Proceedings of the 13th International Wheat Genetics Symposium

April 23-28, 2017 - Tulln, Austria

13th International
Wheat Genetics
Symposium

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Editors
Hermann Buerstmayr, Christina Lang-Mladek, Barbara Steiner, Sebastian Michel, Maria Buerstmayr, Marc Lemmens, Johann Vollmann, Heinrich Grausgruber

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P 161 - Topic: Applying Novel Tools to Practical Wheat Improvement

Vegetative growth and water use efficency characterization of durum wheat near isogenic lines for the QTL *Qyld.idw-3B*

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Key message: The major yield and plant height QTL *Qyld.idw-3B* affect plants growth in late vegetative/reproductive stages but not at earlier stages.

The study of the genetic basis of grain yield is one of the major challenges of the scientific community because of both its complex genetic control and the strong interaction with environment and management practices. Furthermore, such interactions may affect yield during the entire life cycle of the plant. It is therefore crucial to consider yield as the result of multiple simpler traits and thus study their genetic control separately. In this study, we used the phenotyping platform PhenoArch in order to identify growth and water use related traits that may explain the segregation for yield and plant height observed at the QTL *Qyld.idw*-3B by Graziani et al. (2010). Four pairs of durum wheat near-isogenic lines (NILs) for the QTL *Qyld.idw*-3B were grown at three levels of drought stress: no stress (soil water potential > -1 bar), mild stress (soil water potential of -5/-8 bar) and severe stress (soil water potential ≈ -13 bar). The stress was applied at the beginning of stem elongation until the end of the experiment (late milk stage, Zadok 77) on eight replicates per genotype per treatment. We recorded two main types of phenotypic data: (i) canopy images and (ii) weight measurements: every night, digital RGB images were collected. From these images we estimated several growth related phenotypes like biomass, leaf expansion and plant height; every plant was weighted to estimate the evapotranspiration at least once per day. Combining these data, it was possible to evaluate key physiological parameters like water use efficiency (WUE) and leaf transpiration. The QTL seemed to not affect vegetative behaviour and water use of plants during the early vegetative stages while majorly differentiating the NILs couples during the reproductive and earl ripening stages. This explains the segregation for final plant height previously observed by Graziani et al (2010). These results may provide useful information for further phenotypic as well as physiological and genetic characterization of the QTL *Qyld.idw*-3B with a main focus on mid to late stem elongation and reproductive/maturity stages.

Acknowledgements

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Reference

Graziani M, Maccaferri M, Tuberosa R, Feuillet C, Salse J, Demontis A (2010) Fine mapping approaches of two major QTLs for yield in durum wheat. J Biotechnol 150: 501-502.

Short history of International Wheat Genetics Symposia (IWGS)

1st IWGS August 11-15, 1958 in Winnipeg, Canada
2nd IWGS August 19-24, 1963, Lund, Sweden
3rd IWGS August 5-9, 1968, Canberra, Australia
4th IWGS August 6-11, 1973, Columbia, Missouri, USA
5th IWGS February 23-28, 1978, New-Delhi, India
6th IWGS November 28- December 3, 1983, Kyoto, Japan
7th IWGS July 13-19, 1988, Cambridge, England
8th IWGS July 20-25, 1993, Beijing, China
9th IWGS August 2-7, 1998, Saskatoon, Canada
10th IWGS September 1-6, 2003, Paestum, Italy
11th IWGS August 24-29, 2008, Brisbane, Australia
12th IWGS September 8-14, 2013, Yokohama, Japan

FIRST INTERNATIONAL WHEAT GENETICS SYMPOSIUM

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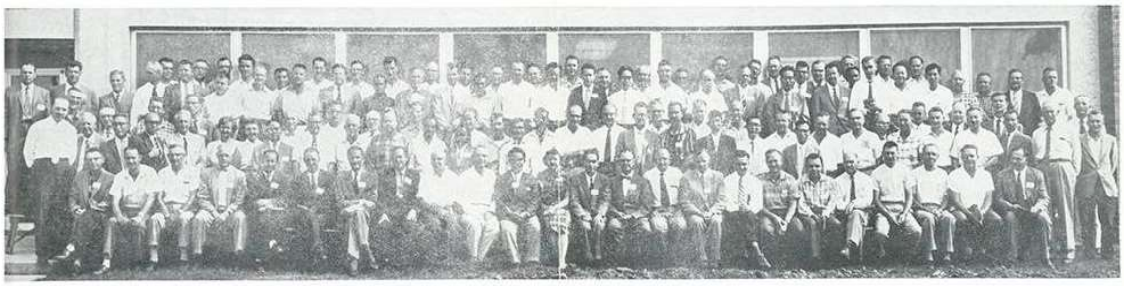
Winnipeg - Manitoba - Canada

AUGUST 11th - 15th, 1958



LEFT TO RIGHT—Sitting: W. H. Johnston, Canada; W. W. Sisler, U.S.A.; E. R. Ausemus, U.S.A.; W. Q. Loegering, U.S.A.; J. C. Fuad, Iraq; N. E. Borlaug, Mexico; R. de Vilmorin, France; H. C. Thorpe, Kenya; A. G. O. Whiteside, Canada; L. P. Reitz, U.S.A.; K. Yamashita, Japan; P. A. Sarvella, U.S.A.; H. Kihara, Japan; B. C. Jenkins, Canada; E. R. Sears, U.S.A.; A. Müntzing, Sweden; R. C. McGinnis, Canada; J. E. Andrews, Canada; O. N. Sosa, Guatemala; J. M. Poehlman, U.S.A.; J. Ortego, Mexico; T. E. Haus, U.S.A.; W. H. Foote, U.S.A.; H. A. Sheybani, Iran.

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International Organizing Committee, Reviewers, and Supporters

Yasunari Ogihara

Kihara Institute for Biological Research, Yokohama City University, Japan

Role: Head of IOC

Yasunari Ogihara teaches Plant Genomics at the Department of Life and Environmental Sciences, Yokohama City University, Japan. He is former head of the Kihara Institute for Biological Research, Yokohama City University.
He would like to contribute production of useful crops for sustainable cultivation with the novel biotechnology. His interest is focused on the functional genomics of polyploid wheat. He contributed to perform the nucleotide sequencing of chloroplast, mitochondira and nuclear genomes of Chinese Spring wheat. He carried out the research work on comprehensive gene expression patterns of common wheat in response to developmental and/or environmental conditions. He applies genomics to improve grain quality and omit allergens of wheat flour. He also aims to improve stresses-resistance of common wheat using genetic and genomic resources. His activities are available at: http://pgenome.sci.yokohama-cu.ac.jp/

Ahmed Amri

International Center for Agricultural Research in the Dry Areas (ICARDA, www.icarda.org), Morocco

Role: IOC and Reviewer

Holds a PhD Genetics and Plant Breeding from Kansas State University (1989); worked at INRA-Morocco for 20 years as cereal breeder (release of 17 barley varieties, 5 triticale and 7 bread wheat and durum varieties resistant to Hessian fly). Ahmed Amri works at ICARDA since 1999 as regional coordinator for a GEF West Asia Dryland Agrobiodiversity project (1999-2005), ICARDA Regional Coordinator for West Asia (2001-2008), Coordinator Iran-ICARDA office (2005-2009) and since 2008, appointed as the Head of Genetic Resources Unit and Deputy Director of the Biodiversity and Integrated Gene Management Program. He has a total of 132 publications including 72 in refereed journals and advised 27 PhD and MSc. students. His expertise is in pre-breeding, breeding of cereals, *ex situ* conservation of plant genetic resources and on approaches for promoting the *in situ*/on-farm conservation of dryland agrobiodiversity.

Alexey Morgounov

International Maize and Wheat Improvement Center (CIMMYT), Winter Wheat Porgram in Turkey, Head of IWWIP (www.iwwip.org)

Role: Reviewer

Several achievements were accomplished in the last 10 years: 1) More than 70 IWWIP originated varieties have been released in the region and occupy more than 2.5 mln ha. 2) National wheat landraces inventory completed in Turkey with collections covering 60 provinces and thousands of lines characterized and evaluated. 3) Winter wheat germplasm resistant to Ug99, stripe rust, common bunt and soil-borne pathogens was identified and distributed through IWWIP international nurseries. 4) Winter hexaploid synthetics were developed, characterized and included into breeding.

Andreas J. Obrecht

Austrian Agency for International Cooperation in Education and Research (OeAD GmbH), Austria

Role: Facilitator for Public Evening Discussion

Andreas Obrecht is a social and cultural anthropologist, writer and sociologist; habilitation in sociology with an emphasis on developmental sociology (1997); head of the Interdisciplinary Research Institute for Development Cooperation (IEZ), Johannes Kepler University Linz (1998-2009); visiting professor for the thematic focus Sub-Saharan Africa and South Pacific at the Department for Contemporary History, Karl Franzens University Graz (1998-2013); since 2004 host for science and culture in the ORF-radio broadcast „Von Tag zu Tag"; since 2009 head of the Commission for Development Research (www.kef-research.at) at the Austrian Agency for International Cooperation in Education and Research (OeAD GmbH) and head of the Austrian Partnership Programme in Higher Education and Research for Development (www.appear.at)

Bernd Friebe

Wheat Genetics Resources Center at Kansas State University, USA

Role: Reviewer

I received my Ph.D. in 1977 from the Free University of Berlin and after postdocs at the Technical University in Munich-Weihenstephan and the University of Manitoba, Winnipeg, I joined the Wheat Genetics Resources Center at Kansas State University in 1991. My research focusses on the molecular cytogenetics and evolution of wheat and its wild relatives with special emphasis on the transfer and characterization of agronomically useful alien genes from distantly related wild species into bread wheat using directed chromosome engineering. I am also involved in the management of wheat genetic resources, germplasms, and genetic stocks.

Cristobal Uauy

John Innes Centre, Norwich, UK.

Role: IOC and Reviewer

Cristobal Uauy is a Project Leader in wheat genetics and genomics at the John Innes Centre. He studied Agronomy in Chile and holds a PhD in Genetics from the University of California, Davis. His work was recognized as the most outstanding PhD dissertation in Biological and Life Sciences in the US and Canada (2007). His programme focuses on the identification of genes involved in wheat productivity traits, including grain size/yield, and the development of tools and resources to enhance scientific discovery. Uauy is using molecular genetic approaches to identify these genes and enhance the pipeline to translate new knowledge at the molecular level into improved wheat varieties for growers, industry and consumers. Cristobal's work has been recognized through the Bayer Foundation Early Excellence in Science Award (2012) and the Society of Experimental Biology President's Medal (2014).

Elena Salina
Laboratory of Plant Molecular Genetics and Cytogenetics at the Institute of Cytology and Genetics (IC&G) in Novosibirsk, Russia.
Role: IOC and Reviewer

Head of the laboratory, joined the Institute in August 1981 after graduation from Moscow University. Her main scientific interest was connected with reorganization wheat genome during remote hybridization, amphi-ploidization and evolution. The last years one of the research directions of her lab was focused on identification genes and alien translocations responsible for wheat agricultural traits such as resistance to disease, heading time, spike morphology. This information is then used for improving methods and strategies for harnessing allelic diversity of wheat relatives and hybrids and using its in wheat breeding. Elena Salina is a team leader in IWGSC since 2007 and responsible for physical mapping and sequencing of 5BS chromosome.

Eva Stoeger
University of Natural Resources and Life Sciences Vienna, Austria
Role: Speaker at the Public Evening Discussion

Eva Stoeger is Professor of Molecular Plant Physiology at the University of Natural Resources and Life Sciences in Vienna, Austria. Eva Stoeger holds a PhD from from the University of Vienna. Further stages in her career brought her to the University of Florida (USA), the John Innes Centre, Norwich (UK), and at the Aachen Technical University (Germany). Her main research interests are in the areas of cereal biotechnology, endomembrane dynamics and the production of high-value recombinant proteins in seed crops. http://www.boku.ac.at/en/personen/person/EDCFD1D522BED587/

Franziska Löschenberger
Saatzucht-Donau, Probstdorf, Austria
Role: Speaker at the Public Evening Discussion

Franziska graduated at the University of Natural Resources and Life Sciences Vienna, she did her PhD studies in the field of doubled haploids in wheat. She is working for Saatzucht-Donau, a medium sized Austrian plant breeding company as wheat breeder. She has attained 175 cultivar registrations of 100 bread wheat and durum wheat cultivars in 18 countries on three continents. She has till now developed 50 winter wheat cultivars from crossing to cultivar registration. Her breeding program covers wheat cultivars for conventional farming and for organic farming, with a particular emphasis on stable performance, resilience and superior end use quality. http://www.saatzucht-donau.at/

George Fedak

Ottawa Research and Development Centre, Agriculture and Agri-food Canada, Ottawa, Ontario, Canada
Role: Reviewer

George Fedak is a principal research scientist at the Ottawa Research and Development Centre of Agriculture and Agri-food Canada in Ottawa, Canada.
His main research interests focus on cytogenetic studies of interspecific and intergenic hybrids in wheat for progress of resolving genomic relationships and transfer of disease resistance from the alien species to wheat. Thus far QTL for resistance to Fusarium head blight from five alien species have been introgressed into wheat and mapped. These genes are being pyramided and used to augment FHB resistance in spring wheat breeding programs. For resistance to Ug99, pyramids of up to four known resistance genes have been built up by mean of DH technology and markers. The pyramids have been crossed and backcrossed into spring and winter varieties and widely distributed to wheat improvement programs. The screening of cytogenetic stocks and alien species for Ug99 resistance has revealed numerous sources of resistance. Procedures are underway to introgress these into wheat.

Hans-Joachim Braun
CIMMYT – Centro Internacional de Mejoramiento de Maíz y Trigo, Mexico
Role: speaker at the public evening discussion

He serves as the Director of CIMMYT's Global Wheat Program (GWP) since 2006 and Director of the CGIAR Research Program on Wheat (WHEAT) since 2015. Based in Mexico, Braun leads and manages 40 internationally recruited scientists as part of the GWP. His achievements include contributing to the development and release of 44 winter wheat varieties grown on 2 million hectares in Central and West Asia. Prior to his current position, Dr. Braun led the Turkey International Winter Wheat Improvement Program. During his 20 years in Turkey he was also involved in identifying Zn deficiency and soil borne diseases as production constraints for wheat production in rainfed areas of Central Anatolia and other regions in West Asia. In 2003 he received the Chinese Friendship Award for his contributions to wheat improvement in Gansu Province. Braun currently holds positions as a board member for the Wheat Initiative and the International Wheat Yield Partnership.

Hélène Lucas
Institut National de la Recherche Agronomique, France
Role: IOC and Reviewer

After a scientific career dedicated to the analysis of plant genomes organisation and evolution, with a special focus on retrotransposons, Hélène Lucas took the role of Head the Genetics and Plant Breeding Division of INRA (2005-2011). As its International Scientific Coordinator, she established successfully the G20-endorsed Wheat Initiative from 2011 to 2016, while chairing the Managing Board of the French "Plant Biotech" Public-Private Partnership Scientific Group. She is now Scientific Advisor to the President and CEO of INRA.

Helmut Haberl

Institute of Social Ecology, Alpen Adria Universitaet Klagenfurt/Graz/Wien, Vienna Austria

Role: Keynote Opening Speaker

Helmut Haberl studied biology, ecology and mathematics at the Universities of Vienna and Salzburg. PhD 1995, Habilitation 2001, both University of Vienna. He currently serves as director of the Institute of Social Ecology at the Alpen-Adria Universitaet Klagenfurt, Wien, Graz in Vienna. His mission is to contribute to sustainability through inter- and transdisciplinary research on society-nature interaction, with a focus on society's use of biophysical resources such as raw materials, energy, and land. He has pioneered socioecological sustainability indicators such as the human appropriation of net primary production (HANPP) as well as indicators for the energetic metabolism of societies and contributed to the emergence of the research field of Long-Term Socio-Ecological Research (LTSER). He served on the SSC of the Global Land Project, the Scientific Committee of the European Environment Agency and in contributed to the Global Energy Assessment, IPCC's Fifth Assessment Report (AR5, WGIII) and the Austrian Panel on Climate Change's (APCC) first Austrian Climate Assessment Report 2014. Further information is available at: http://www.uni-klu.ac.at/socec/eng/inhalt/885.htm

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Hermann Buerstmayr

University of Natural Resources and Life Sciences Vienna, Austria

Role: Head of LOC and Reviewer

He teaches Plant Breeding at the University of Natural Resources and Life Sciences Vienna. His mission is to contribute to sustainable improvement of crop production through genetics and genomics research and capacity building. His main research interests focus on disease resistance in crop plants, particularly on wheat. He is recognized as a leading expert in Fusarium head blight resistance research. He aims to combine germplasm improvement, with classical and molecular genetics and genomics in order gain novel knowledge. At the same time improved germplasm, sometimes from exotic sources and wild relatives, is generated and made available for practical breeding. Further information is available at: http://www.ifa-tulln.boku.ac.at/en/institut-fuer-biotechnologie-in-der-pflanzenproduktion/

Mark E. Sorrells

Cornell University, Ithaca, USA

Role: IOC and Reviewer

Mark E. Sorrells joined the faculty at Cornell University in the Department of Plant Breeding & Biometry in 1978. Currently, he is a Professor in the Department of Plant Breeding & Genetics. The primary focus of Dr. Sorrells' research program is on breeding methodologies incorporating new technologies such as high throughput phenotyping and genomic selection. His breeding program has released 18 small grains varieties. He has published more than 260 papers in peer-reviewed journals and served as major advisor to 37 PhD students and 15 M.S. graduate students. Further information is available at: http://smallgrains.cals.cornell.edu

Parveen Chhuneja

School of Agricultural Biotechnology, Punjab Agricultural University, Ludhiana, India
Role: IOC and Reviewer

Dr. Parveen Chhuneja has been working on wheat hybridization for more than 20 years and presently is the Director, School of Agricultural Biotechnology, Punjab Agricultural University, Ludhiana. She has identified and transferred a number of novel alleles and genes from progenitor and non-progenitor Aegilops and Triticum species to cultivated wheat. Her group has transferred and mapped a number of alien genes for disease resistance, productivity and quality traits which are being used in the wheat varietal development programme for diversifying the breeders' germplasm base. Dr Chhuneja is responsible for maintaining and utilising the largest collection of wild species of wheat among all the National Institutes and SAUs in India. She has supervised 17 post-graduate students. Dr Parveen Chhuneja has worked as visiting scientist at Institute of Plant Molecular Biology, University of Zurich, Switzerland and John Innes Centre, UK. Dr Chhuneja has also been awarded Merit Certificate and Plaque by her University in recognition of her outstanding research contributions. She has been awarded Dr Gurdev Singh Khush Distinguished Professor award by her institution for 2016-19.

Peter Langridge

Wheat initiative and University of Adelaide, Australia
Role: IOC and Reviewer

Peter is Emeritus Professor at the University of Adelaide, Australia. Peter established the Australian Centre for Plant Functional Genomics (ACPFG) and was appointed Chief Executive Officer in 2003. In 2014 Peter resigned as CEO of ACPFG to focus on his role on the boards of several research organisations in Europe, North America and in developing countries. Peter's interests have focused on the role of modern technologies in crop improvement with a particular focus on the importance of science and education in helping to improve food security. Further information is available at: http://www.adelaide.edu.au/directory/peter.langridge

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Peter Sharp

University of Sydney, Australia
Role: Reviewer

Peter Sharp teaches in the areas of genetics, plant breeding and biotechnology in the School of Life and Environmental Sciences at the University of Sydney. He is Head of the Plant Science Cluster in the School, and is Director of the university's Plant Breeding Institute, which is at two locations; Cobbitty near Sydney, and Narrabri, in the NW cereal growing area of NSW. His research in wheat is on molecular markers, mapping of grain quality and agronomic traits, and diversity generation –TILLING and use of wild relatives. Outputs from his research (linkages and germplasm) are being used by commercial breeders. Further information is available at:
http://sydney.edu.au/agriculture/academic_staff/peter.sharp.php

Ravi Prakash Singh

Global Wheat Program, CIMMYT – Centro Internacional de Mejoramiento de Maíz y Trigo
Role: IOC and Reviewer

Dr. Ravi P. Singh has made highly significant contributions in the generation and application of science that has enhanced food production and security in numerous developing countries during his 33 years' scientific career at CIMMYT where he is Distinguished Scientist and leads the Wheat Improvement and Rust Research. He is also Adjunct Professor in Cornell and Kansas State Universities. Dr. Singh's research on rust epidemiology and durable resistance are widely recognized and he has contributed and led to the development of over 400 more productive, disease resistant, stress tolerant and nutritious wheat varieties released and widely grown by National program partners in many countries of Asia, Africa and Latin America. He has authored or coauthored 234 research and review articles in peer reviewed journals. Dr. Singh is also recipient of various awards and recognitions including Outstanding CGIAR Scientist Award, Crop Science Research Award by CSSA, E.C. Stakman Award by Univ. of Minnesota, and Friendship Award by the China State Council.

Ruth Wanyera

Kenya Agricultural and Livestock Research Organization Njoro, Kenya
Role: IOC and Reviewer

Ruth a Principal Research Scientist at Kenya Agricultural and Livestock Research Organization Njoro. She is head of Plant Plant Pathology and National Wheat Coordinator. Ruth has extensive research experience in wheat rust diseases, including phenotyping, surveys and surveillance. She has contributed to the release of wheat varieties with adult plant resistance to the wheat stem rust race Ug99 and its variants. She also has good background and research knowledge on sunflower, soybean and canola diseases and seed health. She has coordinated research projects funded by International, regional and national bodies. Has won a number of awards including the 2015 Borlaug Global Rust Initiative (BGRI) Gene Stewardship Award, Sydney, Australia. A mentor of a number of university students (Msc and PhD).She aspires to mentor young women scientists, contribute to improving food security in her country by sharing knowledge, experience and learning from other scientists what they have in terms of current innovations and technologies.

Silvia Germán

Instituto Nacional de Investigación Agropecuaria, Uruguay (www.inia.uy).
Role: IOC and Reviewer

Principal Researcher at La Estanzuela Experimental Station, with main focus on wheat breeding for disease resistance, genetics of resistance and rust pathology. Works on the development of bread wheat germplasm resistant to multiple diseases, study of the basis of resistance to rusts and Fusarium Head Blight, and variation and evolution of wheat rusts.

Simon Krattinger

University of Zurich, Switzerland
Role: Reviewer

Simon Krattinger's main research interests focus on the molecular understanding of fungal disease resistance in cereals. One aim of the group consists in the development of novel approaches to rapidly isolate agriculturally important genes. In particular, the group works towards a better understanding of broad-spectrum and durable disease resistance.

Susanne Weber

University of Natural Resources and Life Sciences Vienna, Austria
Role: Symposium Secretary

Susanne holds a master degree from the University of Natural Resources and Life Sciences Vienna. She joined the Department of Agrobiotechnology Tulln only one year ago. She is the master mind behind the organization and practical implementation of IWGS 2017.

Thomas S. Payne

CIMMYT – Centro Internacional de Mejoramiento de Maíz y Trigo
Role: Reviewer

Tom Payne (Ph.D.) is currently in charge of the world's largest, publically available, collection of wheat and its related species, held by CIMMYT. The collection consists of over 125,000 accessions collected or donated by nearly 80 countries. He is also responsible for CIMMYT's international maize and wheat germplasm testing unit, which since the 1960's has dispatched annually hundreds of experimental varieties, free-of-charge, to public and private sector researchers globally for experimental testing and release. During the 1990's, Tom spent six years with CIMMYT based in Zimbabwe and Ethiopia, coordinating European Commission funded regional maize and wheat improvement networks, with other long-term postings in Mexico, Turkey, Syria and Yugoslavia.

Wolfgang Spielmeyer

CSIRO Agriculture & Food, Canberra, Australia
Role: Reviewer

Research interests: Molecular genetics of important traits in wheat including rust resistance, crop establishment and carbon partitioning. Major focus is on using mutagenesis to generate novel variants and next-generation sequencing technologies to identify functional mutations and genes that generate basic knowledge of mechanisms and can be used to develop accurate selection tools for the industry.

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