, having been accelerated. With respect to Convolvulus tricolor, not included in the above list, I may mention that many of the seeds germinated and came out of their husks, whilst still in the salt water, after six or seven days' immersion.

To return to the subject of transportal, I may state that in "Johnston's Physical Atlas"[3] the rates of 10 distinct currents in the Atlantic (excluding drift currents) are given, and the average of them is 33 nautical miles per diem; hence in 42 days, which length of immersion seven out of the eight kinds of seed as yet tested have already stood, a seed might be readily carried between 1300 and 1400 miles.

I will conclude this too lengthy communication by observing that all the 40-50 seeds which I have as yet tried sink in sea-water; this seems at first a fatal obstacle to the dissemination of plants by sea currents; but it may be doubted whether most seeds (with the exception of the winged kinds), when once shed, are so likely to get washed into the sea as are whole or nearly whole plants with their fruit by being carried down rivers during floods, by water-spouts, whirlwinds, slips of river-cliffs, &c., continued during the long lapse of geologically modern ages. It should be borne in mind how beautifully pods, capsules, &c., and even the fully expanded heads of the Compositae close when wetted, as if for the very purpose of carrying the seed safe to land. When landed high up by the tides and waves, and perhaps driven a little inland by the first inshore gale, the pods, &c., will dry, and opening will shed their seed; and these will then be ready for all the many means of dispersal by which Nature sows her broad fields, and which have excited the admiration of every observer. But when the seed is sown in its new home then, as I believe, comes the ordeal; will the old occupants in the great struggle for life allow the new and solitary immigrant room and sustenance?

1. *Gardeners' Chronicle and Agricultural Gazette*, no. 21, 26 May 1855, pp. 356-57.

2. Edward Forbes. See, for example, "On Some Indications of the Molluscous Fauna of the Azores and St. Helena," *Report of the Twenty-first Meeting of the British Association for the Advancement of Science; Held at Ipswich in, July 1851* 20(1852):76–77; "On the Extinct Landshells of St. Helena," *Quarterly Journal of the Geological Society of London* 8(1852):197–99; and "On the Manifestation of Polarity in the Distribution of Organized Beings in Time," *Edinburgh New Philosophical Journal* 57(1854):332–37.

3. Alexander Keith Johnston. *The Physical Atlas*: A Series of Maps & Illustrations of the Geographical Distribution of Natural Phenomena Embracing: I. Geology. II. Hydrography. III. Meteorology. IV. *Natural History* (Edinburgh and London: Blackwood, 1850).

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