Germination of Seeds of *Bertholletia excelsa*.

BY

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With Plates IV and V.

THE tree which yields the 'Brazil-nuts' of commerce is a native of Guiana, Venezuela, and Brazil, where it forms forests in the neighbourhood of large rivers. According to Humboldt it attains a height of a hundred to a hundred and twenty feet, the trunk two or three feet in diameter, with large open branches bearing tufts of very close foliage at their summits. The trees flower in March or April, and the fruits ripen in about two months, 'forming in less than fifty or sixty days a pericarp, the ligneous part of which is half an inch thick, and which it is difficult to cut with a sharp saw.' The fruit is spherical, about six inches in diameter, and it contains from fifteen to twenty nuts, arranged with their thin edge inwards. At the apex of the fruit there is an aperture half an inch in diameter, which is closed with a plug formed by the hardened calyx. Humboldt says this plug 'seldom opens of itself. Many seeds from the decomposition of the oil contained in the cotyledons lose the faculty of germination before the rainy season, in which the ligneous integument of the pericarp opens by putrefaction.'

There are various explanations current as to the way the seeds are set free from their iron-like enclosure ; such as that monkeys break the shell by striking it on stones ; or that

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rodents succeed in gnawing through it; or that the seeds germinate whilst inside the pericarp, and the first seedling to push out the plug and emerge through the aperture occupies the whole of it, so as not only to prevent the other seedlings from getting out, but also to provide for its own future in the decayed remains of its brethren, on which it lives until the pericarp has been softened by natural decay.

The arrival at Kew, six years ago, of fresh fruits of *Bertholletia* from Trinidad offered an opportunity to get at the truth of the matter. Accordingly, two of the most perfect were placed, on October 22, 1894, in a bed of moist cocoa-nut fibre kept at a temperature of from 75° to 85° Fahr. They were quite intact, the plugs firmly fixed in the apertures, and it is unlikely that either air or water could find a way in. Some of the fruits received at the same time were broken open, a by no means easy operation. The outside of the pericarp was as hard as well-seasoned oak, whilst the inner lining was even harder, and smooth and glass-like.

After the two fruits had been in the bed a year, on no signs of growth being visible, the shell of one was carefully sawn in half without disturbing the nuts. It was then as hard and water-tight as when it was planted. Germination had begun, and some of the seeds had shoots several inches long. The plug fell out during the sawing operation, and on examining the plug of the second fruit we found that it had shrunk and no longer served to keep out air and light. The cut shell was put together again and bound with wire. It had however been spoilt for the purpose of the experiment, the result of the interference being to hasten the growth of the seedlings and the decay of the pericarp so that a batch of healthy plants resulted.

A seedling pushed through the aperture in the second fruit eighteen months from the time of planting, and it was followed by others until within a few weeks six had found a way through. They grew as well as seedlings under ordinary conditions until they felt the pressure of the ring-like aperture, when the effect was seen in their smaller leaves

and arrested growth. By the thickening of their stems they had completely closed the way to salvation for which they had raced; the mystery was, therefore, how they were sustained; they received no help from us. The pericarp was as hard and apparently as impervious to water as when it was first planted.

The struggle for life continued for the next four years. Now and then a plant would die, but its place was soon taken by another shoot, and this went on until the sixth year. Although it appeared that other seedlings were waiting inside until the death of one of those outside afforded them a chance, yet it seemed more than doubtful that seeds which had germinated about four years before could be still alive without having ever seen the light. An explanation was forthcoming when, on finding the pericarp had softened so that it could be broken away by hand, we decided to open it. This was done on October 22, 1900, exactly six years from the date of sowing.

What we saw is shown by the three photographs here reproduced (Plates IV and V).

I. The fruit with a portion of the pericarp removed, showing the arrangement of the seeds, and the result of the pressure on the lower portion of the stem of the seedlings. Six were alive. The upper part of the stem of one had died, but a new lateral shoot had started again from the base near the seed.

II. The whole of the nuts and seedlings after the pericarp had been removed. The shells of every one of the fifteen nuts which the fruit originally contained were there, and nearly all intact; five had never germinated, and contained only mould-like remains; four had germinated, but perished afterwards; six had formed plants.

III. Three of the seedlings. These show how great the struggle had been: (*a*) has had the life squeezed out of the exposed part of its stem three times, but had still sufficient vigour to start a fourth shoot; (*b*) bears evidences of hard times in the condition of the lower part of its stem; (*c*) has

had the best of the fight from the start, and is by far the strongest of the six seedlings.

It will be noticed that (c) has a few woody roots, whilst the other two have scarcely any. The whole of the kernel of the nuts that were successful appears to have formed a tuber-like reserve capable of sustaining growth without any assistance from roots. The six seedlings are now planted singly in pots of soil and show promise of becoming established.

For explanation of Plates IV and V, see text, p. 101.

I

WATSON.—*BERTHOLLETIA EXCELSA*.

II

WATSON.—BERTHOLLETIA EXCELSA.

b

c

a

III

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