CENTENARY OF "THE ORIGIN OF SPECIES"

SOME BOTANICAL ASPECTS

THE Conference arranged by the Botanical Society of the British Isles to celebrate the centenary of the publication of the "Origin of Species" was held during November 27-29 and was well attended by members and visitors.

The President, in his introductory remarks, directed attention to the importance of Darwin's friendship with Hooker in the development of the botanical arguments in the "Origin".

Lady Barlow enlarged on this theme, among others, in the course of a most interesting and illuminating account of her grandfather's botanical activities. She pointed out that, though Darwin had benefited greatly from his taxonomic work on Cirripedia, his work on plants was entirely of an experimental kind and laid the foundations of a great deal of the subsequent development of these branches of botany.

Prof. T. W. Böcher (Institute of Plant-anatomy and Cytology, Copenhagen) traced the development of cytotaxonomy since Darwin's time. He pointed out that though Robert Brown discovered the nucleus when Darwin was twenty-two, and when he was only thirty-nine Hofmeister discovered chromosomes, what is now called cytotaxonomy was not born until this century. He regarded Rosenberg, who in 1909 demonstrated a polyploid series in *Drosera*, as the Father of this branch of botany. Rosenberg had many distinguished pupils, among them Täckholm and Heilborn, who together with Jørgensen, Tischler, Winge and, in Britain, Ruggles Gates, Blackburn and Heslop-Harrison placed the study on a firm footing in the 1920's. Among others who played an equally important part in this early development were Clausen, Hagerup, Langlet, Percival and Senjaninova. Meanwhile, in the U.S.S.R. under Navashin another school grew up more concerned with ideograms and karyotypes than with chromosome numbers.

Both these approaches, combined with the discovery of apomixis, permanent structural hybridity and allopolyploidy by later workers, have been extremely fruitful.

Not least among the benefits which botanists have derived from the growth of cytotaxonomy is the kind of information which should deter them from, as Prof. Böcher said, "attempting species-making in groups where any cutting up into described taxa will, at most, have only local or temporary importance".

The vital necessity of combining careful taxonomic work with cytological studies was pointed out and illustrated by reference to *Campanula rotundifolia* and *Triglochin maritima*, among others. *C. rotundifolia* is a variable complex consisting of rather local diploids, usually clearly distinguished from one another but resembling tetraploids growing in the same neighbourhood, which are themselves widespread and intergrading. The variation here seems to be mostly due to structural hybridity and has so far defied satisfactory taxonomic analysis. In the *Triglochin maritima* complex, on the other hand, there is a polyploid series ranging from $2n$ to $24n$ and at least some of the members of this series have dis-

tinct morphological characters and distributions, and correspond to previously described though not generally accepted species.

After surveying recent work on genera and families, Prof. Böcher pointed out that the names cytotaxonomy, experimental taxonomy, biosystematics or synthetic taxonomy are perhaps superfluous. It might be better just to use the word taxonomy, "presupposing that all taxonomists now and in the future to the best of their ability are cyto-geno-ecochoro-taxonomists".

Prof. W. H. Camp (Connecticut) in the course of an illuminating and entertaining hour described some of the ways in which evolution is occurring in the world to-day, illustrating his lecture with examples from his own experience. During the past century biologists had paid little more than lip-service to Darwin, and it was only recently that we had obtained a real insight into the mechanism of evolution.

His own approach to the problem had been via population genetics, which attempts, to begin with, to discard the classical species-concept and to study either populations in the field or samples of them in cultivation. From studies of this kind series of group concepts develop which are often, though not necessarily, identical with the traditional species, and at the same time a great deal of information is obtained about evolutionary processes which are going on now and often also about those which have taken place in the past. Knowledge of the cytology and breeding systems of the plants with which he is concerned, as well as the 'taxonomic eye', are essential for the accurate interpretation of the biosystematist's observations.

The variation in morphology and ecology in American species of *Fagus* and *Vaccinium* can be explained largely by the effects of Pleistocene changes in climate which gave the opportunity for introgression between a number of distinct but homoploid species, followed by selection for particular combinations of physiological and morphological characters adapted to the various habitats available in post-glacial times. Corroborative evidence for this is provided by the fossil remains of *Fagus* in various parts of the North Temperate regions and by the variation in kind and quantity of alkaloids in the bark of different *Cinchona* populations. In the *Vaccinium corymbosum* complex the situation is further complicated by the production of both auto- and allopolyploids.

Prof. Camp went on to demonstrate the extremely rapid changes which occur in *Viola* populations in response to variations in light-intensity, humidity and other habitat factors. This is a group in which morphological and physiological variation is very great and sterility barriers almost non-existent.

Attempts at subdivision into species seem to be meaningless as there is a continual evolution of new genotypes from chasmogamous flowers and, at the same time, the abundant production of seed from cleistogamous flowers allows of rapid increase of the best-adapted individuals in a population.

In conclusion, he suggested that evolution is perhaps best regarded not primarily as the production

of new species but as the genetic ability of organisms to fill the multitudinous new habitats being constantly presented to them by the changing environment. Species may then be considered as 'ephemeral nodes in the genetic reticulum' within the space-time continuum.

Prof. D. H. Valentine (Durham) spoke about evolution in *Primula* section *Vernales* in which there are nine species, all with $2n = 22$, and all but two, *P. veris* and *P. loftthousei*, capable of crossing with fairly good meiotic pairing in the hybrids. Most species have long peduncles and erect capsules with dry seeds but in three with short peduncles the capsules lie on the ground. Of these *P. vulgaris* has sticky ant-dispersed seeds and occurs over quite a wide area, but the other two, with dry seeds, are very local endemics, the difference being perhaps attributable to the relative efficiency of the dispersal mechanisms.

It is possible to arrange the species of this section in a series based on the ease with which they can be crossed. This does not altogether agree with the morphological sequence, and, in the absence of almost all knowledge of the genetic mechanism and physiological basis of 'crossability', it is impossible to be certain which is nearer the phylogenetic truth. It is clear that evolution in this group has been gradual and continuous and is combined with geographical and ecological isolation rather than sterility barriers. In other sections of the genus, for example *Farinosae*, polyploidy has played an important part.

Dr. N. Hylander (Uppsala) gave an account of some trends in modern research work on Scandinavian plants. He pointed out that a number of species previously unknown in Scandinavia had been discovered, even in the past decade, a remarkable thing in a region which has for long possessed an unusually high concentration of botanists. The possibility of periglacial survival has been the subject of many investigations, and, Dr. Hylander thought, had perhaps been rather overdone. So many species have been added to the list of survivors that the supposed nunataks now gave the impression of having been overpopulated. Endemism in the *Papaver radicum* group, he suggested, might after all be of relatively recent origin. The ecotype concept of Turesson is an important Scandinavian contribution to botany and one which, combined with cytological work, has occupied the attention of many workers.

Variation within agamospecies has been observed in a number of plants and the basis of it investigated by Sørensen and Gudjonsson in triploids of the *Vulgata* group of *Taraxacum*. Here it has been shown that loss of one, or rarely two, chromosomes is responsible for most of the variations, and that *gigas* forms arise through polyploidy. Detailed study of the taxonomy and the method and speed of dispersal of microspecies has yielded much information about plant migrations and the age of different floristic elements.

Prof. I. Manton (Leeds), before proceeding to discuss some aspects of evolution in Pteridophyta, said how much she owed to the stimulation and instruction she had received from both Rosenberg and Prof. W. H. Lang. She then outlined some of the main aspects of the cytology of the group, pointing out that, since high basic numbers and polyploidy were frequent, it was important for cytologists to be well acquainted with the twenty-nine times table. In some tropical species of *Ophioglossum* diploid

numbers greater than 1,000 occur and it is difficult to imagine the mechanism by which pairing is achieved at meiosis.

Allopolyploidy appears to be the chief means by which species have been formed, at least among Polypodiaceae in the broad sense. About 50 per cent of British ferns are known to be allopolyploids, one parent of which is often known; the other parent is sometimes to be found in N. America and most of those at present unknown will probably be found in temperate Asia when that region is better explored botanically.

From a fairly exhaustive study of the cytology of Pteridophyta in Britain, Madeira, Ceylon, Malaya and Tropical Africa it is evident that in this group polyploidy is not a response to cold, as has been suggested for angiosperms. In Ceylon and Tropical Africa 60 per cent of the species so far investigated are polyploids.

Natural hybrids occur among the ferns far more frequently than is generally recognized, but the F_1 generation is often so like one parent that they pass unnoticed. Prof. Manton estimated the number of living species of ferns at approximately ten thousand and between them at the very least five thousand hybrids occur. It is thus evident that ample opportunities exist for continued evolution through allopolyploidy.

Dr. G. D. H. Bell (Plant Breeding Institute, Cambridge) demonstrated how 'pure' cytotaxonomy was being applied to the improvement of crop plants. He made it clear that the highest taxonomic skill combined with a good knowledge of cytology and genetics, and adequate facilities, were essential for this work and that so far, even with *Triticum*, no more than a small beginning had been made.

The collection of wild relatives of crop plants from centres of genetic variation followed by a thorough study of the genetics, cytology and taxonomy of the material provide the basic information, which in *Triticum* has led to a good understanding of the genomes of the cultivated hexaploids. New amphidiploids produced, with the aid of colchicine, from crosses between *Aegilops ovata* and $6n$ wheats have enabled increased genetic variability to be introduced into this important crop plant. Resistance to *Erysiphe graminis*, for example, can be brought in from the *Aegilops* parent and promises to be valuable. A technique has recently been worked out for introducing one or two *Secale* chromosomes into hexaploid wheat through suitable hybridizations, thus giving an entirely new source of variation which may prove of practical importance.

Dr. Bell pointed out that not only was taxonomy *sensu* Böcher the basis of plant-breeding but also that the benefits were reciprocal; indeed, work of this kind could go far towards solving the problem of world food supplies.

An interesting series of exhibits illustrating recent research on the subjects of Darwin's botanical works was on view and directed attention to the variety of lines in which he was the pioneer. It is perhaps not generally known, for example, that he was the first person to use coleoptiles in the experimental investigation of phototropism.

A highly successful and enjoyable meeting concluded with a conversazione and a visit to Down House.

A full account of the Conference will be published by the Society. T. G. TUTIN