Book Reviews

Lewis, W.H.: Polyploidy. Biological Relevance. New York: Plenum Press 1980. 583 pp., 47 figs., 40 tabs. Hard bound U$ 66.00.

'Polyploidy' with the subtitle 'Biological Relevance' traces back to a three day conference held in october 1979 in St. Louis, Missouri. One has to thank Walter H. Lewis, St. Louis, for the edition of the papers presented at the conference. The 25 contributions, each presented by experts in their particular field, offer a comprehensive and, at the same time, detailed survey of the field which by now has become very extensive.

Not only the role of polyploidy in evolution (chapter 1), including the physiology and chemistry of polyploids and its importance to plant breeding and agriculture (chapter 4), is shown. For the first time we are informed about the present day knowledge of polyploidy in the different plant taxa, arranged systematically into algae, fungi, mosses, pteridophytes, gymnosperms and angiosperms (chapter 2). The third chapter deals with polyploidy in animal evolution, presented with data on insects, fishes, amphibians and reptiles. Although within these animals the multiplication of the chromosome-sets plays a less important role than within the plants, especially the angiosperms, the symptoms of polyploidy within the particular animal races are very interesting. For example, insects which are polyploid always reproduce apomictically and frequently the lack of wings is connected with it. Within amphibians polyploidy causes an extreme shift in the sex ratios.

Without criticizing the value of any of the contributions it should be pointed out that the different reports have different weights. It is no wonder that the most experienced expert, G. Ledyard Stebbins, grasps polyploidy in its most elementary aspects best of all. In chapter 5 he presents us with unsolved problems and prospects, calls special attention to the critical results of the preceding, sometimes far diverging, chapters, and at the same time brings them together with a rigorous scientific approach. Everyone working in the field of polyploidy should take note of his clear definition of the conceptions of Auto- and Allopalyploidy; several comparisons of Diploids with for example Tetraploids, especially those in physiology and biochemistry, would become more solid and less misleading, if one would held in mind: 'First and foremost neither evolutionists nor plant breeders will understand their problems completely if they pay too much attention to the process of chromosome doubling itself. This quantitative change in chromosome number and nuclear DNA content is only one of a series of complex processes that must take place for polyploidy to be successful in nature. Hybridization that produces genetic and/or chromosomal heterozygosity, mutation at the polyploid level, inactivation or elimination of duplicate gene loci, and gene-controlled regulation of chromosome pairing: all of these changes are as important for successful polyploid evolution as is doubling or trebling the chromosome number'.

In addition to unsolved problems, several questions have been elucidated by scientific work in the last decades. Thus the distribution of polyploides in nature, which appeared strange for a long time, could be explained for the phanerogames as Stebbins showes in connection with the contribution of Fr. Ehrendorfer. It seems to be a general rule that hybridization and polyploidy in plants preceeds the evolution of apomixis whereas in animals hybridization and asexual propagation are prerequisites of polyploidy. In either case holds true: 'the most valuable advantage of apomixis is preservation of highly adaptive and heterozygous gene combinations'.

Winding like a red thread through nearly all contributions of this book is the recognition that hybridization constitutes the basis for viable polyploids. A separate paper in the breeding chapter is dedicated to maximizing heterozygosity in autopolyploids. It remains therefore all the more unintelligible that nowhere in this book one can read, which biologist was the first to point to this fact of genetically decisive importance (G. Melchers in Zeitschrift für induktive Abstammungs- u. Vererbungslehre, Band 76, 1939, Seite 251). Most of the references don't discuss the historical development of the problems and in this sense are without historical foundation. An exception is Fr. Ehrendorfer, who in 'polyploidy and distribution' appreciates the merits of Hagerup, Tischler and Manton in this field. Who believes the knowledge of the development of a problem reflects only charging the experimentators or the reader, is set right by the contribution of Arne Müntzing dealing with allopolyploidy in Triticale. This particularly impressive article develops the Triticale-problem from the beginning and shows the way in which the progress came about over many decades. This historical view is completed by the representation of the useful substitutional Triticals, their breeding and the analysis of their value. If the reader is new to this field he will get an inside view on how successful breeding work can be linked to the progress in cytology, genetics and also in biochemistry. All who want to work on Triticals will learn what has been done and the methods applied; therefore they will be able to be sparing of their own research time.

Some workshop-reports have been added to part V of this book. Some of them contain the latest methods in biochemistry which can be helpful even in polyploidy-research. The isolation of specific DNA-sequences is not lacking either. The last report deals with the question, whether the new technologies such as tissue culture, microspore culture and protoplast fusion can be applied efficiently in polyploid-breeding. It seems remarkable to me, that E. R. Sears together with G. Kimber, two experts in scientific breeding, affirm the question. They believe that the fusion of protoplasts especially should be suitable for overcoming barriers and for installing parts of a new genome where normal crossing fails.

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