

## SCIENTIFIC COMMISSION IHGC SUMMARY REPORT 2005

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UDC/UDK: 633.791 : 061.3 : 001.814 (045)  
review article/pregledni znanstveni članek  
prispelo/received: 22. 08. 2005  
sprejeto/accepted: 15. 10. 2005

### ABSTRACT

The Scientific Commission of the International Hop Growers' Convention (IHGC) aims in promoting high scientific research results in a field of hop breeding, chemistry and quality of hops as well as hop diseases and pests. On its biannual meeting in George, South Africa, from 20-25 February 2005 the 31 scientists and representatives of the hop and brewing industry from 10 different countries all around the globe participated with their research contributions. In 12 papers and 10 posters the hop scientists presented their work covering the relevant topics.

**Key words:** IHGC, hop breeding, hop chemistry, hop diseases and pests

## POVZETEK PRISPEVKOV NA ZNANSTVENI KOMISJI MHZ V LETU 2005

### IZVLEČEK

Znanstvena komisija Mednarodne hmeljarske zveze (IHGC) skrbi za promocijo rezultatov raziskav s področja žlahtnjenja hmelja, kemije in kakovosti hmelja ter varstva hmelja pred boleznimi in škodljivci. Znanstvena komisija zaseda vsaki dve leti. Med zasedanjem komisije v letu 2005 v Južnoafriški Republiki je v času od 20-25 februarja 31 raziskovalcev iz 10 držav predstavilo svoje raziskovalne dosežke s področja hmeljarstva in pivovarstvo. Raziskovalni rezultati so bili predstavljeni v 12 referatih in na 10 posterjih.

**Ključne besede:** MHZ, žlahtnjenje hmelja, kemija hmelja, bolezni in škodljivci hmelja

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## 1 INTRODUCTION

The Scientific Commission of the International Hop Growers' Convention (IHGC) aims in promoting high scientific research results in a field of hop breeding, chemistry and quality of hops as well as hop diseases and pests [1]. Also in 2005, the meeting of the IHGC Scientific Commission in the RSA has proven to be a valuable forum for bringing together hop experts with different backgrounds and responsibilities [3]. In their papers and posters hop scientists presented their current research and together with their partners from the hop and brewing industry they discussed issues facing the hop growers and the hop market in order to develop common strategies for the future [2].

Apart from the scientific part of the meeting there was a chance for an overview about the South African Hop Industry and the SAB Hop Farms. During excursions to the SAB hop yards, current hop varieties and breeding lines could be assessed by the hop experts. In the SAB breeding program main emphasize is put on the development of high-yielding high alpha varieties adapted to the South African growing conditions. During these tours also the whole procedure from the harvest of the hop cones at the SAB Hop Farms and their contract growers to the processing of the hop cones at the SAB facilities was shown. A guided tour through the SAB brewery in Cape Town completed the educational program.

In the paper the sessions' summaries are included together with the incorporated contribution titles and their authors.

## 2 SUMMARY OF THE IHGC SCIENTIFIC COMMISSION 2005

### 2.1 Hop Breeding

High yield, excellent brewing quality and an increased level of resistance to diseases and pests are the stated aims of all hop breeding programs. Following these aims, it is crucial to improve the selection efficiency. In this context the appropriate methods for the assessment of resistance towards the major fungal diseases were presented. To a greater extent the chemical analysis of bitter acids and essential oils of male hops should be exploited to facilitate the evaluation of male crossing partners. Studies were presented which confirmed that high-yielding, high alpha varieties can only be created through the selection of specific parents. Classical cross breeding supported by molecular marker techniques were presented in developing new varieties adapted to the needs of growers and brewers as well. A new perspective in breeding may be genetic engineering. The first transgenic hops expressing a chitinase gene were presented showing increased resistance towards powdery mildew. Other key elements of breeding like the preserving, broadening and characterization of the genetic resources were presented as well. The following contributions were presented:

The assessment of resistance to diseases in the UK breeding programme

**P. Darby**

Stability of the productivity of world hop varieties as an important feature for the selection of parental components

**V. Nesvadba and K. Krofta**

Breeding and development of hop varieties at the Hop Research Center Huell

**E. Seigner, A. Lutz, H. Radić-Miehle and S. Seefelder**

Transfer of a resistance gene into hops

**H. Radić-Miehle and E. Seigner**

Utilisation of chemotaxonomy of male hops for breeding

**K. Krofta and V. Nesvadba**

Genetic sources of hops in the Czech Republic

**V. Nesvadba and K. Krofta**

Cultivation of Czech hop varieties on a farm of Hop Research Institute, Co., Ltd. in Žatec, Czech Republic

**J. Kořen**

Identification of gibberellins and involvement in hop flowering

**N. Fernández Villacorta, M. Á. Revilla and H. Fernández**

## **2.2 DNA-Based Techniques in Hop Research**

In genome analysis various applications of DNA-based markers have been presented. Microsatellites were used to estimate the genetic variability of the hop germplasm, which is crucial to all breeding programs. Genetic maps saturated with AFLPs (amplified fragment length polymorphism) and microsatellites were created: in one work QTL markers associated with alpha acid content could be identified, in another study closely linked AFLP markers for powdery mildew resistance were detected and mapped. Molecular markers were also used to study and elucidate the structure of functional genes involved in metabolic and resistance processes. Comprehensive molecular characterization of *Verticillium* strains revealed differences between mild and lethal isolates. These investigations are of great importance in tracing the spread of a very aggressive form of *Verticillium* wilt in Slovenia. For effective disease management certainly this information is needed. Since HLVd (hop latent viroid) infected plants do not show any symptoms, pathogen diagnosis is only possible using PCR-based techniques. In the case of phytoplasma infections, hops showed morphological changes, but PCR gave the direct proof of this pathogen. It is quite obvious that PCR-based techniques are exploited to establish marker assisted selection and that they are valuable tools for the precise diagnosis of pathogens. The contributions followed as:

Mapping of a powdery mildew resistance gene in hop (*Humulus lupulus* L.)

**S. Seefelder, A. Lutz and E. Seigner**

Hop (*Humulus lupulus* L.) genetic map and QTL analysis

**A. Čerenak, Z. Šatović, and B. Javornik**

Molecular diversity of hops (*Humulus lupulus* L.)

**B. Javornik, J. Jakše, Z. Šatović, N. Štajner, and A. Čerenak**

New molecular markers for hop (*Humulus lupulus* L.)

**J. Patzak, L. Vrba, and J. Matousek**

Characterization of *Verticillium albo-atrum* hop isolates by molecular markers

**S. Radišek, J. Jakše, and B. Javornik**

Callus-derived hop plants show correlation between epigenetic instability and time in culture

**E.L. Peredo, M.A. Revilla, J.M. Martínez-Zapater and R. Arroyo-García**

### 2.3 Hop Chemistry

There is currently much interest in prenylflavonoids and among them especially in Xanthohumol. Since this compound has shown a significant anticarcinogenic potential, hop chemists focus on the analysis of the amount of Xanthohumol and its derivatives in hop varieties and beers. Although specific varieties provide 1% and more of this compound, during the brewing process a high percentage of Xanthohumol is converted into its iso-form. But the production and usage of a xanthohumol enriched hop extract would significantly increase the amounts of this anticarcinogenic substance in beer. The contributions included:

Contents of prenylflavonoids in Czech hops and beers

**K. Krofta, V. Nesvadba, J. Poustka, K. Nováková and J. Hajšlová**

Production of Xanthohumol enriched hop extracts using carbon dioxide as solvent at pressures up to 1000 bars

**R. Schmidt, J. Schulmeyr and M. Gehrig**

### 2.4 Hop Diseases and Pests

Powdery mildew (PM) caused by *Podosphaera macularis* (formerly called *Sphaerotheca humuli*) is a serious disease which is associated with significant loss of quality and yield. Thus, the development of a forecasting model for PM will help growers to apply fungicides more efficiently. Besides fungal diseases, infestations with Damson hop aphids are a problem, especially in hot seasons. Investigations clearly showed that the registration of new efficient aphicides is urgently needed, since aphid populations in the Czech Republic have already evolved resistance to several insecticides. Moreover, for an efficient control of aphids a threshold for economic damage should be established. In another paper factors that influence the application of pesticides were elucidated. In this way valuable information was given about what should be kept in mind when spraying and evaluating the efficacy of pesticides or phytopharmaceutical substances in practice. The following research results were offered:

Development and testing of a forecasting model for powdery mildew (*Podosphaera macularis*) in hops in Bavaria

**B. Engelhard, K. Kammhuber, R. Huber, A. Lutz, H. Hesse**

The resistance phenomenon in damson-hop aphid (*Phorodon humuli* Schrank) in the Czech Republic

**J. Vostřel**

Economic threshold of intervention against *Phorodon humuli* (Schrank, 1801) (Hemiptera: Aphididae) in Leon (Spain): Hop parameters prior to calculation

**A. Lorenzana, A. H. de Mendoza, J.A. Magadán, and M.V. Seco**

Occurrence of Phytoplasma on hops in Poland

**E. Solarska, M. Grudzińska, M. Kamińska, and H. Śliwa**

Infection of HLVd in hop gardens in the Czech Republic

**P. Svoboda, J. Matousek, J. Patzak, and K. Krofta**

Second thoughts about different ways of evaluation of spraying techniques

**M. Kač**

### 3 LITERATURE

1. <http://www.hmelj-giz.si/ihgc/obj.htm> (Sept. 15, 2005).
2. Seigner, E. et al., Proceedings of the Scientific Commission IHGC.- George, RSA, 2025 February 2005, 74 p., ISSN 1814-2206, <http://www.lfl.bayern.de/ipz/hopfen/10585/sc05-proceedings-internet.pdf> (Sept. 15, 2005).
3. Seigner, E., Engelhard, B., Pavlovič, M., Report on the meeting of the Scientific Commission.- Proceedings of the Technical Commission IHGC, BE ISSN 0303-9056, <http://www.hmelj-giz.si/ihgc/doc/1-TC-05.pdf> (Sept. 15, 2005).