International Oat Genome, Chromosome, Gene, and Gene Model Nomenclature

The International Oat Nomenclature Committee

Rick Jellen, Chair, Brigham Young University, Provo, UT, USA; jellen@byu.edu

The recent publication of whole-genome sequence assemblies for the wild *Avena* diploids *A. atlantica, A. eriantha, A. longiglumis,* and tetraploid *A. insularis,* along with the hexaploid oat cultivars 'OT3098', 'Sang', and 'Sanfensan', has necessitated the formulation of an internationally accepted system for naming *Avena* spp. genomes, chromosomes, genes, and gene models. These nomenclature rules, along with notes of the IONC meetings where these rules were adopted, can be found on the GrainGenes website at (QR code1 below) https://wheat.pw.usda.gov/GG3/oatnomenclature and in Jellen, *et al*. (2024) at (QR code 2) https://www.publish.csiro.au/cp/Fulltext/CP23247.

An example of a Gene Model Identifier: AVESA.00010a.r1.4D.G0792660.1

AVESA =*Avena sativa* (AACCDD group)	00010a = germplasm code; 'a' signifies the first round of annotation	r1 = release version 1	4D = chromosome 4D	0792660 = gene number in position order	1 = isoform or splice variant

Chromosome and linkage-group correspondences

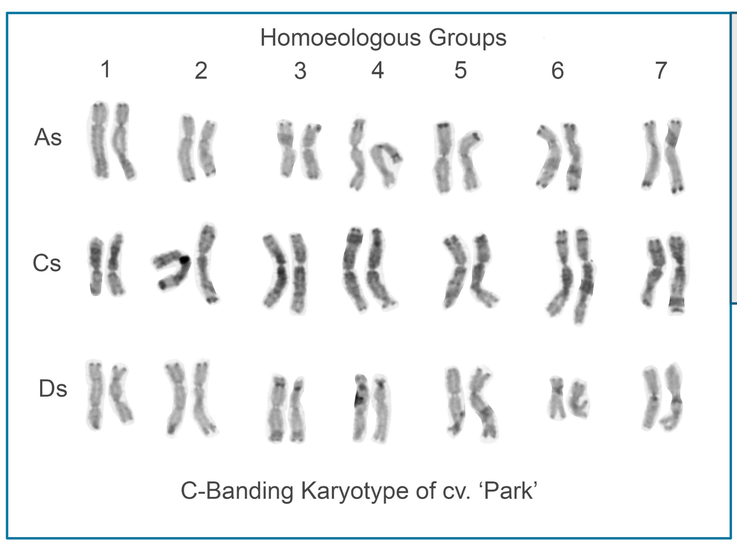
Consensus map Chaffin, *et al.* 2016	Sanz, *et al.* 2010	Diploid WGAs Maughan, *et al.* 2019	NEW 2x designation	NEW 6x designation Kamal, *et al.* 2022
Genome/subgenome A				
Mrg18 (-)	17A	AA2 (+)	$1A_a$	$1A_s$
Mrg33 (+)	15A	AA5 (-)	$2A_a$	$2A_s$
Mrg23 (+)	11A	AA3 (+)	$3A_a$	$3A_s$
Mrg20 (+)	19A	AA4 (-)	$4A_a$	$4A_s$
Mrg24 (+)	8A	AA6 (-)	$5A_a$	$5A_s$
Mrg05 (+)	16A	AA7 (-)	$6A_a$	$6A_s$
Mrg12 (+)	13A	AA1 (-)	$7A_a$	$7A_s$
Genome/subgenome C				
Mrg28 (-)	7C	AE5 (+)	$1C_e$	$1C_s$
Mrg13 (+)	5C	AE4 (-)	$2C_e$	$2C_s$
Mrg15 (-)	2C	AE3 (-)	$3C_e$	$3C_s$
Mrg11 (+)	1C	AE1 (-)	$4C_e$	$4C_s$
Mrg03 (-)	4C	AE6 (-)	$5C_e$	$5C_s$
Mrg17 (-)	3C	AE2 (-)	$6C_e$	$6C_s$
Mrg09 (-)	6C	AE7 (-)	$7C_e$	$7C_s$
Genome/subgenome D				
Mrg01 (-)	14D	--	--	$1D_s$
Mrg08 (-)	12D	--	--	$2D_s$
Mrg19 (+)	21D	--	--	$3D_s$
Mrg21 (+)	20D	--	--	$4D_s$
Mrg06 (-)	10D	--	--	$5D_s$
Mrg04 (-)	18D	--	--	$6D_s$
Mrg02 (-)	9D	--	--	$7D_s$

Correspondence between species codes, genome and subgenome formulae, and *Avena* taxa. Codes are based on the biological species concept.

Species Code	Genome	*Avena* taxa	Genotype ID Codes
AVESA	$A_sA_sC_sC_sD_sD_s$	*byzantina, fatua, hybrida, occidentalis, sativa, sterilis*	00001-09999
AVBAR	A_bA_bBB	*abyssinica, barbata, vaviloviana*	10000-10999
AVAGA	A'A'B'B' (TBD)	*agadiriana*	11000-11999
AVINS	$C_iC_iD_iD_i$	*insularis*	12000-12999
AVMAG	$C_mC_mD_mD_m$	*magna, maroccana*	13000-13999
AVMUR	$C_yC_yD_yD_y$	*murphyi*	14000-14999
AVMAC	EEEE	*macrostachya*	15000-15999
AVATL	A_aA_a (plus auto-tetraploids)	*atlantica, brevis, hirtula, nuda, strigosa, wiestii*	20000-20999
AVCAN	A_cA_c	*canariensis*	21000-21999
AVDAM	A_dA_d	*damascena*	22000-22999
AVLON	A_lA_l	*longiglumis*	23000-23999
AVPRO	A_pA_p	*prostrata*	24000-24999
AVERI	C_eC_e	*clauda, eriantha, pilosa*	25000-25999
AVVEN	C_vC_v	*bruhnsiana, vaviloviana*	26000-26999
AVSYN	Various synthetic allopolyploids		30000+

Examples of oat genotype assignments. As new strains are sequenced, numerical designators should be assigned in consultation with the IONC and the GrainGenes coordinator.

Genotype	Taxon	Species Code	Number
OT3098	*sativa*	AVESA	00001*x*
GMI 423	*sativa*	AVESA	00002*x*
Bingo	*sativa*	AVESA	00003*x*
AAC Nicolas	*sativa*	AVESA	00009*x*
Sang	*sativa*	AVESA	00010*x*
Park	*sativa*	AVESA	00017*x*
Sanfensan	*sativa* ssp. *nuda*	AVESA	00400*x*
PI 182478	*sativa* ssp. *nuda*	AVESA	00401*x*
Victoria	*byzantina*	AVESA	00501x
CN 25955	*fatua*	AVESA	00600*x*
Tn1	*sterilis*	AVESA	00700*x*
Tn5	*sterilis*	AVESA	00701*x*
PI 388828	*barbata*	AVBAR	10000*x*
PI 411152	*abyssinica*	AVBAR	10001*x*
BYU 209	*insularis*	AVINS	12000*x*
CN 58139	*longiglumis*	AVLON	23001*x*
Amagalon	*magna* X *longiglumis*	AVSYN	30000*x*
CN 19328	*eriantha*	AVERI	25000*x*
Cc7277	*atlantica*	AVATL	20001*x*



Standard karyotype of 'Park' oats showing subgenome ($A_sA_sC_sC_sD_sD_s$) and homoeologous group assignments.

Jellen EN, Wight CP, Spannagl M, Blake VC, Chong J, Herrmann MH, Howarth CJ, Huang Y-F, Juqing J, Katsiotis A, Langdon T, Li C, Park R, Tinker NA, and Sen TZ (2024) A uniform gene and chromosome nomenclature system for oat (*Avena* spp.). Crop & Pasture Science 75, CP23247. https://doi.org/10.1071/CP23247

Kamal N, *et al*. (2022) The mosaic oat genome gives insights into a uniquely healthy cereal crop. Nature 606:113-119. https://doi.org/10.1038/s41586-022-04732-y

Chaffin AS, *et al*. (2016) A consensus map in cultivated hexaploid oat reveals conserved grass synteny with substantial subgenome rearrangement. The Plant Genome 9. https://doi.org/10.3835/plantgenome2015.10.0102

Sanz MJ, *et al*. (2010) A new chromosome nomenclature system for oat (*Avena sativa* L. and *A. byzantina* C. Koch) based on FISH analysis of monosomic lines. Theoretical & Applied Genetics 121:1541-1552. https://doi.org/10.1007/s00122-010-1409-3

Maughan PJ, *et al*. (2019) Genomic insights from the first chromosome-scale assemblies of oat (*Avena* spp.) diploid species. BMC Biology 17:92. https://doi.org/10.1186/s12915-019-0712-y

QR code 1

QR code 2