

2021-10-14

Course schedule for Genetic diversity and Plant breeding (BI1103), 2021

Yellow = Lectures

Blue = Sem (compulsory)

Green = Lab (compulsory)

Course leader:

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Course assistants/teachers:

Anna Törnkvist (AT), anna.tornkvist@slu.se, Irene Merino (IM), irene.merino@slu.se ,
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Teachers (from Dept. of Plant Biology if not anything else indicated), e-mail to SLU teachers: first name.surname@slu.se:

ACRW=Ann Christin Rönnberg-Wästljung

AK=Anders Kvarnheden

AW=Anna Westerbergh

CD=Christina Dixelius

JS=Jens Sundström,

MS=Mohammad Sameri,

PI=Pär Ingvarsson,

PS= Per Sandin, Dept. of Ecology, SLU:

Guest teachers:

AC= Alf Ceplitis, Lantmännen

HH= Henrik Hallingbäck, Skogforsk

ML= Matti Leino, Dept. of Archaeology and Classical Studies, Stockholm University

MN=Marie Nyman, The Swedish Gene Technology Advisory Board

MSa=Martin Sandberg, National Food Agency (study visit at the Swedish food agency)

LH=Louise Holmquist, Maribo-Hilleleshög:

PSn=Per Snell, Maribo-Hilleleshög

SM= Salla Marttila

Day	(No in Canvas) Kind ¹ : Room ²	Time: Subject (teacher)	Literature
Introduction			
Week 45			
Tue-2/11	(1) Sem - Sal C216 -biocentrum	9.00-10.00: Roll call & introduction (AS+AT+ IM +SM)	
	(2) Lect: Sal C216 -biocentrum	10.00-12.00: Intro to Breeding (AS)	³ Ch 1, 2
	(3) Lab: BÖL 2- biocentrum	13-15: Introduction to the mapping lab & lab safety (AT+ IM +SM)	
Genetic diversity			
Wed-3/11	(4) Lab: Greenhouse - biocentrum	8-11 (GroupA) 11-14 (groupB) : Transplanting of RILs - group discussion, (AT+ IM +SM)	
	Self-studies		
Thu-4/11	(5) Lect; Sal C216 -biocentrum	9-11: Genetic diversity - basic concepts (PI)	⁴ Ch 21
	(6) Sem: Sal C216 -biocentrum	11-12: Genetic diversity, exercises (PI)	
	(7) Guest lect: Zoom	13-15: Preservation of genetic resources (ML)	⁵ Article
Fri-5/11	(8) Lect; Sal C216 -biocentrum	10-12: Plant domestication (AW)	⁶ Article
	(9) Sem: Zoom	13-16: Genetic diversity, exercises (PI)	

Statistical genetics			
Week 46			
Mon 8/11	(10) Sem: Sal C216 -biocentrum	9:15-10: Questions to Adrien	
	(11) Sem: Sal C216 -biocentrum	10-12: Journal club - domestication (AW)	
	(12) Lect Sal C216 -biocentrum	13-15 Statistics in Genetic analyses (AS)	
Tue 9/11	(13) Sem: Sal C216 -biocentrum	10-12: Literature project - topic decision (JS)	⁶ Article
	Self-studies	Literature project	
Wed 10/11	(14) Lect Sal C216 -biocentrum	9-11: Quantitative genetics (ACRW)	³ Ch 4, 26
	(15) Sem: Sal C216 -biocentrum	11-12: Quantitative genetics, exercises (ACRW)	
	Self-studies		
Thu 11/11	(16) Lab BÖL 2 - biocentrum	8-12: Group A: DNA extraction, PCR run – (AT+ IM +SM)	
		13-17: Group B: DNA extraction, PCR run (AT+ IM +SM)	
Fri 12/11	(17) Lab: BÖL 2 - biocentrum	9-16: DNA extraction, PCR & gel run – Questions & discussion Questions, group discussions (AT+ IM +SM)	
Week 47			
Mon 15/11	(18) –meeting Sal C216	9:15-10: Questions to Adrien	
	(19) Sem: Sal C216 -biocentrum	10-12: Check point: presentations of lit. project outline (JS)	
	(20) Lab: BÖL 2 - biocentrum	13-15: Crossings intro (AT+ IM +SM+ MS)-	
Tue 16/11	(21) Sem: Sal C216 -biocentrum	9-12: Quantitative genetics, exercises (ACRW)	³ Ch 4, 26
	Self-studies		

Wed 17/11	Self-studies		
Thu 18/11	Self-studies		
Fri 19/11	(22) Exam: Tentamenssal 2	8-12: Examination 1: Population genetics, quantitative genetics and domestication	
Traditional breeding			
Week 48			
Mon 22/11	(23) meeting Sal C216 - biocentrum	9:15-10: Questions to Adrien	
	(24) Lect Sal C216 -biocentrum	10-12: Breeding of self- & cross-pollinating species (ACRW)	³ Ch 16, 17
	(25) Sem: Sal C216 -biocentrum	13-15: Breeding methods, group discussions (ACRW)	³ Ch 16, 17
Tue 23/11	(26) Sem: Sal C216 -biocentrum	10-12: Discussion, breeding methods (ACRW)	³ Ch 16, 17
	(27) Sem: Sal C216 -biocentrum	13-13:30: Seed certification, production and legislation: intro (CD) 13.30-16: Work with seed certifications	
Wed 24/11	(28) Sem: Zoom	10-12: Presentations; seed certification, production and legislation (CD)	
	Self studies		
Thu 25/11	(29) Lect Sal C216 -biocentrum	10-12: CMS/hybrid breeding (HH)	³ Ch 18
	(30) Lect Sal C216 -biocentrum	13-15: Polyploidy and breeding (AS)	^{7, 8, 9, 10} Article
Fri 26/11	Self studies		
	(31) Sem: Zoom	12: Half-time course evaluation	
	Self studies	17:00: Deadline send in literature project for comments from other students	

Phenotype-genotype associations			
Week 49			
Mon 29/11	(32) - meeting Zoom	9:15-10: Questions to Adrien	
	(33) Lect Zoom	10-12 Genotype – phenotype associations (ACRW)	¹² Article ³ Ch 21, 22
	Group studies	Perform peer review of literature studies (JS)	
Tue 30/11	(34) Lab: BÖL 2 - biocentrum	8-13: Phenotyping & mapping - intro, group work, summary (AT+ IM +SM)	
	(35) Lect: Sal O2:Undervisningshuset	14-16: Introduction to Genomic data (AS)	^{23, 24, 25} Article
Wed 1/12	Lect: Sal C216 -biocentrum	10-12: Next generation breeding (AS)	^{23, 24, 25} Article
	Self-studies		
Thu 2/12	Lect Sal C216 -biocentrum	10-12: Genomic selection (AS)	
	(36) Sem: Sal C216 - biocentrum	13-15: Discussion genomics (AS)	
Fri 3/12	(37) Lab: Library Datorsal 1 & 2	10-15: Computer lab: QTL-mapping (AT+ IM +SM)	¹² Article
	Self-studies	24:00: Deadline for sending in peer-review of literature studies.	
Week 50			
Mon 6/12	(38) Lab: Library Datorsal 1 & 2	10-15: Computer lab: Genomics (AT+ IM +SM)	

Biotechnological applications and considerations in plant breeding			
Tue 7/12	(39) - meeting Sal C216 -biocentrum	9:15-10: Questions to Adrien about the lab & lab report	
	(40) Lect: Sal C216 -biocentrum	10-12: Generation of transgenic plants (JS)	²¹ Article
	(41) Lect: Sal C216 -biocentrum	13-15: New breeding technologies (JS)	²¹ Article
Wed 8/12	(42) Guest lect: National Food Agency (Livsmedelsverket) Zoom	9-ca10: National Food Agency (MSa)	
	(43) Sem:Zoom	10-12: Journal club - genotype-phenotype associations (ACRW)	^{13,14} Article
	Self-studies		
Thu 9/12	(44) Guest lect: Zoom	10-12: Science and politics – The controversial story of GM-crops (MN)	
	(45) Guest lect: Lect: Sal C216 -biocentrum	13-16: Ethics and Genetic modifications + discussion (PS)	²² Article
Week 51			
Phenotypic and developmental targets in plant Breeding			
Fri 10/12	(46) - meeting Sal C216 -biocentrum	9:15-10: Questions to Adrien	
	(47) Lect: Sal C216 -biocentrum	10-12: Breeding for disease resistance (CD)	³ Ch 14 + 15, 16 Articles
	(48) Lect: Sal C216 -biocentrum	13-15: Breeding for virus resistance (AK)	⁴ Ch 14 + ¹⁷ Article
Mon 13/12	(49) Lect: Sal C216 -biocentrum	10-12: Breeding for abiotic stress (MS)	^{18, 19,} ²⁰ Articles
	(50) Guest lect: Zoom	13-15: Lantmännen and their oat breeding (AC)	
Tue 14/12	(51) Guest lect: Zoom	10-12: Breeding at MariboHilleshög (LH – PSn)	
	(52) Guest lect: Zoom	13-15: Tree breeding at Skogforsk (HH)	
	(53) Guest lecture Zoom	15-16 Grogrund project presentation (Salla Marttila)	

Wed 15/12	(54) Optional, Zoom	9-12: Optional: Lit. project - individual discussion with teachers (JS & AS)	
	(55) Optional, Zoom	13-16: Optional: Lab report - individual discussion with teachers (AT+ IM +SM)	
Thu 16/12	Self-studies	Work with lab report/literature project	
Fri 17/12	Self-studies	Work with lab report/literature project	
Week 52			
Mon 20/12	(56) –meeting Zoom	9:15-10: Questions to Adrien	
	Self-studies	Work with lab report/literature project	
Tue 21/12	Self-studies	Deadline, 24:00: Lab report send in	
Christmas break!			
Week 1, 2021			
Mon 3/1	Self-studies		
Tue 4/1	Self-studies	Deadline, 24:00: Send in literature project to opponent and to JS+AS for comments	
Wed 5/1	(57) Lect: Zoom	10.00-12.00: Questions to teachers	
Thu 6/1		Holiday	
Fri 7/1	(58) Exam: Tentamenssal 1	8-12: Examination II	
Week 2			
Mon 10/1	Self-studies	Work with literature project presentation & opposition	
Tue 11/1	(59) Sem:Sal C216 -biocentrum	9-17: Presentations and opposition of literature projects (JS+AS)	

Wed 12/1	(60) Sem: Sal C216 -biocentrum	9-13: Presentations and opposition of literature projects (JS+AS)	
	(61) Sem: Evald	12: Course evaluation	
Thu 13/1	Self-studies	Work with literature project	
Fri 14/1	Self-studies	Deadline 24:00: Final send in of literature project	

¹ Lect = Lecture; Sem = Seminar (compulsory); Lab = Laboratory practical (compulsory).

² Biocentrum = BioCentre SLU, Lennart Kennes sal is in BioC, Sal O2 is in the main teaching building, Bibliotekets datorsal 1 & 2 = computer room 1, 2 at the SLU library.

Course literature:

Book chapters:

³ Acquaah George: Principles of Plant Genetics and Breeding, Second Edition, Wiley-Blackwell Publishing, 2012, chapters 1, 2, 4, 14, 16, 17, 18, 21, 22, 26

⁴ Russel, Peter J. iGenetics. A molecular approach, (Pearson international edition), chapter 21, Population genetics, pp: 603-649

Articles:

⁵ Dulloo, M. E., Rege, J.E.O., Ramirez, M. *et al.* 20xx. Conserving agricultural biodiversity for use in sustainable food systems. Chapter 5 in:

⁶ Doebly, J. F., Brandon, S. G., Smith B. D. 2006. The molecular genetics of crop domestication. *Cell* 127: 1309-1321.

⁷ Soltis, D. E., Visger, C. V., Marchant, D. B., Soltis, P. D. 2016. Polyploidy: Pitfalls and paths to a paradigm. *Am. J. Bot.* 103 (10): 1-21.

⁸ De Storme, N., Geelen, D. 2013. Sexual polyploidization in plants – cytological mechanisms and molecular regulation. *New Phytologist* 198: 670-684.

⁹ Lloyd, A., Bomblies, K. 2016. Meiosis in autopolyploid and allopolyploid Arabidopsis. *Curr. Opi. Plant Biol.* 30:116-122.

¹⁰ Sattler, M. C, Carvalho, C. R., Clarindo, W. R. 2015. The polyploidy and its key role in plant breeding. *Planta* 243:281-296.

- ¹¹ Thornström, C-G. 2016. Dimensional analysis of international regulations of biological matter. Genetic resources and Agro-biodiversity. Indian J. Plant Genet. Resour. 29(3): 420-422.
- ¹² Collard, B.C.Y., Jahufer, M.Z.Z., Brouwer, J.B., Pang, E.C.K. 2005. An introduction to markers, quantitative trait loci (QTL) mapping and marker-assisted selection for crop improvement: The basic concepts. Euphytica 142: 169-196.
- ¹³ Carletti, C., Carra, A. et.al. 2016. QTLs for Woolly poplar aphid (*Phloeomyzus passerinii* L.) resistance detected in an interspecific *Populus deltoids* x *P. nigra* mapping population. PLoS One. DOI:10.1371
- ¹⁴ Frankenkrog, A.M., Neves, L.G., et al. 2016. Genome-wide association study reveals putative regulators of bioenergy traits in *Populus deltoides*. New Phytologist. DOI: 10.1111/nph.14154.
- ¹⁵ McDonald, B., Linde, C. 2002. Pathogen population genetics, evolutionary potential, and durable resistance. Annu. Rev. Phytopathology. 40: 349-79.
- ¹⁶ Nelson, R., Wiesner-Hanks, T., Wisser, R., Balint-Kurti, P. 2018. Navigating complexity to breed disease-resistant crops. Nat. Rev. Genet. Vol. 19:21-33. doi:10.1038/nrg.2017.82
- ¹⁷ Gómez, P., Rodríguez-Hernández, A.M., Moury, B., Aranda, M.A. 2009. Genetic resistance for the sustainable control of plant virus diseases: breeding, mechanisms and durability. European Journal of Plant Pathology 125: 1-22.
- ¹⁸ Fritsche-Neto, R., Do Vale J.C. A. 2012. Breeding for stress-tolerance or resource-use efficiency? In Plant Breeding for abiotic stress tolerance. Eds: Fritsche-Neto, R., Borém, A. DOI: 10.1007/978-3-642-30553-5_2
- ¹⁹ Pourkheirandish, M., et al. 2015. Evolution of the grain dispersal system in barley. Cell 162, 527–539.
- ²⁰ Sameri, M., et al. 2009. A quantitative trait locus for reduced culm internode length in barley segregates as a Mendelian gene. TAG: 118:643–652.
- ²¹ To be decided
- ²² Siipi, H. 2015. Is genetically modified food unnatural? J Agric Environ Ethics. 28:807-816.
- ²³ Weigel, D., Norborg, M. 2015. Genomics for understanding adaptation in wild plants species. Annu Rev Genet. 49:315-38.
- ²⁴ Gelli, M., Konda, A. R., et al. 2017. Validation of QTL mapping and transcriptome profiling for identification of candidate genes associated with nitrogen stress tolerance in sorghum. BMC Plant Biology 17:123.
- ²⁵ Choquet, M., Smolina, I., et al. 2019. Towards population genomics in non-model species with large genomes: a case study of the marine zooplankton *Calanus finmarchicus*. Ro. Soc. open sci. 6:180608.