

**SCIENTIFIC COMMISSION OF THE INTERNATIONAL  
HOP GROWERS' CONVENTION**

**COMMISSION SCIENTIFIQUE DU COMITE INTERNATIONAL  
DE LA CULTURE DU HOUBLON**

**WISSENSCHAFTLICHE KOMMISSION DES INTERNATIONALEN  
HOPFENBAUBÜROS**

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**Minutes of the Lecture Part**

**Scientific Commission of the I.H.G.C., Dobrna-Zalec, Slovenia**

**24 – 27 June 2003**

55 scientists from 15 countries joined the meeting of the Scientific Commission, Slovenia in Dobrna, Slovenia, from 24 –27 June 2003 to discuss latest results in hop research and to exchange experience and knowledge.

In 20 papers and 14 posters scientists presented their work covering the following topics:

- Hop diseases and pests – latest reports
- Hop quality and chemistry
- Gene-based methods in hop research
- Hop breeding

**Session I: Hop diseases and pests – latest reports**

Infections caused by fungi are serious diseases which are associated with significant losses of quality and yield. Therefore, hop researches all around the world are concerned to collect comprehensive knowledge on various fungal pathogens and diseases. Using morphological characterization of fungal isolates and pathogenicity tests the fungal causes of leaf chlorosis, root necrosis and wilting were identified. For a precise diagnosis of *Sphaerotheca humuli* and *Pseudoperonospora humuli*, causing powdery and downy mildew, and for the differentiation of the various *Verticillium* and *Fusarium* species PCR based methods have been established. Especially with the increasing occurrence and spread of a very aggressive form of *Verticillium* wilt in Slovenia in recent years the precise and exact determination of the various *Verticillium* strains using molecular techniques is crucial. In addition, molecular methods have been used for detailed studies concerning the spread, transmission and possible symptoms of HLVd (hop latent viroid) and HSVd (hop stunt viroid) infections.

In all their works scientists are focusing on the demands and problems of the practice. Thus investigations on different fungicides used to control powdery mildew have been conducted to get more information on reported negative effects on yield and quality of hops associated with the application of specific fungicides. While powdery mildew can be controlled effectively, so far all efforts failed to find pesticides to cure hop plants from *Verticillium*. Even alternative substances so-called “homeopathic” products did not show the intended effect.

Extensive studies on the behavior and the development of aphid populations on various hop cultivars with different susceptibility to aphid infestations should elucidate the reasons (hop volatile attracting substances, barrier function of specific epidermis waxes, leaf age) why some hop varieties are more resistant to aphid infestation than others. Traps catching aphids

were tested to monitor the migration behavior. In this way one aspect of an early warning system for aphid infestation should be worked out.

In controlling Damson hop aphid and the two spotted spider mite a combination of biological and chemical strategy seems to be promising. Pests that have developed resistance to various pesticides can be controlled by predatory mites deployed as natural enemies.

## **Session II: HOP CHEMISTRY AND QUALITY**

Low molecular polyphenols are gaining importance as substances determining hop quality. Comprehensive studies show that there are definite differences in the composition of these compounds in vine leaves and hop cones during the whole vegetation period. Thus, in looking for interesting polyphenolics hop leaves should not be completely overlooked. Quality control of hop samples is crucial for our hop chemists. Investigations on various aspects affecting hop quality have been conducted. Alpha acid contents of hop samples have been examined under different storing conditions. Moreover, the influence of powdery mildew infections on quality determining substances has been analyzed. Also the effect of nitrogen fertilization on the nitrate content of hop cones has been the focus of their interest.

The assessment of hop samples is based on chemical and physical methods. At current a more objective and more reproducible technique is worked out to replace the visual inspection of the color of hop samples. Photographic scanner analysis is much more suitable to assess the influence of diseases and pests causing browning of hop samples.

## **Session III: New gene based techniques in hop research**

New perspectives in breeding are opened up by genetic engineering: in Japan, the Czech Republic, Slovenia and in Germany research activities are being focused to elucidate basic knowledge which is crucial to improve hop quality and resistance via gene transfer. Efficient protocols for transformation and regeneration of hop have been worked out. At current research efforts are being made to identify genes controlling key pathways of aroma and bitter compounds or which confer resistance to fungi.

In the genome analytical field there are numerous efforts to explore the genetic makeup of hops using PCR-based methods. In developing AFLPs (amplified fragment length polymorphism) and microsatellites very efficient new marker systems are being developed in hops which can be used to address various genetic issues.

Estimating the genetic variability of the hop germplasm is crucial to hop breeding. Comprehensive molecular investigations of wild hops from all around the globe revealed a huge, however so far only rarely used, genetic potential. In addition, genetic data have been used to elucidate the spatial and temporal evolution of the various wild hop pools in Europe, Asia and America. Special interest is also centered on the identification of DNA markers closely linked to powdery mildew resistance genes. Marker assisted selection should speed up breeding for disease resistant new hop varieties.

## **Session VI: Hop breeding**

In breeding the objectives are directed to meet the demands of the market, of growers and brewers. Main emphasis is placed on breeding of new varieties with fine aroma or bitter quality with high to very high  $\alpha$ -acid contents. Low cohumulone contents combined with high yield and good disease resistance are decisive selection criteria, as well as the storing stability of alpha acids. Increased attention is put on certain hop compounds that are being investigated as anticarcinogenic substances. In new breeding programs the potential for selective breeding to increase the Xanthohumol content is being exploited. Even already established growing procedures are being optimized continuously. Various measures have been worked out, which increase the productivity of hop already in the first year of planting.

The work of the Scientific Commission provides basic knowledge for the development of new hop varieties and for environmentally beneficial and cost-effective production techniques in hops. Thus all these research activities are focused to increase the international competitiveness of hop growers and brewers. All papers and posters presented clearly demonstrated that all hop research institutes and joint universities are working with great commitment. Their results are very promising and so are the perspectives for the near future in hops.

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