PHYSIOLOGY

Summary of presentations in this section and review of recent years progress

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The physiology of cruciferous plants including oilseed rape has attracted much attention as is evident from the 66 papers presented. The contributions are presentations from 16 countries: Australia, Belgium, Canada, Czechoslovakia, Finland, France, Germany, India, Italy, Japan, Poland, Scotland, Spain, Sweden, United Kingdom, USA. India contributed with 20% of the papers and together with Canada, France, Germany, United Kingdom and USA these 6 countries contributed with nearly 80% of the papers.

It is surprising to see the great amount of time and effort still being devoted to morphological studies, germination and growth analyses, vernalization and determination of seed yield. However, each country has obviously its own problems which influence the types of investigations performed. This can be hydric stress in Spain, frost problems in Finland, short growth seasons which can give serious problems with chlorophyll in the oil as discussed by Canadian groups, and a Canadian wish for early seed growth. A contribution from Scotland reports on effects on the glucosinolate content in rape plants following pest attack by rabbits, deer and insects.

Disease resistance in relation to glucosinolate content, glucosinolate degradation products, and myrosinase activity in different rapeseed varieties has been the subject for comprehensive investigations performed at Rothamsted, U.K. In support of the disease resistance studies is a closely related and encouraging research work on indol phytoalexins and hypersensitive resistance presented by the INRA group, Versailles, France.

Fungicides on the other hand have obviously also physiological effects on the growth of the crops, and the concentration of glucosinolates in the seeds, as demonstrated in a

paper from Rothamsted, U.K. With a new bioregulator used for improving lodging resistance of oilseed rape, a paper from Germany describes that this bioregulator also gives various other effects including increased grain yield.

Several papers from India report on various effects from cadmium and other heavy metals and fungal associated with the plants. In addition to effects on the biomass production, effects on the lipid composition and metabolic changes affecting the phenolics are also reported. Various factors influence thus, according to the above mentioned presentations, the chemical composition of rapeseed.

As described in a contribution from Berlin, Germany, we should also draw attention to the variation in seed glucosinolates as function of seed development. This is also the case with the sulfur supply to rapeseed plants which, according to results presented by the group from Giessen, Germany, has different effects on the seed glucosinolate level depending on the variety. With special regard to double low varieties, sulfur metabolism in oilseed rape plants has been studied in Kiel, Germany. It is stated in this paper, that the role of glucosinolates in plant metabolism not only seems to be restricted to biological interactions, but they also act as a vital storage for sulfur.

In an other paper from Göttingen, Germany, an interesting subject, dealing with studies of the enzymes involved in final steps of indole glucosinolate biosynthesis in different plant organs, has been considered. This work should be considered in relation to corresponding enzyme work performed in Saskatoon, Canada, and presented in the chemistry section (vide supra).

Microspore embryos and somatic embryogenesis in rape have been used in many of the research projects and investigations presented and are e.g. described in contributions from Madison, USA. Microspore-derived embryos of Brassica napus L. have been used by the laboratory in Göttingen, Germany, in studies of fatty acid synthesis. A comprehensive work based on microspore-derived embryos have also been used to study storage lipid biosynthesis in developing oilseed by Canadian research groups. Enzymes of storage lipid biosynthesis, transcription and translation of oil body proteins synthesized late in embryogenesis as well as other subjects have been included in this work.

New technology, including recombinant DNA and plant transformation, has in a fascinating work been used to produce lines of rapeseed with an enhanced content of essential amino acids. This very interesting work performed in Gent, Belgium, describes the altering of genes encoding the 2S albumin storage proteins of Arabidopsis and

transforming these into Brassica napus lines. Plants expressing 2S albumins have an enhanced lysine content.

Finally, a very encouraging work performed at University of Nottingham, deals with composition of cell wall polysaccharides. Work on this type is what we have need of for progress in the field of dietary fibres and in the strongly needed improvements of the digestibility of rapeseed/rapeseed meal and thereby rapeseed quality.

In conclusion:

Techniques based on microspore embryos and somatic embryos are useful for many reserach projects. This can be work on the production of synthetic Brassica napus and interspecific and intergeneric crosses which will permit the general broadening of the genetic base. Development of various breeding methods can be based on such work. We need much more information on the biochemical processes in embryos, and improvements of the techniques with various tissue cultures should be intensified.

Work based on embryos/tissue cultures can with great advantages be utilized in biosynthetic studies as those described on fatty acid and storage lipid biosynthesis. Various enzymes are more easily isolated from tissue cultures than the case is if vegetative plant materials are used as enzyme source. The new technology, including recombinant DNA and plant transformation, will also be the subjects for various research work in the future. It would, however, be recommendable if more attention and resources were placed on biochemical-natural product chemical research in connection with this new technology, including studies of the changes in metabolic processes.

Metabolic processes and sequences of reactions are sensitive to regulation, and studies of metabolic regulation need more attention. Various pest attack on the plants, diseases, chemical treatments, fungicides, bioregulators, fertilization, growth conditions and the plant development change the chemical composition of the plants. These changes occur not only at the place of attack from the herbivore or chemical treatment, on the vegetative part of the plant, but the chemical composition of storage organs as the seeds are also changed.

The metabolism, content and composition in the plants of phenolics and glucosinolates call for attention, and for the latter group especially indolylglucosinolates and transformation products thereof. These compounds are both quantitative and qualitative important in relation to pest and disease resistance, phytoalexins, and the quality of both

seed and vegetative parts of cruciferous plants.

It will be of utmost importance for the research in the future, to go into details with identification of the metabolic changes and accumulated compounds produced as a result of the treatments. This will be a necessity for our understanding of the variations among different plants and possible utilization of the disease and pest resistance. The quality of rapeseed will of course also be a function of the concentration of antinutritional or toxic compounds accumulated as a function of growth conditions, pest or disease attack, and chemicals including pesticides, fungicides and bioregulators as well as altering of genes by use of e.g. recombinant DNA and plant transformations. Research work in the future will require extended collaboration between several specialists and research areas/disciplines for optimal utilization of the resources available.