A PRELIMINARY INVESTIGATION ON THE GROWTH OF *CEPHAËLIS IPECACUANHA* (BROT) A. RICH, UNDER TROPICAL CONDITIONS AT CALCUTTA

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INTRODUCTORY

THE first plant of *Cephaëlis Ipecacuanha* was taken to Calcutta by Dr. King in 1866, and in about 1868 experiments with a view to the introduction of the plant into India were begun by Dr. Anderson in the Royal Botanic Gardens, Calcutta. The original stock of plants came from Kew and Edinburgh. Gammie observed that the varieties from Kew and Edinburgh differed greatly, the leaves of the former being more rough and hence more hardy than the latter. Balfour[1,2] had previously described the difference in the character of the leaves between the plants received from Kew and those sent by Gunning from Rio de Janeiro. The leaves of the Kew plants are firmer in texture, somewhat coriaceous, elliptical or oval, with apex rather blunt, and margin wavy. The leaves of the Rio de Janeiro plants are thinner and more delicate in texture, the shape is rather elliptico-lanceolate, the apex pointed, and the margin less wavy; in the young state the leaves are fringed with hairs; the plants grow more freely and are less shrubby. The Kew plants were also characterised by flowers possessing long stamens and short style as described by Hooker[3], while the plants produced from Rio de Janeiro specimens showed two forms of flowers, viz., one with a short style and long stamens as in the Kew plant and the other with a long style and short stamens. Under cultivation by Gammie the Edinburgh plants did not survive for more than a year or two, but plants of the Kew variety, in the shade, lived. The Kew variety thus seemed to be more hardy and more suitable for cultivation in India. Later ipecacuanha was successfully cultivated in the Sikkim Himalayas. The seeds and plants for the present investigation were obtained from a nursery at Labdah. Evidently the original stock of these plants is the Kew variety, and they resemble the description and drawings given by Bentley and Trimen[4] and by Balfour[2]. But to the authors it seems that the characters of the two forms as mentioned by Balfour have become less clearly defined during natural fertilisations at the early period of their acclimatisation in India. The present production of the drug in India is insufficient to meet the demand, and more attention and systematic research is needed to improve the quality and yield.

EXPERIMENTAL

All the preliminary experiments on the cultivation of *Cephaëlis Ipecacuanha* in India show that for favourable growth and development the plant requires:—a forest area with sandy loam soil rich in humus,

potash, magnesia and lime; a minimum temperature of 50°F. and a maximum of 100°F., with smaller variations in temperature during summer and winter and during day and night; and a minimum rainfall of about 90 in. distributed during monsoon, winter and spring.

The experiments reported here were chiefly concerned with germination of seeds, growth of cuttings and of young plants of *Cephaëlis Ipecacuanha* (Kew variety) obtained from Mungpoo under the changed tropical conditions of the plain. The experiments were made under thatched sheds and on prepared soil beds, as is usual in Mungpoo.

Germination from seeds. The seeds, which usually take 4 to 6 months to germinate, have a very hard coat, are plano-convex and 3 to 5 mm. in length. They were sown on prepared beds in December, 1946, and January, 1947. They were watered morning and evening. By the end of April, the December and January sowings started germination almost at the same time. The curved seedlings were very weak and took 15 to 20 days to become erect with the hard seed coat still enclosing the apices of the first pair of leaves. The seedlings were so delicate and the hard seed coats were so tough that it was not possible to remove the seed coats without damaging the seedlings. The seedlings died under these conditions. Later on monthly sowings of seeds and the treatment of the seeds with acids to remove the hard seed coat were tried. The seeds were also subjected to low temperatures for different periods and to alternate high and low temperatures before sowing. But in no case did the seeds sprout even after 6 or 7 months. The causes of dormancy are being studied in detail.

Growth from Cuttings. By the end of February, 1947, some young plants were obtained from Mungpoo. A few cuttings of roots, stems and leaves from two such young plants were made and planted on prepared beds. The cuttings were kept under humid conditions by a cover of wet moss. They were watered every 3 hours during the day with a suitable arrangement to avoid waterlogging. During April some of the root cuttings began to sprout, but the stem cuttings did not and the leaf cutting began to rot. With the approach of the monsoon (i.e., during the months of May, June, July, August and September) more of the root cuttings sprouted and showed progressive activity by the production of minute leaves and 3 to 4 nodes. The internode varied in length from 1 to 2 cm. The activity of the cuttings was best in August. By the beginning of November the root cuttings were affected for the time with browning of the apices of their leaves. Browning progressed with the advance of the month and resulted in gradual drying up of the cuttings.

Growth of young plants. A few of the young plants obtained from Mungpoo by the end of February, 1947, were planted on prepared beds in earthen pots. They were watered every three hours during the day. The leaves of young plants within a few days showed browning of their apices and periphery. Browning progressed from these areas to the middle region of each lamina. As a result, the leaves soon crumpled

and were shed. Microscopical examination of the brown patches of the leaf lamina showed that they were not due to fungal attack, and the anatomical structure of the leaf showed the characteristic tissue development and differentiation of a shade and moisture-loving plant. Frequent spraying with water failed to check the browning of the leaves, and by the end of April all the leaves of the young plants were shed. Though they were completely defoliated, they were alive, as shown by the freshness of their terminal buds, and the gradual appearance of axillary buds gradually increased during the months of May, June, July, August and September. The buds only slightly expanded into one or two pairs of minute leaves. The growth was best in August. By the beginning of November the young plants were again affected with browning of the apices of the small leaves of terminal and axillary buds. Browning of the apices of leaves of the buds similarly progressed very quickly, and by the end of the third week of the month resulted in their drying up.

Experiments under scientificially increased humid conditions. Towards the end of the third week of November, when the root cuttings and the young plants were both showing definite signs of drying up, they were subjected to increased humidity for the purpose of studying its effect upon their growth. Accordingly, on November 21, 1947, the root cuttings and young plants, which were already affected with browning of their leaves, were covered with bell-jars leaving a little space for the access of air; inside each bell-jar a dish containing water was kept. Each morning and evening, fresh air was admitted so as to avoid the accumulation of carbon dioxide. Both root cuttings and young plants responded quickly to this treatment. It was observed that browning of apices of leaves of the root cuttings, which had already started, could not be checked, but, later, new leaves were formed. The effect was more marked in young plants. One of the axillary buds of a young plant near the base of its stem steadily increased in length and in the surface area of its leaves. At the beginning of the experiments the length of the axillary shoot was 1 cm., and 8 weeks later it had increased to 5 cm., while in the same period the length of one of the first pair of leaves of the axillary shoot which was 1·2 cm. and the other one which was 0·6 cm. had increased to 5·3 cm. and 3·1 cm. respectively. Two more pairs of leaves of the axillary shoot were developing by this time.

Discussion

The preliminary experiments in the acclimatisation of plants in India show that the plants can easily be propagated from root cuttings and seeds, and that they prefer moist shady spots where there is much vegetable mould in the soil and an equable steamy atmosphere. The plants and cuttings, especially the roots, showed the best growth in August in nursery conditions but, in artificially increased humidity, during the winter months, the growth was much more than in August. The mean minimum temperature curve of Labdah is always far below that

of Calcutta throughout the year, and in some months the difference is as great as 20°F., whilst the mean maximum temperature curve at Labdah is slightly below that of Calcutta, excepting in the months of July and August. So the mean maximum temperature of the plain may not affect the growth of the plants, but the duration of the maximum temperature in the hills and in the plains is to be taken into consideration. In the hills the mean maximum temperature lasts for a few hours, while in the plains it persists for a longer time. As regards the duration of the mean minimum temperature it is just the reverse. The rainfalls of the two places show wide differences. The total rainfall during a year at Labdah is 137 in., while at Calcutta it is 63 in.

It was seen from these experiments that the high temperature of the summer months, April, May and June, did not prevent the natural growth of the cuttings and young plants and the germination of seeds. Further, under natural conditions, the growth of the cuttings and of young plants improved with the onset of rains, and was found to be the best in August. In November, however, the cuttings and young plants showed the signs of decay as seen by the browning of their leaves. Again, it was found that on increasing the humidity, which was 64, by growing the cuttings and young plants under bell-jars their growth was revived to a great extent as seen by the development of the branches and leaves. Thus from November onwards, through the winter months, the condition of the growth of the cuttings and young plants, if kept in increased humid condition, was much better than what was found in the natural condition during the month of August. The humidity inside the bell-jar may be assumed to approximate to that prevailing in the monsoon, say, in the month of August. The observations indicate the favourable influence of the lower temperature of the winter months as compared with August, provided the humidity is not allowed to decrease, and the mean maximum temperature which persists for a longer duration in the plain appears to be above the optimum temperature, otherwise we would have expected the best growth in August.

The anatomical structure of the leaves also indicates that the plants are sensitive to desiccation, which was supported by the revival of growth of the cuttings and young plants in November when they were grown under the bell-jars in increased humid conditions. The browning of leaves in November can be ascribed to the desiccatory effect of lowering of humidity in that month.

SUMMARY

1. Under the tropical conditions of the suburbs of Calcutta the seeds of *Cephaëlis Ipecacuanha* (Kew variety) sprouted in April, 4 and 5 months after their sowing, but quickly died.

2. The young plants and cuttings, especially the roots, showed the greatest activity in August when the rainfall was 15·4 inches and the mean minimum temperature 79·5°F., whilst in November, when there

was no rain and the mean minimum temperature was 64·6°F., they showed signs of drying up.

3. Artificial increase of humidity at this stage revived the growth of young plants and cuttings. Onwards through the winter months the growth of the cuttings and young plants was maintained.

4. The observations indicate the favourable influence of the lower temperature of the winter months provided that the humidity is not allowed to decrease. The monthly mean maximum temperature of the plains appears to be above the optimum for growth of the plant.

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References

1. Balfour, *Proc. roy. Soc. Edinb.*, 1871/72, 688.
2. Balfour, *Trans. roy Soc. Edinb.*, 1872, **26**, 781, plates 31-32.
3. Hooker, *Curtis's Bot. Mag.*, tab. 4063.
4. Bentley and Trimen, *Medicinal Plants,* Churchill, London, 1880, 2, No. 145.