A PRELIMINARY NOTE ON THE EMBRYO-SAC OF PROTEA LEPIDOCARPON. R.Br.—The Proteaceae form one of the outstanding features of the flora of Cape Colony. As very little is known of the structure and development of the embryo-sac in the Order, an investigation was commenced on *Protea Lepidocarpon*, one of the commonest and best known of the Cape species.

It is a xerophytic shrub often attaining a height of eight feet. It usually exhibits a subsocial tendency. Each terminal bud gives rise to a capitulum. Several sugar-birds and a number of insects visit the flowers in search of the honey which they contain.¹

A preliminary study of *Protea grandiflora* was made in 1906 by Mr. E. P. Phillips, B.A.; the results agree in the main with those obtained for other species of *Protea* which have been examined.

The young ovule arises laterally near the top of the ovary, but turns through an angle of 90° and soon becomes pendulous. There are two integuments, which arise in basipetal succession. While they are making their appearance the sporogenous tissue is also becoming differentiated. A small group of large cells situated below the hypodermal layer includes one which becomes the megaspore mother-cell. By this time a very definite meristematic tissue has arisen at the base of the nucellus. This tissue remains active until about the time of fertilization, and owing to its activity the ovule becomes about 5 mm. long. The megaspore mother-cell increases in size, and divides in the usual manner to a row of four cells. The reduced number of chromosomes is twelve. The four megaspores are readily distinguished from the surrounding cells.

The basal cell of the row rapidly increases in size, while the other three become crushed. The single surviving megaspore increases in length very rapidly, and on division gives the typical eight-nucleate embryo-sac. The usual polar arrangement of the nuclei is very early established. Meanwhile the cells of the nucellus immediately surrounding the embryo-sac become densely packed with starch. The growth of the sac keeps pace with the elongating nucellus, and at the eight-nucleate stage the former is extremely long and narrow, except at the poles, where it is somewhat expanded. The inner integument becomes very long and several cells thick, the outer remaining only two cells thick.

The cells of the inner integument surrounding the micropyle are very large and glandular, and they dovetail more or less into one another. They are also very closely applied to the cells of the tip of the nucellus, which are also somewhat glandular in appearance.

When the embryo-sac has reached its adult form it has forced its way through the tip of the nucellus, and its upper end forms a short wide tube projecting into the micropylar tube of the sac. The antipodal nuclei disintegrate about the time of fertilization.

Owing to the difficulty of obtaining satisfactory preparations of the very large embryo-sac, neither fertilization nor the fusion of the polar nuclei has yet been seen. The first recognizable stage of the embryo was a small group of cells, with definite

¹ Scott Elliott, Ornithophilous Flowers in South Africa. *Annals of Botany*, vol. iv, p. 274.

cell-walls, situated in the micropylar prolongation of the sac. The embryo has no suspensor. In this respect and in its globular form it closely resembles the young embryo of *Penaea*.¹ The endosperm is copious. In many of the South African representatives of the Proteaceae only a small percentage of the flowers set seed. In *Protea Lepidocarpon* only about 30 per cent. of the flowers in the capitulum are fertile, while in some of the other species the percentage is lower. Mr. Phillips found that of the 1260 flowers on five capitula from different plants of *Protea grandiflora*, Thunb., 1067 contained aborted ovaries. A careful search for fertile seeds of this species has not yet met with any success, though seedling plants are occasionally established. In *Protea mellifera*, Thunb., it appears that less than 50 per cent. of the ovaries become aborted.

Irregular protuberances of the nucellus—the origin of which calls for further investigation—penetrate the tissue of the integuments. These are presumably haustorial in function. The nucellar tissue disappears very soon after the appearance of the embryo.

The tetragonal pollen-grains show some peculiarities. The two divisions of the pollen mother-cell are rapid. Here also the reduced number of chromosomes is twelve. After the first division of the mother-cell a thick transitory wall appears between the nuclei. The microspores are in tetrads by the time the megaspore mother-cell is dividing.

These investigations were carried out in the Botanical Laboratory of the South African College, Cape Town, at the suggestion and under the supervision of Professor H. H. W. Pearson. The work was done during the early part of 1908, before the Winter Session at Edinburgh commenced.

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¹ Stephens, E. L. A Preliminary Note on the Embryo-sac of certain Penaeaceae. *Annals of Botany*, vol. xxii, p. 329.

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