

Evaluation of Genetic Variability within Actual Hop (*Humulus lupulus* L.) Cultivars by an Enlarged Set of Molecular Markers

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Table S1. List of 135 world hop cultivars used for molecular genetic analyses

Cultivar	Origin	Released	Ploidy	Pedigree
Pride of Ringwood	AUS	1963	2n	2 nd generation OP selection from Pride of Kent (derived from Brewer's Gold) × open-pollinated
Helga	AUS	2004	2n	Hallertauer Mtf. × open-pollinated
Ella	AUS	2010	3n	J78 (seedling of Pride of Ringwood) (4n) × 94-020-030 (seedling of Perle)
Topaz	AUS	1999	3n	J78 (seedling of Pride of Ringwood) (4n) × 29/70/54
Galaxy	AUS	2009	3n	J78 (seedling of Pride of Ringwood) (4n) × 91-004-010 (seedling of Perle)
Enigma	AUS	2012	3n	Swiss Tett nang (4n) × open-pollinated
Vic Secret	AUS	2013	3n	J78 (seedling of Pride of Ringwood) (4n) × 29/70/54
Saaz	CZE	1952	2n	landrace
Bor	CZE	1994	2n	Northern Brewer × open-pollinated
Sládek	CZE	1994	2n	Northern Brewer × (Northern Brewer × (Osvald clone 126 × Saazer))
Premiant	CZE	1996	2n	Osvald clone 72 × Sm 70 (Osvald clone 72 × Colorado male)
Agnus	CZE	2001	2n	2933 (Northern Brewer × open-pollinated) × 82/6 (Sládek × 74/4 (Bor × Saazer))
Harmonie	CZE	2004	2n	Premiant × 81/1 (3231 (50% Saaz, 50% Northern Brewer) × 74/1 (40% Northern Brewer, 20% Saaz, 12.5% Fuggle))
Rubín	CZE	2007	2n	Bor × 86/4 (Bor × 72/9 (Northern Brewer × Saazer))
Kazbek	CZE	2008	2n	Bor × 79/4 (Wild Russian × (Styrian × open-pollinated))
Vital	CZE	2008	2n	Agnus × Sm95H31 (4240 (25% Sládek, 12.5% Bor, 12.5% Saaz) × open-pollinated)
Bohemie	CZE	2010	2n	Sládek × Sm98H5 (Sm95H6 × 81/1 (50% Northern Brewer, 50% Saaz))
Saaz Late	CZE	2010	2n	3654 (Sládek × 74/4 (Bor × Saazer)) × open-pollinated
Saaz Special	CZE	2012	2n	unknown (Saaz progeny)
Hallertau	DEU	1600	2n	landrace
Spalt	DEU	1800	2n	landrace
Hersbruck	DEU	1806	2n	landrace
Tett nang	DEU	1819	2n	landrace
Perle	DEU	1978	2n	Northern Brewer × 63/5/27M
Spalter Select	DEU	1991	2n	76/18/80 (seedling of Spalt) × 71/16/7M (seedling of Hallertau Mtf. and Northern Brewer)

Table S1 to be continued

Cultivar	Origin	Released	Ploidy	Pedigree
Hallertau Tradition	DEU	1992	2n	Hallertauer Gold × 75/15/106M (seedling of Saaz and Northern Brewer)
Magnum	DEU	1993	2n	Galena × 75/5/3M
Taurus	DEU	1995	2n	82/39/37 (seedling of Magnum) × 85/54/15M (seedling of Galena)
Merkur	DEU	2000	2n	Magnum × 81/8/13M
Saphir	DEU	2000	2n	83/17/20 × 80/56/6M
Opál	DEU	2001	2n	Hallertaur Gold × unknown male
Smaragd	DEU	2002	2n	Hallertaur Gold × unknown male
Herkules	DEU	2005	2n	Taurus × male seedling of Nugget
Polaris	DEU	2012	2n	94/075/758 (seedling of Taurus) × 97/060/720 (seedling of Nugget)
Hallertau Blanc	DEU	2012	2n	Cascade × Hüll male
Mandarina Bavaria	DEU	2012	2n	Cascade × (94/045/001 × wild male)
Hüll Melon	DEU	2012	2n	Cascade × Hüll male
Monroe	DEU	2015	2n	seedling of Cascade
Relax	DEU	2015	2n	unknown
Striesselspalt	FRA	1885	2n	derived from Hersbruck
Aramis	FRA	2002	2n	Striesselspalt × male seedling of Whitbread Golding
Triskel	FRA	2006	2n	Striesselspalt × male seedling of Yeoman
Barge-Rouge	FRA	2014	2n	Striesselspalt × English male
Golding	GBR	1790	2n	landrace
Fuggle	GBR	1861	2n	landrace
Brewer's Gold	GBR	1934	2n	BB1 (Manitoba wild) × open-pollinated
Northern Brewer	GBR	1944	2n	Canterbury Golding × OB21 (Brewers Gold × OY1)
Bramling Cross	GBR	1951	2n	Bramling Golding × OL45 (BB1 × open-pollinated)
Northdown	GBR	1971	2n	Northern Brewer × open-pollinated
Challenger	GBR	1972	2n	17/54/2 (Zattler × open-pollinated) × 1/61/57M (Northern Brewer × open-pollinated)
Target	GBR	1984	2n	1/61/1 (Northern Brewer × open pollinated) × 27/57/281M (Eastwell Golding × OB79 (Neomex AA7 × open-pollinated))
Yeoman	GBR	1984	2n	43/69/17 (Northern Brewer in origin) × 25/68/173M (Keyworths Early × 14/66/82M (Bramling Cross × 1/63/42))
Zenith	GBR	1984	2n	25/68/22 (seedling of Eastwell Golding and Bramling Cross) × 25/68/173M
Phoenix	GBR	1996	2n	1/73/234 (Challenger × 11/65/186M) × 32/73/20 (29/70/4 × 11/65/186M (Northern Brewer in origin))
First Gold	GBR	1996	2n	Whitbread Golding × dwarf male 23/77
Admiral	GBR	1996	2n	Yeoman × 38/77/14M
Endeavour	GBR	2002	2n	Cascade × 20/86/12M (Target × 18/84/5M (34/73/11 × dwarf male 23/77))
Boadicea	GBR	2004	2n	23/90/58 (55/87/209 (32/75/157 (seedling of Yeoman) × wild Japanese INT101 male)) × open-pollinated
Sovereign	GBR	2006	2n	37/91/22 (Pioneer × open-pollinated) × open-pollinated
Minstrel	GBR	2012	2n	unknown
Sorachi Ace	JPN	1984	2n	Brewers Gold × (Saaz × Beikei No. 2)
Smooth Cone	NZL	1966	2n	Late Cluster × seedling of Fuggle
Green Bullet	NZL	1972	3n	Smooth Cone (4n) × open-pollinated

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Table S1 to be continued

Cultivar	Origin	Released	Ploidy	Pedigree
Pacific Gem	NZL	1987	3n	Smooth Cone (4n) × (Late Cluster × seedling of Fuggle)
Southern Cross	NZL	1994	3n	Smooth Cone (4n) × (Callicross × seedling of Fuggle)
Pacifica	NZL	1994	3n	Hallertauer Mtf. (4n) × open-pollinated
Nelson Sauvin	NZL	2000	3n	Smooth Cone (4n) × New Zealand male
Rakau	NZL	2007	3n	Smooth Cone (4n) × New Zealand male
Wakatu	NZL	2011	3n	Hallertauer Mtf. (4n) × open-pollinated
Wai-iti	NZL	2011	3n	(Liberty × open-pollinated) × (Hallertauer Mtf. (4n) × open-pollinated)
Kohatu	NZL	2011	3n	Hallertauer Mtf. (4n) × (Late Cluster × seedling of Fuggle)
Waimea	NZL	2012	3n	(Smooth Cone (4n) × (Late Cluster × seedling of Fuggle)) × (Saaz × open-pollinated)
Dr. Rudi	NZL	2012	3n	Smooth Cone (4n) × open-pollinated
Lublin	POL	1964	2n	landrace (Saaz)
Nadwislavsky	POL	1964	2n	landrace
Marynka	POL	1988	2n	Brewer's Gold × Yugoslavian male
Izabela	POL	1990	2n	Lublin × Yugoslavian male
Sybilla	POL	1996	2n	Lublin × Yugoslavian male
Junga	POL	2004	2n	Northern Brewer × male seedling of Marynka
Serebrjanka	RUS	1941	2n	selection from landrace of Siberian hop
Savinský Golding	SVN	1900	2n	derived from Fuggle
Atlas	SVN	1973	2n	Brewer's Gold × 3/3
Aurora	SVN	1973	2n	Northern Brewer × TG
Buket	SVN	1979	2n	Northern Brewer × 2/137
Bobek	SVN	1979	2n	Northern Brewer × TG
Blisk	SVN	1979	3n	Atlas (4n) × 1/9
Cicero	SVN	1990	3n	Aurora × 3/3 (4n)
Celeia	SVN	1990	3n	Savinsky Golding (4n) × 105/58
Dana	SVN	2012	2n	Magnum × Slovenian male
Eureka	SVN	2014	2n	Taurus × Slovenian male
Styrian Cardinal	SVN	2015	2n	unknown
Styrian Wolf	SVN	2015	2n	unknown
Late Cluster	USA	1629	2n	Cluster × open-pollinated
Cascade	USA	1971	2n	(Fuggle × (Serebrjanka × seedling of Fuggle)) × open-pollinated
Comet	USA	1975	2n	Sunshine (derived from <i>H. aureus</i>) × utah wild male
Willamete	USA	1976	3n	Fuggle (4n) × seedling of Fuggle
Eroica	USA	1978	2n	Brewer's Gold × open-pollinated
Galena	USA	1978	2n	Brewer's Gold × open-pollinated
Nugget	USA	1982	2n	USDA65009 (Brewer's Gold × Early Green Golding) × USDA63015M (Brewer's Gold × East Kent Golding)
Chinook	USA	1985	2n	Petham Golding × USDA63012M (Brewer's Gold × utah wild hop)
Mt. Hood	USA	1989	3n	Hallertauer Mtf. (4n) × USDA19058M (Early Green open-pollinated)
Sterling	USA	1989	2n	USDA 21522 (Saazer 38) × USDA 21361M (Cascade × (65009 × 64035M))
Cenntenial	USA	1990	2n	OR6619-04 (25% Brewer's Gold) × USDA63015M (25% Brewer's Gold, 12.5% Fuggle)
Liberty	USA	1992	3n	Hallertauer Mtf. (4n) × 64035M
Crystal	USA	1993	3n	Hallertauer Mtf. (4n) × 21381M

Table S1 to be continued

Cultivar	Origin	Released	Ploidy	Pedigree
Santiam	USA	1997	3 <i>n</i>	Tettnanger × USDA21381M (4 <i>n</i>) – Hallertauer Mtf.
Vanguard	USA	1997	2 <i>n</i>	Hallertauer × 64035M
Horizon	USA	1998	2 <i>n</i>	Nugget × 64035M (25% B.G., 25% german aroma hop, 12,5% Early Green, 37.5% unknown)
Columbus / Zeus / Tomahawk	USA	1999	2 <i>n</i>	USDA65009 (Brewer's Gold × Early Green Golding) × unknown male
Glacier	USA	2000	2 <i>n</i>	Sriesselspalt × US male (31.2% Brewer's Gold, 25% Northern Brewer, 43.8% English and German hops)
Warrior	USA	2000	2 <i>n</i>	unknown
Palisade	USA	2000	2 <i>n</i>	Tettnanger × open-pollinated
Millenium	USA	2000	2 <i>n</i>	Nugget × seedling of Columbus
Simcoe	USA	2000	2 <i>n</i>	unknown
Summit	USA	2003	2 <i>n</i>	ADHA 99-12 (Zeus × USDA19058) × ADHA 99-26 (Zeus × ADHA98013)
Apollo	USA	2006	2 <i>n</i>	Zeus × (98001 × USDA19058M)
Bravo	USA	2006	2 <i>n</i>	Zeus × (98004 × USDA19058M)
Super Galena	USA	2006	2 <i>n</i>	98001 (Nugget × open-pollinated) × USDA19058M
Citra	USA	2007	2 <i>n</i>	Hallertauer Mtf. × (US Tettnang × (Brewer's Gold × seedling of East Kent Golding))
Amarillo	USA	2009	2 <i>n</i>	unknown (seedling of Liberty)
Lemon Drop	USA	2009	2 <i>n</i>	Cascade × USDA19058M
Delta	USA	2009	2 <i>n</i>	Fuggle × seedling of Cascade
El Dorado	USA	2010	2 <i>n</i>	Unknown (probably Brewers Gold)
Mosaic	USA	2012	2 <i>n</i>	Simcoe × seedling of Nugget
Triple Pearl	USA	2013	3 <i>n</i>	Perle (4 <i>n</i>) × open-pollinated
Yakima Gold	USA	2013	2 <i>n</i>	Early Cluster × Slovenian male
Equinox/Ekuanot	USA	2014	2 <i>n</i>	unknown
Jarrylo	USA	2014	2 <i>n</i>	Summit × ADHA 75-2 (Summit × G-7)
Azacca	USA	2015	2 <i>n</i>	Toyomidori (Northern Brewer × USDA64103) × ADHA 94/95 (Summit × ADHA 99-25)
Eureka!	USA	2015	2 <i>n</i>	unknown (Appolo, Merkur)
Backa	YUG	1950	2 <i>n</i>	derived from Hersbruck, Striesselspalt and Elsaser
Vojvodina	YUG	1973	2 <i>n</i>	Northern Brewer × (Savinsky Golding × open-pollinated)
Southern Brewer	ZAF	1972	2 <i>n</i>	Fuggle × seedling of Fuggle
Outeniqua	ZAF	1992	2 <i>n</i>	Atlas × Yugoslavian male 39-06
Southern Star	ZAF	2001	2 <i>n</i>	Outeniqua × South African male