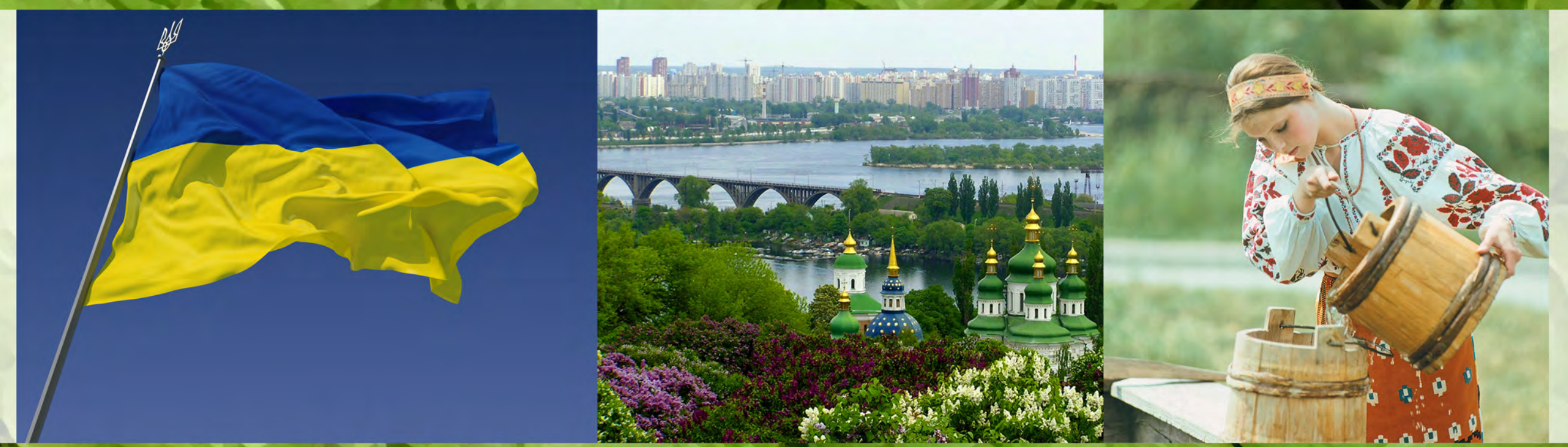


# NEW BIOTECHNOLOGICAL APPROACHES OF GROWING HOP IN THE UKRAINE



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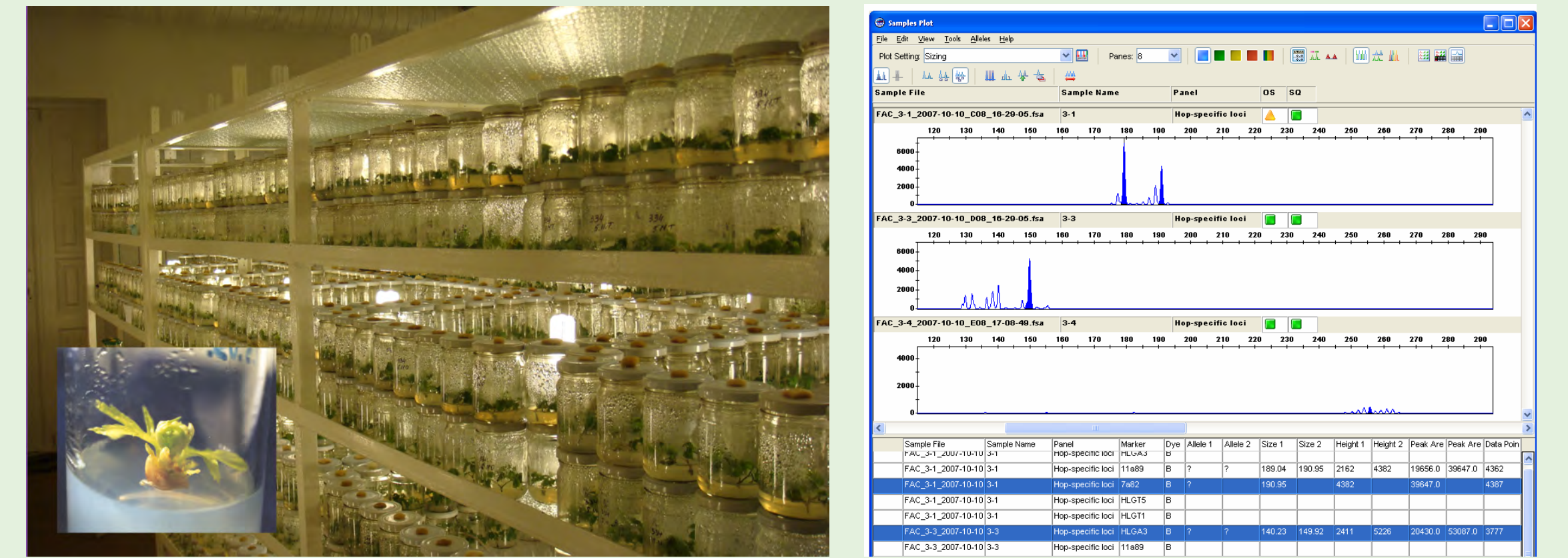


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During 2000-2010 we have developed a new technique of clonal in vitro micropropagation of 20 Ukrainian hop varieties with the financial and technical support of the hop industry. Since 2005 more than 300 ha of new hop gardens have been created in several regions of Ukraine. The monitoring of the hop infection rate in last period was done from commercial hop gardens in the Zhitomir region, representing 11% of acreage. The regeneration ability of different types of meristems and the efficiency in the elimination of viruses were studied. The modern variation technique of biotechnological virus free material of hop production with using thermotherapy, chemical therapy in combination with the method of apical meristem selection was proposed. The morphogenic potential of hop tissues and organs by selection and modification of culture medium components for the different stages of morphogenesis in vitro were investigated. Callus induction was established for the different varieties of Ukraine hops. The influence of different concentrations of phytohormones, mineral and organic compounds of culture medium on induction of roots was studied. The method for the identification of thirteen Ukrainian hops on the base of nine SSR markers was created. All analyzed genotypes have a unique combination of alleles. This allowed us to identify each of them by using nine microsatellite loci. The direct biotechnological adaptation in vivo was first done with the hop variety "National" as that had been cloned in vitro. As result nearly 100% adapted plants were obtained, without using of hops nursery. This technology foresees the adaptation in phytocontainers, compost and making the direct planting on commercial hop-gardens that allowed to get industrial harvests (1.2-1.5 t/ha) in the next year. The granulation of hop was made on minigranulator Eco-Bio 100 that allowed obtaining high-quality pellets of hops with minimal energy consumption without loss of quality of the ingredients of hops. The long-lived biological investigations of development of hop have shown that productivity of crop on hop gardens is defined in many things of conditions artificial isolation of pistillate plants. We have established the direct dependence between formation of parthenocarpic fruits and development of cone tissue. The histochemical researches have shown that intensive overgrowth of fruits tissue without seeds is promoting to synthesis of proteins in glandular cells of peltate glands and intensify secretory activity of them. The ecological and cytological researches have allowed revealing the agents which initiate the parthenocarpy of hop and promote to increase the quality of the production. We have observed less virus symptoms and good morphological stability of hop plants despite the low levels of agricultural engineering and chemical plant protection in hop growing. During 2003-2010 we have investigated hop gardens in 4 regions of Ukraine where virus free in vitro hop clones were adapted. Using the electron microscope and PCR-methods we have shown the presence of hop mosaic virus (HMV) and hop latent virus (HLV) in 1.5% of the samples. On the basis of the results of this complex research we have developed conceptually a new and economically approach of growing hops.

**Keywords:** hop, micropropagation, in vitro, SSR-markers, analysis of genotype, adaptation, direct adaptation, parthenocarpic fruits, histochemical analysis, hop mosaic virus, hop latent virus, virus free hop.



## Genetic passports of Ukrainian Hops varieties

Hops variety	Genetic passport
Ruslan	1111110011001100010001010001010101001010
Triumph	111101010001100011000000110001010001101010
National	111010101000110001000000001001010000110010
Slovianka	10110100000001100010000000010011010000000010
Kumir	01110100010011000010001000000001010101001010
Promin	11110100011001100010100010110001010001100010
Zlato polissia	11110100010001100110000000110000110000001100
Obolon'skiy	11110100010101011001000000010001010000000010
Hmeleslav	11111000000001100010101000000100010100001000
Al'ta	11110100000001100000000000110001010010001001
Potiivs'kiy	11110100010101110000110001000011010000001010
Haidamatskiy	11110100110001110010000110110011110000001010
Zagrava	11110100010101100010100000010011010001001010



*In vivo adaptation of the in vitro cloned hop (Humulus lupulus L.) from phytocontainers directly to the hop gardens conditions (22 of May - 12 of September 2007 year, Zhytomyr region, Ukraine)*



*Hop granules obtained on minigranulator Eco-Bio 100 (9 kWt/h, 100 kg/h)*

*Hop cones and lupulin grains formations and parthenocarpic effect investigation of cones tissue. Stimulation effect of the development peltate glandulars were observed*