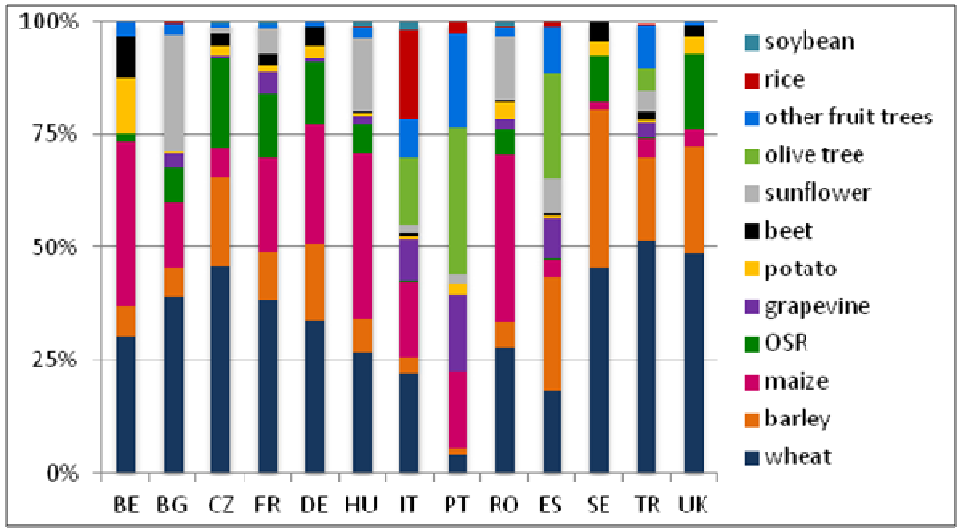
Supplementary material 1.

Agricultural data of major crops in 13 selected European countries

Source: data for 2011 from Eurostat (http://epp.eurostat.ec.europa.eu),
FAO STAT (http://faostat3.fao.org/home/index.html) and national statistical institutes.
Abbreviations: Belgium (BE), Bulgaria (BG), the Czech Republic (CZ), France (FR), Germany (DE), Hungary (HU), Italy (IT), Portugal (PT), Romania (RO), Spain (ES), Sweden (SE), Turkey (TR), and the United Kingdom (UK).

Panel 1. Areas of major crops in % in the 13 selected European countries.



Panel 2. Table of major crop areas in the 13 selected European countries.

Countries	BE	BG	CZ	FR	DE	HU	IT	PT	RO	ES	SE	TR	UK
Agricultural area[1] (in MHa)	1,34	5,087	4,229	28,852	16,521	5,337	12,4	3,59	12,6	27,012	2,617	38,226	17,172
Crop area (Ha)													
Wheat[2]	203 200	1 137 640	863 100	5 491 197	3 248 200	977 844	1 726 030	42 894	1 947 000	1 992 700	420 619	8 096 000	1 969 000
Barley	44 139	178 993	372 800	1 544 665	1 598 100	261 254	269 675	16 627	419 500	2 700 700	323 317	2 868 830	970 000
Maize	245 500	414 400	121 000	3 014 591	2 516 700	1 230 253	1 292 300	181 500	2 589 700	429 700	15 600	700 000	150 000
OSR	12 016	231 309	373 400	1 984 212	1 328 600	233 903	18 834	0	392 700	31 300	97 606	26 830	681 000
Grapevine	0	78 468	17 198	764 124	97 400	81 001	717 600	179 474	176 600	960 190	0	472 545	1 000
Potato	82 341	16 200	33 600	158 643	258 700	20 966	62 091	26 500	242 600	79 900	27 588	142 985	146 000
Beet	62 199	0	50 200	393 134	398 100	15 154	62 200	321	18 800	44 900	39 377	297 265	113 000
Sunflower	0	747 100	28 600	767 463	26 800	579 548	118 100	22 418	995 000	862 900	0	655 700	0
Olive tree	0	0	0	16 945	0	0	1 162 400	345 683	0	2 503 675	0	793 793	0
Other fruit trees (orchards)	21 671	71 642	16 400	170 942	80 135	91 101	677 134	220 988	155 600	1 118 680	0	1 530 000	24 600
Rice	0	11 970	0	23 177	0	2 710	1 490 200	29 100	12 700	122 184	0	99 400	0
Soybean	0	600	7 600	41 571	1 000	41 009	165 965	0	72 100	766	0	26 421	0
Forestry (Mha)	0,649	4,074	2,66	16,61	10,766	1,922	9,45	3,478	6,362	18,954	28,3	21,53	2,88

[1] crops and pastures

[2] bread wheat and durum wheat

Supplementary Material 2.

Table S1. Sources for agricultural data and research programs by country

Country	Institutes
BE	Sources for agricultural data: Agricultural research scientists and farming organizations, VIB, Statistics Belgium (http://statbel.fgov.be/fr/statistiques/chiffres/), and agronomy/plant breeding professors from Ghent University (UGent). Information on research programs was compiled from internal expertise from the research policy department at VIB.
BG	Information on agricultural data was compiled from (1) Faculty of Agronomy, Agricultural University of Plovdiv; (2) farmer's organizations - BAAP and AGP; and (3) official data from Ministry of Agriculture were used as sources to identify the major challenges in the country. Survey of the research programs at the Agricultural Academy, Bulgarian Academy of Science and the Agricultural University of Plovdiv was undertaken to complement the data on challenges.
CZ	Sources for agricultural data: specialized web sites of Ministry of Agriculture (http://eagri.cz/public/web/en/mze/ministry/), Ministry of Environment (http://www.mzp.cz/en/), State Phytosanitary Organisation now Central Institute for Supervising and Testing in Agriculture (http://eagri.cz/public/web/en/ukzuz/portal/), and articles in specialized agricultural journals. Research programs: the Research and Development and Innovation System of the Czech Republic (http://www.isvav.cz/index.jsp)
DE	Sources for agricultural data: representative farmers, offices of farmer organizations, and web site of the German Farmers' Association (DBV) Information on research programs was compiled by Prof. Inge Broer, University of Rostock and Prof. Hans-Jörg Jacobsen, Leibniz Universität Hannover.
ES	Fundacion Antama, ASAJA, Anuario Estadistico 2011 (Ministerio de Agricultura, Alimentacion y Medio Ambiente; http://www.magrama.gob.es/en/), ANOVE (Asociacion Nacional de Obtentores Vegetales), and CRAG (Centre de Recerca en AgriGenòmica)
FR	Sources for agricultural data: Arvalis - Institut du Végétal ; CETIOM (Centre Technique Interprofessionnel des Oléagineux Métropolitains) ; ITB (Institut Technique de la Betterave) ; Ministère de l'Agriculture– Agreste (http://www.agreste.agriculture.gouv.fr/); SupAgro-Montpellier. Research programs: INRA (Institut National de la Recherche Agronomique): Bordeaux /Clermont-Ferrand /Colmar /Rennes /Moulon /Versailles /Montpellier /Orléans /Toulouse ; INRA-CNRS Castanet Tolosan/ Grenoble, Private companies (Biogemma SA, Florimond Desprez Veuve & Fils, Secobra, Syngenta and Limagrain). The Group of Interest "Plant Biotechnologies": http://www.gisbiotechnologiesvertes.com/
HU	Various statistical databases of the Hungarian Central Statistical Office (http://www.ksh.hu/?lang=en; Last update in 2013). GMO trials and relevant research projects were identified from the Hungarian GMO Database (http://biosafety.abc.hu/databases.php) and a public database of the Hungarian Scientific Research Fund (http://nyilvanos.otka-palyazat.hu/), respectively. For further details we contacted researchers involved in the majority of these projects (see Acknowledgements), and monitored five major farmer weekly and monthly journals (Agrofórum, Agro Napló, Haszon Agrár, Magyar Mezőgazdaság and MezőHír) written by experts and/or farmers for farmers. Also, university study books and a few

	local farmers were consulted.
IT	Sources for agricultural data: National Institute of Statistics (ISTAT) www.istat.it/, National Institute for Agricultural Economy (INEA) http://dspace.inea.it/handle/inea/1008 and Ministry of Agricultural, Food and Forestry Policies (MIPAAF). Agronomists and researchers mainly from the public sector: from C.R.A. - Consiglio per la Ricerca e la Sperimentazione in Agricoltura (www.entecra.it/), particularly from Centro di ricerca per la genomica vegetale (Fiorenzuola d'Arda PC) (CRA-GPG), from the University of Milan, of Turin, of Modena and Reggio Emilia, Parco Tecnologico Padano (Lodi), Mach Foundation (Trento), but also people from the private sector (Dekalb, Pioneer-Dupont), and 400 members of the Italian Society for Agricultural Genetics (SIGA). For some details on pesticide treatment on maize: farmers from the province of Crema and the farmer's union Futuragra.
PT	Sources for agricultural data: Agriculture Statisticas 2012, Statistics Portugal Edition 2013, and official manuals for Integrated Pest Management of the Ministry of Agriculture, then some researchers for confirmation. Data on research activities were collected by personal communications with researchers in relevant institutions.
RO	Sources for agricultural data: Romanian farmer associations (especially LAPAR). www.madr.ro (Ministry of Agriculture and Rural Development); www.asas.ro (Academy for Agricultural and Forestry Sciences); www.research.ro (Ministry of Education and Research); www.anpm.ro (National Agency for Environment Protection); www.research.ro (Plum Virus Research Program BRANCUSI)
SE	Sources for agricultural data: Swedish Board of Agriculture databases (http://fou.sjv.se/skade/mobil/default.lasso; http://www.jordbruksverket.se/swedishboardofagriculture.4.6621c2fb1231eb917e680002462.html), the Swedish University of Agricultural Sciences collected additional information. Data on research activities were collected by personal communications with relevant institutions.
TR	The TR agricultural data was compiled in a previous work (Gözen, A., K. Abak, H. Kasnakoglu, S. Cetiner and A. Güzel. 1995. Priorities for Plant Biotechnology Research in Turkey. Technology Development Fund of Turkey. No2. Ankara) and updated by interviews of farmers representatives and agronomists. The sources of agricultural data were already provided at Turkish Statistical Institute (TurkStat) (http://www.turkstat.gov.tr/UstMenu.do?metod=temelist). Information on research programs was obtained from TUBITAK (Scientific and Technical Research Council of Turkey) National Research Database (http://uvt.ulakbim.gov.tr/proje/) and through personal communications.
UK	Agricultural data was compiled by the National Farmers Union and the John Innes Centre, using data obtained from the following websites. Crop Harvest information was obtained using statistics from the UK's Department for Environment and Rural Affairs http://www.defra.gov.uk/statistics/foodfarm/ Information on key challenges was compiled with the help of the following divisions of the Agricultural and Horticultural Development Board (AHDB): AHDB-HGCA for cereals and oilseed; http://www.hgca.com ; and AHDB-Potato Council for potatoes; http://www.potato.org.uk/; and the British Beet Research Organisation BBRO for sugar beet; http://www.bbro.co.uk/. Information on research programmes was compiled from feedback to an email questionnaire sent out to targeted research institutes and universities as part of a pilot study – it therefore provides examples of current research but does not represents an exhaustive summary of UK research programmes.

Table S2. Answers to 9 key questions

Disclaimer. On the basis of the sources shown in Table S1, data and information presented below are gathered in order to provide a general overview rather than a strict analysis and a categorization of participating countries according to their attitudes on the use of transgenesis in agriculture. For an in-depth analysis more and uniformly structured data homogenously available in all participant countries would be required. The data presented in response to some of the 9 key questions are limited in size due to the varying level of replies received in response to the questionnaire in the different participating countries. This limitation must be taken into account in any summaries of the data.

1. Give a brief summary of the agronomical (5 main crops, area in ha and challenges, as in matrix)/economical (in relation to agriculture and research) situation in your country.

	General	**5 main crops (thousands of hectares)**					**Challenges**	**Comments**
Belgium	Arable crop farming. Dairy and meat farming. Orchards (mainly apples & pears). Vegetable cultivation. Cultivation of ornamentals.	Maize (grain & silage)	Wheat	Potato	Sugar beet	Barley	**1.** Diseases (especially fungal diseases, ex potato, apple, pear, maize and wheat cultivation) **2.** Costs of growing crops combined with the volatility of market prices	Cost savings requiring breakthroughs in disease resistance.
		245.5	203.2	82.3	62.2	44.1		
Bulgaria	Crops number is decreasing as the average farm size increases in the last 5-6 years.	Wheat	Sunflower	Maize	OSR	Barley	**1.** Water availability (main crops are rain-fed grown) **2.** Biotic constraints: pests, diseases, and competition from weeds	
		1 137	747.1	414.4	231.3	178.9		
Czech Republic	53.7% of Czech area is agricultural land, with slow decrease. The total production of key crops depends on weather conditions. Acreage of feeding crops	Wheat	Barley	Rape	Maize	Industrial sugar beet	**1.** Weed (normally use pre-emergence and/or post-mergence dose of herbicide) **2.** Diseases: cereals' grass powdery mildew, leaf blotch, common	Seed treatment and relatively resistant varieties of some crops (traditional breeding
		863.1	372.8	363.4	121	50.2		

	decreases due to decrease of number of livestock. Usage of crop for production of bioethanol and biogas increases (maize, rape).						blight wheat, fusarioses and common smut **3.** Pest: Cereal leaf beetle (*Oulema gallaeciana*)	techniques).
France		Wheat	Maize	Barley	OSR	Grapevine	**1.** Stagnating yields due to increasing water scarcity **2.** Insect pests (particularly in OSR and maize) 3. Fungal diseases (powdery mildew in grapevines or fusarium ear blight in wheat)	Selecting high yielding varieties and drought resistance (wheat), NUE (maize) is required.
		5 491	3 014	1 544	1 984	764.1		
Germany		Wheat	Maize	Barley	Winter rape	Sugar beet	**1.** Wheat: Fungal and viral diseases; flies and midges, aphids, nematodes **2.** Maize: European corn borer, Western corn rootworm **3.** Barley: Fungal Disease (Fusarium head blight and root rot) and Viral Disease **4.** Winter rape: Fungal diseases; curculionid and chrysomelid beetles, flies **5.** Sugar beet: Fungal diseases; nematodes wireworms	
		3 248	2 516	1 598	1 328	398.1		
Hungary	Five million ha of arable land	Maize	Wheat	Sunflower	Barley	OSR	**1.** A major emerging	

	(>50% of total land) are cultivated. Agriculture is still a major economic sector. Farm structure is currently in a transition phase in favour of small-scale farmers.	1 325	977.8	579.5	261.2	233.9	constraint for plant production is drought, to which maize and wheat are the most vulnerable **2.** Insect pests in maize Fungal infections in wheat	
Italy	"Genetic spread" phenomenon concerning maize breeding between Italy and other advanced countries. This yield gap translates into extensive losses in economic terms. The spread is likely due to the impossibility to access the best breeding material available at the international level because this is essentially all transgenics (with insect resistance or herbicide tolerance traits).	Wheat	Rice	Maize	Olive trees	Grapevine	**1.** Maize insect parasites (European corn borer and Western corn rootworm) **2.** Drought and cold for wheat (both durum and bread wheat) **3.** Fungal diseases in apple, rice and grapevine	
		1 726	1 490	1 292	1 162	717.6		
Portugal		Olive tree	Grapevine	Maize	Winter Cereals	Forestry	Species used for feed (*Medicago*, *Lathyrus*, alfalfa, etc.)	
		345.7	179.4	100	150	3 400		
Romania		Grain maize	Wheat	Sunflower	Barley	Rapeseed	Economic challenges: shortage of financial resources	

		2 588	1 947	995	419.5	392.7	**1.** Wheat: resistance to *Fusarium*, *Puccinia* and *Eurigaster* **2.** Grain maize: main diseases (*Helminthosporium*, *Ustilago*) and pest (*Ostrinia nubilalis*) **3.** Sunflower: testing at farm level for resistance to *Orobanche cumana*	
Spain	Agriculture is important to the national economy; 20.6 million ha, about 40% are suitable for cultivation. Soil is generally of poor quality. Roughness of the terrain has been an obstacle to agricultural mechanization. Land erosion is a serious problem in parts of the country.	Barley	Olive Trees	Wheat	Grapevine	Maize	**1.** Insect pests (*e.g.*, ground beetles in barley, fruit flies in olive production, and European corn borer in maize) **2.** Fungal diseases (*e.g.*, smuts in barley and wheat, olive leaf spot, mildew in grapevines) **3.** Viruses	
		2 700	2 503	1 992	960.2	429.7		
Turkey	The 7th largest agricultural producer in the world with 21.3 million ha agricultural land and different agro-ecological conditions.	Wheat	Barley	Tomato	Maize	Sunflower	**1.** Wheat and barley production: drought, pests (Hessian fly, Sunn pest) and diseases (rust and mildew) **2.** Sunflower: downy mildew and sunflower broomrape 3. Maize: pests (European corn borer,	

		8 096	2 868	1 100	700	655	corn root worm and stem borer)	
Sweden	Swedish forests dominated by Norway spruce and Scots pine, forests cover over 28 000 kHa. 100 mil ton harvested. Climate adaptation, root rot, pine weevil.	Wheat	Barley	OSR	Potato	Forests	**1.** Yield, disease and insects for wheat, barley **2.** Yield, pollen beetle for rapeseed *Phytophthora* for potatoes	
		420.6	323.3	97.6	27.6	28 300		
United Kingdom		Wheat	Barley	OSR	Potato	Sugar beet	**1.** Fungal diseases such as septoria in wheat and net blotch in barley **2.** Phoma stem canker is the most economi-cally important oilseed rape disease **3.** Potato late blight control requires several fungicides	
		1 969	970	681	146	113		

2. Is your country developing specific breeding techniques such as Agro-infiltration, Cisgenesis, Intragenesis, MAS (Marker-Assisted Selection: SNP (Single Nucleotide Polymorphism) and QTL (Quantitative Trait Loci)), ODM (Oligonucleotide Directed Mutagenesis), RNA-dependent DNA methylation (RdDM), Reverse Breeding, or ZFN (Zinc Finger Nuclease Technology) and other nucleases (meganuclease, TALEN (Transcription Activator-Like Effector Nuclease) and CRISPR (Clustered Regularly Interspaced Short Palindromic Repeats))?

	Agro-infiltration	**Cisgenesis Intragenesis**	**MAS (SNP and QTL)**	**ODM**	**RdDM**	**Reverse Breeding**	**ZFNs and other nucleases**	**Comments**
Belgium		Cisgenesis		New traits in canola, lettuce, petunia, tobacco, tomato				Relevant alternatives for generating genetic variation.
Bulgaria			Cotton and sunflower.					Transgenic research is essentially banned.
Czech Republic			**1.** To improve coping of cereals (wheat and barley) with abiotic stress: Crop Res. Inst. Prague. **2.** To enhance resistance of garden pea to pea seed-borne mosaic virus, fusarium root rot (*Fusarium solani*), fusarium wilt (*Fusarium oxysporum*): Agritec Plant Research Ltd., Šumperk; SEMO, Smrzice; Palacký Univ., Olomouc; Mendel Univ., Brno; Institute of Entomology, CAS.					**1.** Positional cloning is used for resistance of wheat to the powdery mildew *Blumeria graminis f. sp. tritici* and to septoria leaf blotch *Mycosphaerella graminicola*. **2.** Biotechnology is used for increasing the resistance of rape to blackleg disease (*Leptosphaeria maculans*).

France	SNP and QTL.	Not tested or developed.	Meganuclease, TALEN and CRISPR (and also transgenesis) tested on wheat, maize, rice, OSR, tomato, potato, apple, poplar, and *Brachypodium* ('Genius' programme)	French breeding programs tend not to use transgenesis for political reasons. Meganuclease, CRISPR, and TALEN are developed in basic research mostly for proof of concept (*e.g.* biotic and abiotic stress): 'Genius' *Genome ENgineering Improvement for Useful plants of a Sustainable agriculture* is an ANR funded project gathering a consortium of 15 public & private partners. Public partners : INRA, CIRAD Université Lyon 3; Private partners: Cellectis, Biogemma, Germicopa, Pépinières et Roseraies G. Delbard, Vilmorin The traits targeted in case studies are yield, architecture and resistance to biotic and abiotic stress (Nitrogen Use Efficiency) http://www.genius-project.fr

Germany				These techniques are being developed, but there remains a gap in the translation of proven technologies, especially transgenesis into practice.
Hungary	Wheat, grape and forestry.	In experimental phase.		
Italy	To improve some crops, especially cereals (durum wheat, bread wheat, barley and rice) and woody plants (grapevine and apple).			
Portugal	SNP and QTL.	Yes.		
Romania	Yes.			
Spain	SNPs and QTLs in tree major crops: prunus, strawberry and melon.		ZFN is recent and expensive. It is cheaper to use the kit of direct mutagenesis (*e.g. Arabidopsis* plants).	
Sweden	Some breeding programs.			

Turkey	**1.** To improve bread and durum wheats (glutenin and gliadin alleles, high protein, Waxy, lipoxygenase, and *Puccinia* resistance). **2.** To improve the malt quality of brewing barley. **3.** Tomatoes and eggplants.	
UK	Relies on transgenesis, TILLING, and techniques utilizing the latest advances in next-generation sequencing.	Active in genome editing technologies.

3. Is transgenesis in plants used in basic research and/or to create new varieties?

	Basic research	Creation of new varieties	Institutions	Comments
Belgium	Yes	Yes	Ghent (UGent, VIB, Bayer Cropscience CropDesign (part of BASF Plant Sciences) Devgen Other universities and research institutes	Genetic modification is used to study plant related sciences, especially Bayer Cropscience and Crop Design. Crop Design has a strong focus on intragenesis.
Bulgaria	By three different groups.			Few new genotypes are developed per year, but reaching the field trial stage is explicitly banned, not to speak about approaching variety registration.
Czech Republic	Yes, see Kodrik et al. (2013) in Suppl. Material 5	The research is mainly targeted on the enhancement of yield and tolerance to stress.	Crop Research Institute, Institute of Experimental Botany AS CR, Universities, Potato Research Institute, AGRA GROUP.	Bureaucratic difficulties for scientists, majority of new traits only ever reach evaluation under glasshouse conditions, field trial or even practical application.
France	Public research uses transgenesis	No		The private sector performs its field trials mainly in the USA to assess new GM varieties.
Germany	Yes	Yes	Leibniz Universität Hannover is focusing on the development of transgenic legume prototypes (mainly pea and faba bean) conferring fungal, insect and drought tolerance resistance. These prototypes are designed to become introduced into breeding programs as the required traits are unavailable in the respective gene pools.	Transgenesis is used already by students (during undergraduate or graduate years, depending on the focus of their work and the university's curriculum).

Hungary	Yes: public institutes for generating prototypes.	No		Transgenic plants are used for proof-of-concept research only: see Balázs et al. (2011) Plain Facts About GMOs – Hungarian White Paper (www.pannonbiotech.hu)
Italy	Yes	Yes. This was done for truit trees (apple, grapevine, kiwi, olive...) as well as annual crops (wheat, barley…).		None has any chance of reaching the field trial stage, not to mention commercial release, due to the present regulation and political climate.
Portugal	Yes	No		
Romania	Yes	Yes		Seven references in total.
Spain	Rice and specially *Arabidopsis thaliana* are used as models plant, transformed with new unknown genes and promoters to study their functions, and then the information can be extrapolated to other non model plants.	Transgenic plants of different species (orange trees in Valencia, grapevine in Galicia, vegetables crops and fruit trees in Catalonia etc.) have been obtained but until now only Bt maize is commercialized and cultivated in Spain since 1998.		
Sweden	A lot	Not yet		
Turkey	Only in a few university laboratories			Cultivation of transgenic plants is explicitly banned by the Biosafety Law there is no sense of wasting resources on transgenic research.

United Kingdom	Yes	Yes	Transgenesis is used as a tool for the study of gene function. The information is then used in conventional breeding approaches. Transgenesis has the advantage that it allows the introduction or modification of genes that would be difficult or impossible by conventional approaches, *e.g*. enhanced nutritional quality leading to health benefits. However, the route to development of new varieties for commercial use is extremely costly and difficult at present.

4. What is the number of research projects using transgenesis in plants among the projects?

See Figure 2

5. How many field trials using GM crops are implemented?

* 2013 data are presented here. Full data of field trials concerned with biotic stress challenges (2003-2013) are in Supplementary Material 7.

Total field trials using GM plants	**0**	**1-5**	**10-28**
Maize		BE CZ (4 joint) HU (4 public)	ES
Potatoes		BE (1/1) DE HU (1 public) UK	
Sugar beet		CZ (2 private) DE ES (3 private)	
Poplar trees		FR (1 public, stopped in July 2013) BE (public) SE (public)	
Others	BG IT PT TR	CZ (2/2, 1 joint) UK	 RO SE (2/8)

Brackets: private/public or joint participation

6. How did the number of field trials of GM plants change over the last 10 years (discontinued, stable, declined, increased)?

Change of number of field trials of GM plants	Discontinued	Declined	Stable	Increased
Countries	BG IT PT TR	BE CZ DE FR HU RO UK	SE	ES

7. Is plant breeding primarily developed by the public sector or by the private sector, or both in equal levels?

Sector	Countries
Primarily by public sector	BG* CZ PT RO
Primarily by private sector	BE* DE
By both sectors in equal levels	FR HU* IT* ES TR UK
Very few plant breeding	SE

* For these countries, private companies are mostly interested in major crops.

8. Is there significant cooperation between the two sectors to create new varieties?

No significant cooperation: BG, IT, SE , TR.
Significant cooperation: BE, CZ, ES, FR, DE, HU, PT, RO, UK
For Bulgaria, Italy and Turkey, there is almost no cooperation because international companies are not interested in cooperating with national public research.
For Hungary and the Czech Republic, there is only cooperation between national companies and public research to create new varieties but there is no significant cooperation between transnational companies and public research.
It is quite the opposite for Germany, Romania and Spain: there is significant cooperation between national public research and the private international sector.

9. What are the sources of financial support (private, government, EC) for public research in plant breeding?

Sources	Countries
Only governmental funds	RO TR
Mainly governmental funds	CZ FR HU PT SE UK
Both governmental and private funds	BG* DE ES IT*
Mainly private funds	BE
Extra European and international funds	SE UK

* For these two countries, the answers hint that there is financial support other than governmental funds but the kind of these funds is mixed (private companies, foundations).
NB: For Belgium, Bulgaria, Hungary and Italy, the financial support is limited and decreasing due to the economic crisis.

Table S3. Queries used for searching papers related to biotic stress (BS) challenges and plant breeding techniques with Luxid®.

Table S3a. BS challenges

Crop	Queries
Wheat	Topic=("Leaf blotch" OR "Septoria tritici" OR "Mycosphaerella graminicola") Topic=("leaf rust" OR "Puccinia triticina") AND Topic=(Wheat OR triticum) Topic=("Stripe rust" OR "yellow rust" OR "Puccinia stiiformis") Topic=("Wheat dwarf virus") AND Topic=("dwarf virus") AND Topic=(Wheat OR triticum) Topic=("Hessian fly" OR "Mayetiola destructor" OR Cecidomyiidae) Topic=(wheat OR triticum) AND (Chlorops OR (Chloropid NEAR fly) OR (gout NEAR fly) Topic=(wheat OR triticum) NEAR ("Drechslera tritici" OR "Pyrenophora tritici" OR "tan spot" OR "yellow leaf spot") Topic=((wheat OR triticum) NEAR ("take all" OR "Gaeumannomyces graminis" OR "Ophiobolus graminis")) Topic=(wheat OR triticum) AND (oscinella OR "frit fly") Topic=(wheat OR triticum) AND (oulema OR lema OR "leaf beetle" OR "leaf beetles") Topic=(wheat OR triticum) NEAR ("Pseudocercosporella herpotrichoides" OR eyespot) Topic=(wheat OR triticum) NEAR ("stem rust" OR "Puccinia graminis") Topic=(wheat OR triticum) NEAR ("Sitobion avenae" OR "Metopolophium dirhodum" OR "grain aphid" OR "grain aphids") Topic=(wheat OR triticum) NEAR ("Sitodiplosis mosellana" OR "Contarinia tritici" OR "blossom midge")
Wheat & Barley	Topic=("Sunn pest" OR "Eurygaster integriceps") Topic=("Corn Ground Beetle" OR "Zabrus tenebrioides") Topic=(Bunt OR smut OR "Ustilago tritici" OR "Tilletia caries" OR "Tilletia Leavis" OR "Tilletia contraversa" OR Ustilago OR Tilletia) AND Topic=(Barley OR "Hordeum vulgare" OR "cereal grain" OR Poaceae OR "wheat" OR "triticum" OR Triticeae) Topic=(Fusarios* OR "Fusarium graminearum" OR "Fusarium culmorum" OR fusariose* OR "Fusarium avenaceum" OR Fusarium) AND Topic=(Barley OR "Hordeum vulgare" OR "cereal grain" OR Poaceae OR "wheat" OR "triticum" OR Triticeae) Topic=("Powdery mildew" OR "Erysiphe graminis" OR "Blumeria graminis" OR mildew) AND Topic=(Barley OR "Hordeum vulgare" OR "cereal grain" OR Poaceae OR "wheat" OR "triticum" OR Triticeae)
Barley	Topic="barley midge" Topic="Barley rust" OR "Puccinia hordei" Topic=(rust) AND Topic=(Barley OR "Hordeum vulgare") Topic=("yellow dwarf virus") AND Topic=(Barley OR "Hordeum vulgare" OR "cereal grain" OR Poaceae OR "wheat" OR "triticum" OR Triticeae) Topic=(barley OR "Hordeum vulgare") NEAR ("Helminthosporium sativum" OR "Cochliobolus sativus" OR "Spot blotch") Topic=(barley OR "Hordeum vulgare") AND (oulema OR Lema OR "cereal leaf beetle" OR "cereal leaf beetles") Topic=(barley OR "Hordeum vulgare") NEAR ("oscinella frit" OR "frit fly") Topic=(barley OR "Hordeum vulgare") NEAR ("Chlorops pumilionis" OR (chloropid NEAR/3 fly) OR "gout fly" OR "gout flies") Topic=(barley OR "Hordeum vulgare") NEAR ("pyrenophora teres" OR "Helminthosporium teres" OR "net blotch") Topic=(barley OR "Hordeum vulgare") NEAR ("Rhynchosporium secalis" OR "leaf blotch") Topic=(barley OR "Hordeum vulgare") NEAR (Sitobion OR Metopolophium OR "grain aphid" OR "grain aphids")

	Topic=(barley OR “Hordeum vulgare”) NEAR (Rhopalosifum OR “wheat aphid” OR “wheat aphids”) Topic=(barley OR “Hordeum vulgare”) NEAR (wheat NEAR/1 "dwarf virus")
Maize	Topic=("Common smut" OR "Ustilago zeae" OR Ustilago OR Smut) AND Topic=("Zea mays" OR corn OR Maize) Topic=("European corn borer" OR "Ostrinia nubilalis" OR "corn borer") Topic=("Corn Rootworm" OR "Diabrotica") Topic=(Wireworm* OR Elateridae) Topic=(maize OR “Zea mays”) NEAR (“Heliothis armigera” OR “Helicoverpa armigera” OR “cotton bollworm”) Topic=(maize OR “Zea mays”) NEAR (“Tanymecus dilaticollis” OR “corn weevil”) Topic=(maize OR “Zea mays”) NEAR (“Sesamia nonagrioides” OR “corn stalk borer”) Topic=(maize OR “Zea mays”) AND (Scutigerella OR symphylan*) Topic=(maize OR “Zea mays”) NEAR (tetranychus OR “spider mite” OR “spider mites”) Topic=(maize OR “Zea mays”) NEAR (“cereal fly” OR “cereal flies” OR geomyza OR oscin*) Topic=(maize OR “Zea mays”) NEAR (“Zyginidia scutellaris” OR leafhopper*) Topic=(maize OR “Zea mays”) NEAR (aphid* OR “Metopolophium dirhodum” OR “Sitobion avenae”) Topic=(maize OR “Zea mays”) NEAR ((corn NEAR maggot) OR delia) Topic=(maize OR “Zea mays”) NEAR (cutworm* OR agrotis) Topic=(maize OR “Zea mays”) NEAR (Fusari*) Topic=(maize OR “Zea mays”) NEAR (Exserohilum OR Helminthosporium OR “northern leaf blight”)
Sunflower	Topic=("Broomrape" OR "Orobanche cumana" OR "Sunflower Broomrape" OR "Orobanche") Topic=("Phoma Black Stem" OR "Phoma macdonaldii") Topic=("Puccinia helianthi") Topic=(rust) AND Topic=(Sunflower OR "Helianthus annuus") Topic=(sunflower OR “Helianthus annuus”) NEAR Sclerotinia Topic=(sunflower OR “helianthus annuus”) NEAR Botrytis Topic=(sunflower OR “helianthus annuus”) NEAR (phomopsis OR diaporthe) Topic=(sunflower OR “helianthus annuus”) NEAR Verticillium Topic=(sunflower OR “helianthus annuus”) NEAR (Macrophomina OR “charcoal rot”) Topic=(sunflower OR “helianthus annuus”) NEAR ((white NEAR/2 rust) OR “blister rust” OR pustula) Topic=(sunflower OR “helianthus annuus”) NEAR (wireworm* OR “wire worm” OR “wire worms” OR agriotes OR elaterid* OR “Click beetle” OR “click beetles”) Topic=(sunflower OR “helianthus annuus”) AND (aphis OR blackfl* OR “black fly” OR “black flies” OR aphid* OR brachycaudus) Topic=(sunflower OR “helianthus annuus”) AND (ambrosia OR ragweed*)
Grapevine	Topic=("leafroll" OR GLRV OR "leafroll-associated virus*" OR fanleaf or GFLV or GFV) Topic=("Powdery mildew" OR "Erysiphe necator" OR "Uncinula necator") AND Topic=(grapevine OR vitis OR grape*) Topic=(”Downy mildew” OR “Plasmopara viticola”) Topic=(grapevine* OR “grape vine” OR vitis OR vineyard*) NEAR ((gray near/2 mold) OR botryotinia OR botrytis) Topic=(grapevine* OR “grape vine” OR vitis OR vineyard*) AND (leafroller* OR “leaf roller” OR “leaf rollers” OR sparganothis) Topic=(grapevine* OR “grape vine” OR vitis OR vineyard*) NEAR (Eriophyes OR Colomerus OR Phytoptus OR ((blister OR bud OR erineum OR eryophid) near/2 mite*)) Topic=(grapevine* OR “grape vine” OR vitis OR vineyard*) NEAR ((spider near/2 mite*) OR eotetranychus OR tetranychus) Topic=(grapevine* OR “grape vine” OR vitis OR vineyard*) NEAR (Lobesia OR Eupoecilia OR Polychrosis OR (european near/3 moth*) OR eudemis OR “vine moth” OR “vine moths”) Topic=(grapevine* OR “grape vine” OR vitis OR vineyard*) NEAR (Argyrotaenia OR Eulia OR Tortrix)

	Topic=(grapevine* OR “grape vine” OR vitis OR vineyard*) NEAR (Scaphoideus OR (American near/2 leafhopper*) OR Flavescence OR “Bois noir” OR “Black wood” OR “Grapevine yellows” OR “Grapevine yellow” OR phytoplasma*)
Potato	Topic=("Golden nematode" OR "Globodera rostochiensis") Topic=("Aecidium cantense") Topic=("Deforming rust") AND Topic=(Potato* OR "Solanum tuberosum" OR Solanace*) Topic=("Phytophthora infestans") Topic=("Late blight") AND Topic=(Potato* OR "Solanum tuberosum" OR Solanace*) Topic=(”Potato virus Y”) Topic=(potato* OR “Solanum tuberosum”) NEAR (“Alternaria solani” OR “early blight”) Topic=(potato* OR “Solanum tuberosum”) NEAR ((potato NEAR/4 aphid*) OR macrosiphum OR Siphonophora) Topic=(potato* OR “Solanum tuberosum”) NEAR (Leptinotarsa OR Chrysomela OR Doryphora OR Polygramma OR beetle* OR spearman OR “potato bug” OR “potato bugs”) Topic=(potato* or “Solanum tuberosum”) NEAR “leafroll virus” NEAR (resistan* OR toleran*)
Oilseed Rape	Topic=("Sawfly" OR "Athalia rosae") Topic=("Flea beetl*" OR "Psylliodes chrysocephala") Topic=("Pollen beetle" OR "Meligethes aeneus") Topic=(“Brassica napus” OR rapeseed* OR “rape” OR “oilseed rape” OR canola) NEAR (Pseudocercosporella OR (white NEAR/3 spot)) Topic=(“Brassica napus” OR rapeseed* OR “rape” OR “oilseed rape” OR canola) AND (Mycosphaerella OR “ring spot” OR ringspot) Topic=(“Brassica napus” OR rapeseed* OR “rape” OR “oilseed rape” OR canola) NEAR (“verticillium longisporum” OR wilt) Topic=(“Brassica napus” OR rapeseed* OR “rape” OR “oilseed rape” OR canola) NEAR (“Erysiphe cruciferarum” OR “powdery mildew”) Topic=(“Brassica napus” OR rapeseed* OR “rape” OR “oilseed rape” OR canola) NEAR (“Hyaloperonospora parasitica” OR “downy mildew”) Topic=(“Brassica napus” OR rapeseed* OR “rape” OR “oilseed rape” OR canola) NEAR (“cabbage aphid” OR “cabbage aphids” OR brevicoryne) Topic=(“Brassica napus” OR rapeseed* OR “rape” OR “oilseed rape” OR canola) NEAR (“terminal bud weevil” OR “terminal bud weevils” OR “Ceutorhyncus picitarsis” OR “Ceutorhynchus picitarsis” OR “stem weevil” OR “stem weevils”) Topic=(“Brassica napus” OR rapeseed* OR “rape” OR “oilseed rape” OR canola) NEAR (“cabbage root fly” OR “cabbage root flies” OR “delia radicum” OR maggot) Topic=(“Brassica napus” OR rapeseed* OR “rape” OR “oilseed rape” OR canola) NEAR (“green peach aphid” OR “green peach aphids” OR myzus)
All *Brassica* species	Topic=("Gray leaf spot" OR "Alternaria Brassicae") Topic=(Sclerotinia OR "Sclerotinia sclerotiorum") Topic=("Black Leg" OR "Phoma linga" OR "Leptosphaeria maculans") Topic=(Clubroot OR "Plasmodiophora Brassicae") Topic=(“Cabbage seed weevil" OR "Ceutorhynchus napi") Topic=("Brassica pod midge" OR "Dasineura Brassicae")
Sugarbeet	Topic=(beet$ OR sugarbeet* OR “beta vulgaris”) NEAR cercospor Topic=(beet$ OR sugarbeet* OR “beta vulgaris”) AND ramulari* Topic=(beet$ OR sugarbeet* OR “beta vulgaris”) NEAR (mildew OR erysiphe) Topic=(beet$ OR sugarbeet* OR “beta vulgaris”) AND (rust$ OR Uromyces OR Nigredo OR Uredo) Topic=(beet$ OR sugarbeet* OR “beta vulgaris”) AND rhizopus Topic=(beet$ OR sugarbeet* OR “beta vulgaris”) NEAR (rhizoctonia OR “foliar blight” OR Moniliopsis OR “damping off” OR (crown NEAR/3 rot) OR “root rot”) Topic=(beet$ OR sugarbeet* OR “beta vulgaris”) NEAR (“leaf miner” OR “leaf miners” OR “leaf mine” OR “leaf mines” OR Pegomya OR Anthomyia OR Anthomyza OR “beet fly” OR “beet flies”)

	Topic=(beet$ OR sugarbeet* OR “beta vulgaris”) AND (“flea beetle” OR “flea beetles” OR chaetocnema OR “beet flea” OR “beet fleas”) Topic=(beet$ OR sugarbeet* OR “beta vulgaris”) AND (Wireworm* OR “click beetle” OR “click beetles” OR (striped near/2 beetle*) OR elaterid* OR Agriotes) Topic=(beet$ OR sugarbeet* OR “beta vulgaris”) AND ((crane near/2 fly) OR ((crane near/2 flies) OR cranefl* OR longleg*) Topic=(beet$ OR sugarbeet* OR “beta vulgaris”) AND (Scrobipalpa OR Phthorimaea or Gnorimoschema OR Lita OR “beet moth” OR “beet moths” OR “sugarbeet moth” OR “sugarbeet moths”) Topic=(beet$ OR sugarbeet* OR “beta vulgaris”) NEAR (aphid* OR “black fly” OR “black flies” OR “green fly” OR “green flies” OR blackfl* OR greenfl* OR aphis OR myzus) Topic=(beet$ OR sugarbeet* OR “beta vulgaris”) NEAR (eelworm* OR nematod* OR Heterodera OR Tylenchus OR Heterobolbus) Topic=(beet$ OR sugarbeet* OR “beta vulgaris”) NEAR (“western yellow virus” OR “western yellows virus” OR “beet yellowing virus” OR “beet mild yellowing virus”) Topic=(beet$ OR sugarbeet* OR “beta vulgaris”) NEAR ((necrotic Near/4 virus) OR (vein NEAR/2 virus) OR rhizomania OR madness OR polymyxa) Topic=(beet$ OR sugarbeet* OR “beta vulgaris”) NEAR “mosaic virus”
Olive	Topic=(olea OR olive*) NEAR (Spilocea OR Cycloconium OR “Peacock spot” OR (olive near/2 spot) OR “leaf spot” OR Spilocaea OR Fusicladium) Topic=(olea OR olive*) NEAR verticilli* Topic=(olea OR olive*) NEAR (anthracnose* OR colletotrichum) Topic=((olea OR olive*) NEAR (Pseudomonas OR knot)) NOT nematode* Topic=(olea OR olive*) NEAR ((olive* near/3 fly) OR (olive* near/3 flies) OR Bactrocera OR Dacus OR Musca) Topic=(olea OR olive*) NEAR ((leaf near/2 moth*) OR (jasmine near/2 moth*) OR (leaf near/2 worm*) OR (bud$ near/2 moth*) OR palpita OR Margaronia) Topic=(olea OR olive*) NEAR (((leopard OR pyralid) near/2 moth*) OR Zeuzera OR Euzophera OR Phalaena OR Phalaena) Topic=(olea OR olive*) NEAR (“olive moth” OR “olive moths” OR (kernel near/2 borer*) OR prays)

Table S3b. Plant breeding techniques	
Key-words of technique	**Synonymous**
Mass selection	
Mutagenesis	artificial mutagenesis
	chemical mutagenesis
Pedigree selection	
Protoplast fusion	
Recurrent selection	
Single Seed Descent	
Wide crosses	
Agro-infiltration	agro-infection
	agro-infiltration 'sensu stricto'
	floral dip
Agro-inoculation	
Cisgenesis	
Intragenesis	
Grafting on GM rootstocks	
Oligonucleotide-Directed Mutagenesis	ODM
Reverse breeding	
RNA-dependent DNA methylation	RdDM
Zinc-Finger Nuclease	ZFN-1
	ZFN-2
	ZFN-3
Transgenesis	agrobacterium mediated, *Agrobacterium tumefaciens*
Biolistics	
RNAi	
	TALEN
Clustered Regularly Interspaced Short Palindromic Repeats	CRISPR, CRISPR/Cas9

Table S4

Queries used with the Search tool of Questel Orbit for searching Patents about Biotic Stress (BS) challenges according to pests/diseases and crop.

CROP	QUERIES
Wheat	(((wheat OR triticum))/TI/AB/IW ET (("Leaf blotch" OR Septoria OR Mycosphaerella OR rust OR Puccinia OR "dwarf virus" OR Mayetiola OR Cecidomyiidae OR Chlorop+ OR fly OR Drechslera OR Pyrenophora OR spot OR "take all" OR Gaeumannomyces OR Ophiobolus OR Oscinella OR oulema OR lema OR beetle+ OR Pseudocercosporella Ou eyespot OR Sitobion OR Metopolophium OR aphid+ OR Sitodiplosis OR Contarinia OR midge OR "Sunn pest" OR Eurygaster OR Zabrus OR Bunt OR smut OR Ustilago OR Tilletia OR Fusari+ OR Erysiphe OR Blumeria OR mildew))/TI/AB/IW AND (Resistan+ OR toleran+)/TI/AB/IW)
Barley	((Barley OR Hordeum)/TI/AB/IW AND (“Sunn pest" OR Eurygaster OR Beetle+ OR Zabrus OR Bunt OR smut OR Ustilago OR Tilletia OR Fusari+ OR mildew OR Erysiphe OR Blumeria OR midge OR rust OR Puccinia OR "dwarf virus" OR Helminthosporium OR Cochliobolus OR blotch OR oulema OR Lema OR beetle+ OR oscinella OR fly OR flies OR Chlorop+ OR pyrenophora OR Helminthosporium OR blotch OR Rhynchosporium OR Sitobion OR Metopolophium OR aphid+ OR Rhopalosifum)/TI/AB/IW AND (Resistan+ OR toleran+)/TI/AB/IW)
Maize	(("Zea mays" OR corn OR Maize)/TI/AB/IW AND (smut OR Ustilago OR borer+ OR Ostrinia OR Rootworm+ OR Diabrotica OR Wireworm+ OR Elaterid+ OR Heliothis OR Helicoverpa OR bollworm+ OR Tanymecus OR weevil+ OR Sesamia OR Scutigerella OR symphylan+ OR tetrany+ OR mite OR mites OR fly OR flies OR geomyza OR oscin+ OR Zyginidia OR leafhopper+ OR aphid+ OR Metopolophium OR Sitobion OR maggot+ OR delia OR cutworm+ OR agrotis OR Fusari+ OR Exserohilum OR Helminthosporium OR blight)/TI/AB/IW AND (Resistan+ OR toleran+)/TI/AB/IW)
Oilseed rape - Brassica all species	((Brassica OR rapeseed+ OR “oilseed rape” OR canola)/TI/AB/IW AND (Sawfly OR Athalia OR Flea OR beetl+ OR Psylliodes OR Meligethes OR Pseudocercosporella OR spot OR Mycosphaerella OR ringspot OR verticillium OR wilt OR Erysiphe OR mildew OR Hyaloperonospora OR aphid+ OR brevicoryne OR weevil+ OR Ceutorhyncus OR fly OR flies OR delia OR maggot OR myzus OR Alternaria OR Sclerotinia OR « Black Leg » OR Phoma OR Leptosphaeria OR Clubroot OR Plasmodiophora OR Dasineura)/TI/AB/IW AND (Resistan+ OR toleran+)/TI/AB/IW)
Sunflower	((Sunflower OR Helianthus)/TI/AB/IW AND (Broomrape OR Orobanche OR Phoma OR "Black Stem" OR Puccinia OR Rust OR Sclerotinia OR Botrytis OR phomopsis OR diaporthe OR Verticillium OR Macrophomina OR “charcoal rot” OR pustula OR wireworm+ OR “wire worm” OR “wire worms” OR agriotes OR elaterid+ OR beetle+ OR aphis OR blackfl+ OR “black fly” OR “black flies” OR aphid+ OR brachycaudus OR ambrosia OR ragweed+)/TI/AB/IW AND (Resistan+ OR toleran+)/TI/AB/IW)

Grapevine	((grapevine OR vitis OR grape+)/TI/AB/IW AND (Leafroll+ OR GLRV OR fanleaf OR GFLV OR GFV OR mildew OR Erysiphe OR Uncinula OR Plasmopara OR mold OR botryotinia OR botrytis OR “leaf roller” OR “leaf rollers” OR sparganothis OR Eriophyes OR Colomerus OR Phytoptus OR blister+ OR erineum OR eryophid+ OR mite OR mites OR eotetranychus OR tetranychus OR Lobesia OR Eupoecilia OR Polychrosis OR moth+ OR eudemis OR Argyrotaenia OR Eulia OR Tortrix OR Scaphoideus OR leafhopper+ OR Flavescence OR “Bois noir” OR “Black wood” OR “Grapevine yellows” OR “Grapevine yellow” OR phytoplasma+)/TI/AB/IW AND (Resistan+ OR toleran+)/TI/AB/IW)
Potato	((potato+ OR “Solanum tuberosum”)/TI/AB/IW AND (Nematod+ OR Globodera OR Aecidium OR rust OR Phytophthora OR blight OR ”virus Y”OR Alternaria OR aphid+ OR macrosiphum OR Siphonophora OR Leptinotarsa OR Chrysomela OR Doryphora OR Polygramma OR beetle+ OR spearman OR “potato bug” OR “potato bugs” OR “leafroll virus”)/TI/AB/IW AND (Resistan+ OR toleran+)/TI/AB/IW)
Beet - Sugarbeet	((beet OR sugarbeet OR “beta vulgaris”)/TI/AB/IW AND (Cercospor+ OR ramulari+ OR mildew OR erysiphe OR rust OR Uromyces OR Nigredo OR Uredo OR rhizopus OR rhizoctonia OR blight OR Moniliopsis OR damping OR rot OR“leaf miner” OR “leaf miners” OR “leaf mine” OR “leaf mines” OR Pegomya OR Anthomyia OR Anthomyza OR fly OR Flies OR beetl+ OR chaetocnema OR flea OR fleas OR Wireworm+ OR elaterid+ OR Agriotes OR cranefl+ OR longleg+ OR Scrobipalpa OR Phthorimaea OR Gnorimoschema OR Lita OR moth OR moths OR aphid+ OR blackfl+ OR greenfl+ OR aphis OR myzus OR eelworm+ OR nematod+ OR Heterodera OR Tylenchus OR Heterobolbus OR virus OR rhizomania OR madness OR polymyxa)/TI/AB/IW AND (Resistan+ OR toleran+)/TI/AB/IW)
Olive	((olea OR olive+)/TI/AB/IW AND (Spilocea OR Cycloconium OR spot OR Spilocaea OR Fusicladium OR anthracn+ OR colletotrichum OR Pseudomonas OR knot OR fly OR flies OR Bactrocera OR Dacus OR Musca OR moth+ OR worm+ OR palpita OR Margaronia OR pyralid+ OR Zeuzera OR Euzophera OR Phalaena OR borer+ OR Pray+)/TI/AB/IW AND (Resistan+ OR toleran+)/TI/AB/IW)

Supplementary Material 3.

List of biotic stress (BS) challenges per crop in the various selected countries in Europe

Legend:
+ means that less than 25% of the crop area is affected by the pathogen/pest,
++ means that between 25% and 50% of the crop area is affected by the pathogen/pest,
+++ means that more than 50% of the crop area is affected by the pathogen/pest.
The sign corresponds to a mean of three years of observation in crop areas.
Abbreviations:
Belgium (BE), Bulgaria (BG), the Czech Republic (CZ), France (FR), Germany (DE), Hungary (HU), Italy (IT), Portugal (PT), Romania (RO), Spain (ES), Sweden (SE), Turkey (TR), and the United Kingdom (UK).

Devoted research programs in the public sector (see Supplementary Material 6):
In blue: BS challenge dealt with by a public research program not involving a GM tool. Some research programs are carried out in countries where the particular pest / pathogen is not a major problem, here the BS is coloured but with no '+'.
In green: same as in blue but using transgenesis T (or at least as a research tool).

Programs generating knowledge about basic mechanisms were not included. Only programs designed to provide elements of resistance in varieties are taken into account.
[#] Example of a former BS challenge currently resolved by breeding of resistant varieties.
* BS challenges not addressed in any paper (71).
Note that a challenge can be due to several agents.
In red: 'neglected' BS challenges (51) not identified in the current European public research programs or in the recent literature search (see Supplementary Material 4 and 5); 1 of them was concerned with field trials in Europe (see Supplementary Material 7) and 11 of them have been dealt with European or not European Patents (See Supplementary Material 8).

Patents (public and private sectors) were identified using the database Questel Orbit (last updated on 17.12.2014). E= European Patents; NE= Non-European Patents.

Crop species	Type of BS challenges	Latin names	Patent	BE	BG	CZ	FR	DE	HU	IT	PT	RO	ES	SE	TR	UK
Wheat	**Fungal diseases**															
	Leaf (brown) rust	*Puccinia triticina* (*Puccinia recondita* f. sp. *tritici*)	NE	++	++	+	+++	+	+	+/++	+	+/++	+	+	++	+
	Stem (black) rust #	*Puccina graminis*	NE													
	Stripe (yellow) rust	*Puccinia striiformis*	NE	++	++	+	+		+	+	+	+		++	++	++
	Bunts and smuts	*Ustilago tritici,Tilletia* spp., *Urocystis agropyri*	NE		+	+++		+	+	+		++	-		+	+
	Fusarioses (incl. Fusarium head blight) Crown rot	*Fusarium graminearum* (head blight), *Fusarium* spp., *Microdochium* spp.	E/NE	+		+	++	+	+	+	+	+		+		++
	Powdery mildew	*Blumeria (Erysiphe) graminis*	E/NE		++	++	+	+	++	++	+	+			+	++
	Septoria leaf blotch	*Mycosphaerella graminicola* (anamorph: *Septoria tritici*)	NE	++		+++	+++	++	+	+	++	+		+++	++	++
	Take-all	*Gaeumannomyces graminis* var. *tritici* (*Ophiobolus graminis*)	NE				++	+		+	+	+		+		++
	Eyespot	*Pseudocercosporella herpotrichoides*				+	++			+	+	+				+
	Tan spot (yellow leaf spot)	*Drechslera* (*Pyrenophora*) *tritici-repentis*	NE			+	+									
	Insect pests															
	Hessian fly	*Mayetiola destructor*			++			+			+					
	Sunn pest	*Eurygaster integriceps*	NE		++				+		+	+++			+	
	Corn ground beetle*	*Zabrus tenebrioides*			+	+			+		+	+++	-		+	
	Grain aphid Rose-grain aphid	*Sitobion avenae* *Metopolophium dirhodum*	NE			+	+	+		++	+		-	++	+	+
	Frit fly*	*Oscinella frit*				+		+	+			+		+		
	Chloropid gout fly*	*Chlorops pumilionis*				+			+			+				
	Wheat blossom midge: orange wheat blossom midge, yellow wheat blossom	*Sitodiplosis mosellana* *Contarinia tritici*				+	+									

	midge														
	Cereal leaf beetle	*Oulema melanopus* (*Lema melanopa*)			+				+						
	Viral diseases	Vector													
	Wheat dwarf virus (WDV)	Leafhoppers			++			++	+		++		+		+
	Barley yellow dwarf virus (BYDV)	Aphids	E/NE		++			++	+		++		+		+
Barley	**Fungal diseases**		**Patent**	**BE**	**BG**	**CZ**	**FR**	**DE**	**HU**	**IT**	**PT**	**RO**	**ES**	**SE**	**TR**	**UK**
	Barley leaf (brown) rust	*Puccinia hordei*	E/NE		++	+	+	+	+	+	+	+	-	++	+	+
	Stem rust	*Puccinia graminis*[#]	E/NE		++	+	+	+	+	+	+	+	-	++	+	+
	Bunts and smuts	*Ustilago tritici, Tilletia caries, T. laevis, T. controversa*	NE		++	+		+	+	+		++	+		+	
	Fusarioses (incl. Fusarium head blight)	*Fusarium graminearum* (head blight), *Fusarium* spp., *Microdochium* spp.	E/NE			+		+	+	+	+	+				+
	Powdery mildew	*Blumeria* (*Erisyphe*) *graminis*	NE		++	+	+	+	+	++	++	++		+	+	+
	Spot blotch	*Bipolaris sorokiniana* (teleomorph: *Helminthosporium sativum, Cochliobolus sativus*)			++	+	+++	+	+	++		+				
	Net blotch	*Pyrenophora* (*Helminthosporium*) *teres*				++				+	++	+		++		++
	Leaf blotch	*Rhynchosporium secalis*				+	++			+	++					++
	Insect pests															
	Sunn pest*	*Eurygaster integriceps*			++				+			+			+	
	Corn ground beetle*	*Zabrus tenebrioides*			++				+			++			+	
	Grain aphid* Rose-grain aphid* Bird cherry-out aphid (wheat aphid)*	*Sitobion avenae* *Metopolophium dirhodum* *Rhopalosiphum padi*				+	+	+		++	+		-	-	+	
	Cereal leaf beetle*	*Oulema melanopus* (*Lema melanopa*)			++	+		+			+	+				
	Frit fly*	*Oscinella frit*				+		+	+			+				
	Chloropid gout fly*	*Chlorops pumilionis*				+			+			+				
	Viral diseases	Vector														
	Barley yellow dwarf virus (BYDV)	Aphids	E/NE		++	+		+	-	+++		+	-		+	+
	Wheat dwarf virus	Leafhoppers	NE			++			++			++				

	(WDV)*															
Maize	**Fungal diseases**		**Patent**	**BE**	**BG**	**CZ**	**FR**	**DE**	**HU**	**IT**	**PT**	**RO**	**ES**	**SE**	**TR**	**UK**
	Common smut	*Ustilago zeae* (*U. maydis*)	E/NE			+		+	+	+	+	+			+	
	Fusarioses	*Fusarium* spp. (conidial form of *F. graminearum*: *Gibberella zeae*)	E/NE	+		+		+	+	++	+	+	-		+	
	Northern leaf blight	*Setosphaeria turcica* (anamorph: *Exserohilum* (*Helminthosporium*) *turcicum*)	E/NE				+									
	Insect (arthropod) pests		NE													
	European corn borer	*Ostrinia nubilalis*	E/NE			++	++	+	+	++	++	+	+		++	
	Corn rootworm	*Diabrotica* spp.	E/NE		+	+		+	+	++		+			+	
	Wireworm (click beetle)*	*Agriotes* spp.	E		++	+++	+++	++		+	++	++	++/ +++	+	+	
	Corn earworm (cotton bollworm)	*Helicoverpa* (*Heliothis*) *armigera*	E/NE								+	+	++/ +++		+	
	Maize leaf (gray corn) weevil *	*Tanymecus dilaticollis*							+			+++			+	
	Mediterranean corn borer	*Sesamia nonagrioides*					++			++	++				++	
	Symphylan*	*Scutigerella immaculata*				+	+				+					
	Spider mite*	*Tetranychus* spp.				+	+/++				+++					
	Cereal fly* Frit fly*	*Geomyza* spp. *Oscinella* spp.				+	+									
	Leafhopper* Maize orange leafhopper*	*Zyginidia scutellaris* *Cicadulina bipunctata*				+	+									
	Rose-grain aphid* Grain aphid*	*Metopolophium dirhodum* *Sitobion avenae*				+	+								+	
	Corn seed maggot*	*Delia platura*				+	+									
	Cutworm*	*Agrotis* spp.					+	+			++					
Oilseed rape	**Fungal diseases**		**Patent**	**BE**	**BG**	**CZ**	**FR**	**DE**	**HU**	**IT**	**PT**	**RO**	**ES**	**SE**	**TR**	**UK**
	Light leaf spot*	*Pyrenopeziza brassicae*				+ +	++	+		++		++				+
	Gray leaf spot*	*Alternaria brassicae*			+		++	++	+	++		+		+		
	Sclerotinia (white	*Sclerotinia sclerotiorum*	E/NE		++	+	+++	+	+	+		++		++		+

	mold)															
	Blackleg (Phoma stem canker)	*Leptosphaeria maculans* (anamorph: *Phoma lingam*)	E/NE		++	+	++	+	+	+		++		+		+
	Clubroot	Rhizaria*: Plasmodiophora brassicae*	E/NE				+++	+		++		+		++		+
	White leaf spot*	*Pseudocercosporella capsellae*				+	++					-				
	Ring spot*	*Mycosphaerella brassicicola*	E				++									
	Verticillium wilt	*Verticillium longisporum* (*V. dahliae var. longisporum*)	E/NE				++					+				
	Powdery mildew*	*Erysiphe cruciferarum*				+	++					+				+
	Downy mildew*	*Hyaloperonospora brassicae*	E/NE				+									
	Insect pests															
	Rape stem weevil*	*Ceutorhynchus napi*			+	+	+++	+	+			++			+	
	Cabbage seed weevil	*Ceutorhynchus assimilis*			+	+	+	+	+			++			+	
	Stem weevil (terminal bud weevil)*	*Ceutorhyncus picitarsis*					+++	+	-			-			-	
	Brassica pod midge*	*Dasineura brassicae*			++	+	+++	+				++			+	+
	Turnip sawfly*	*Athalia rosae*			+	+	+		+			++		+	+	
	Cabbage stem flea beetle*	*Psylliodes chrysocephala*	NE		++	+	++	+	+			++		+	+	+
	Pollen beetle*	*Meligethes aeneus*			+	+	++	++	+			+		+++	+	+
	Cabbage aphid* Green peach aphid (green fly)*	*Brevicoryne brassicae* *Myzus persicae*				+	+++					++				
	Flea beetle*	*Phyllotreta* spp.			+	+										
	Cabbage root fly (maggot)*	*Delia radicum*				+	+	+								
Sunflower	**Fungal diseases**		**Patent**	**BE**	**BG**	**CZ**	**FR**	**DE**	**HU**	**IT**	**PT**	**RO**	**ES**	**SE**	**TR**	**UK**
	Downy mildew	*Plasmopara halstedii* *P. helianthi*	NE		+	+	+++	+	+		+	+			+	
	Phoma black stem	*Phoma macdonaldii*			++	+ +	+++		+ +	+	+	++			+	
	Rust	*Puccinia helianthi*				+	+			++	+				+	
	Sclerotinia (white mold, basal stem rot, Sclerotinia head rot)	*Sclerotinia sclerotiorum*	E/NE		++	+	+++	+	+	++	+	++			+	
	Botrytis bunch rot*	*Botrytis cinerea*	NE			+	++	+	+	+	+	+			+	

	Phomopsis stem canker*	*Diaporthe helianthi*	NE			+	+++					++				
	Verticillium wilt	*Verticillium dahliae*				+	++					+			+	
	Charcoal rot*	*Macrophomina phaseolina*				+	+					+				
	White blister rust*	*Pustula helianthicola*					+									
	Insect pests															
	Wireworm (click beetle)*	*Agriotes* spp.			++	+	+++			+	++	+			+	
	Black bean aphid (blackfly)*	*Aphis fabae*				+	++	+	+	++						
	Leaf curl plum aphid *	*Brachycaudus helichrysi*														
	Parasitic plant	See footnote 1														
	Sunflower broomrape	*Orobanche cumana*	E/NE		++	+			+		+	+++			++	
	Weed															
	Common ragweed*	*Ambrosia artemisiifolia*				+			+							
Grapevine	**Fungal diseases** (see footnote 2 on Esca)		**Patent**	**BE**	**BG**	**CZ**	**FR**	**DE**	**HU**	**IT**	**PT**	**RO**	**ES**	**SE**	**TR**	**UK**
	Downy mildew	*Plasmopara viticola*			++	+ +	++/ +++	++	+	++	++	++	++		+	
	Powdery mildew	*Erysiphe* (*Uncinula*) *necator*	NE		++	+ +	++/ +++	++	+	++	++	++	++		+	
	Gray mold (grey mould, Botrytis bunch rot)*	*Botryotinia fuckeliana* (anamorph: *Botrytis cinerea*)	E/NE		++	+	++	+	+	++	++	++	++		+	
	Insect (arthropod) pests															
	Grape leafroller*	*Sparganothis pilleriana*				+					+		+++			
	Grape leaf blister mite (grape bud mite, grape erineum mite)*	*Eriophyes* (*Colomerus*, *Phytoptus*) *vitis*				+					+		+++			
	Yellow spider mite*	*Eotetranychus* (*Tetranychus*) *carpini*			++						+		+++		+	
	European grapevine moth*	*Lobesia* (*Polychrosis*) *botrana*			++	+	++/ +++	+		++	++	++	++		+	
	Grapevine moth*	*Eupoecilia ambiguella*														
	Grape tortrix*	*Argyrotaenia ljungiana*					+++									
	Virus like diseases	Vector														
	Flavescence dorée*	*Scaphoideus titanus*	E				++/			++	+					

	Bois noir (black wood)*	*Hyalesthes obsoletus* and other planthoppes					+++									
	Viral diseases	Vector														
	Grapevine fanleaf virus (GFLV)	*Xiphinema index*	E/NE		++	+	+			++	+				+	
	Grapevine leafroll-associated virus (GLRaV) *	Pseudococcidae Coccidae	E/NE		++	+	+			++	+	+				
Potato	**Fungal diseases**		**Patent**	**BE**	**BG**	**CZ**	**FR**	**DE**	**HU**	**IT**	**PT**	**RO**	**ES**	**SE**	**TR**	**UK**
	Late blight	*Phytophthora infestans*	E/NE	+++	++	++	+++	+++	+ +	++	+	+++		+++	+	++
	Deforming rust*	*Aecidium cantense*					+				+				+	
	Early blight	*Alternaria solani*	NE	++	++	+		+		++	+	++		+	+	
	Potato aphid*	*Macrosiphum euphorbiae* (*Siphonophora solanifolii*)	E/NE				+	+		++		+				
	Green peach aphid (green fly)	*Myzus persicae*														
	Colorado potato beetle (ten-striped spearman, ten-lined potato beetle, potato bug)	*Leptinotarsa* (*Chrysomela*, *Doryphora*, *Polygramma*) *decemlineata*	NE		++	+	+	++		+++	++	+++			++	
	Nematode pests															
	Potato cyst nematodes: golden nematode, pale cyst nematode	*Globodera rostochiensis* *G. pallida*	E/NE	+		+	+		+	+	+	+				
	Viral diseases	Vector														
	Potato Virus Y (PVY)	Aphids	E/NE		++	+++	+	++	++	+++	+	+		+	+	
	Potato leafroll virus (PLRV)	Aphids	E/NE			+++		+	+ +	++	+	+			+	
Beet	**Fungal diseases**		**Patent**	**BE**	**BG**	**CZ**	**FR**	**DE**	**HU**	**IT**	**PT**	**RO**	**ES**	**SE**	**TR**	**UK**
	Cercospora leaf spot	*Cercospora beticola*		++		+	+++	++	+	+++	+	++		+	+	
	Ramularia leaf spot*	*Ramularia beticola*		++		+	+++	+						++		
	Powdery mildew	*Erysiphe betae* (*E. polygoni*)	NE	+		+	++		+	+	++	+			+	
	Rhizopus root rot*	*Rhizopus stolonifer* *R. arrhizus*				+			+							
	Rhizoctonia foliar blight	*Rhizoctonia* (*Moniliopsis*) *solani*		+			+++			++	++	+				

	Crown/Root rot															
	Insect pests															
	Beet leaf miner* Beet fly*	*Pegomya hyoscyami* *P. betae* (*Anthomyia betae*)				+	+	+		+	++				+	
	Flea beetle*	*Chaetocnema tibialis*	NE			+					+	+			+	
	Wireworm (click beetle)*	*Agriotes* spp.				+	++	+		+	+++					
	Crane fly (daddy longlegs)*	*Tipula* spp.				+	++									
	Sugar beet moth*	*Scrobipalpa* (*Phthorimaea*, *Gnorimoschema*, *Lita*) *ocellatella*				+	+++					++				
	Black bean aphid (black fly)* Green peach aphid (green fly)*	*Aphis fabae* *Myzus persicae*				+		+		++						
	Nematode pests															
	Beet cyst eelworm (beet cyst nematode)*	*Heterodera* (*Tylenchus*, *Heterobolbus*) *schachtii*		+		+	+++	+++	+	+++		+		++	+	
	Stem nematode (stem and bulb eelworm)*	*Ditylenchus dipsaci*					++	++	+	++						
	Viral diseases	Vector	E													
	Beet western yellows virus (BWYV)* Beet mild yellowing virus (BMYW)	*Aphis fabae* *Myzus persicae*	E/NE			+	+	++		++						
	Beet necrotic yellow vein virus (BNYVV) causing Rhizomania disease	*Polymyxa betae*	E/NE			+	+++	++		+++						
	Beet mosaic virus (BtMV)*	*Aphis fabae* *Myzus persicae*				+		+								
Olive	**Fungal diseases**		**Patent**	**BE**	**BG**	**CZ**	**FR**	**DE**	**HU**	**IT**	**PT**	**RO**	**ES**	**SE**	**TR**	**UK**
	Olive leaf spot (peacock spot)*	*Spilocaea oleaginea* (*Cycloconium* (*Fusicladium*) *oleaginum*)					+/++			+	++		++		+	
	Verticillium wilt*	*Vertilicium dahliae*					+			+	+		++		+	
	Anthracnose	*Colletrotichum acutatum* (*C. cingulata*)									++					
	Bacterial diseases															

Olive-knot disease*	*Pseudomonas syringae pv. savastanoi*	NE	+/++	+	+		+
Insect diseases							
Olive fruit fly*	*Bactrocera oleae* (*Dacus (Musca) oleae*)		+++	+++	++	++	+
Olive leaf moth (jasmine moth, olive leaf worm)*	*Palpita (Margaronia) unionalis*		+		+	+	
Leopard moth* Olive pyralid moth*	*Zeuzera* (*Phalaena*) *pyrina* (*P.esculi*) *Euzophera pinguis*		+		++	+	
Olive moth (olive kernel borer)*	*Prays oleae* (*P. oleellus*)		++	+	++	-	+

Note 1. Orobanche, a parasitic plant, also occurs in OSR growing areas.

Note 2. Esca, which is a grapevine trunk disease, has not been dealt with in this study and is not indicated in the table, as it is caused by a complex of several fungal pathogens.

Supplementary Material 4.
Number of scientific articles according to pests/disease, crop, technique

4a: Transgenesis
4b: Cisgenesis
4c: RNAi /silencing (stable and transient assays)
4d: Other transient assays
4e: Cloning of resistance gene
4f: Mutagenesis
4g: Conventional breeding
4h: Molecular markers used to tag resistance genes and for MAS

Scientific papers concerning the identified biotic stress (BS) challenges were exhaustively analyzed over the period between January 2007 and January 2014. The CAB (Commonwealth Agricultural Bureaux), FSTA **(**Food Science and Technology Abstracts), PubMed (National Center for Biotechnology Information) and Web of Science (Thomson Reuters) databases were screened using queries built for each BS/crop pair (Table S3a of Supplementary Material 2) as well as for terms corresponding to plant breeding techniques (Table S3b) by using synonyms, Boolean and proximity operators and truncations. The resulting papers were first divided into thematic groups according to BS/crop pairs, then filtered further with Luxid® (a new text-mining software platform developed by Temis) according to plant breeding techniques (e.g. transgenesis or other plant breeding methods), BS and crop. Finally, papers remaining in these groups were manually selected as describing either a plant improvement project (leading to a breeding line with a new resistance trait) or a pre-breeding advance with high potential for direct application (such as identification of moleculer markers which can be subsequently used for MAS, or transient assays describing a concept which can be transfered to stable transgenic lines). Articles on model plants for research (Arabidopsis, Nicotiana, …) were not included. This compilation is not meant to be a comprensive review of all upstream research on these BS challenges. On-going research programs are presented in Supplementary Material 6.

Abbreviations: RNAi, RNA interference; MAS, marker assisted selection.

In blue, private compagnies as a co-author (71 articles in total); in yellow, review (13 articles in total).

Some articles are classified in several sections (in bold).

Supplementary Material 4a: Transgenesis

Plant	Origin of transfered genes	Pests/Diseases	Country	University or lab	References

1.	Wheat	Wheat	Leaf rust	Australia Switzerland	CSIRO Plant Ind, Australia Univ Zürich, Inst Plant Biol	Risk JM, Selter LL, Krattinger SG et al. 2012. Functional variability of the *Lr34* durable resistance gene in transgenic wheat. Plant Biotechnol J 10(4): 477-87.
2.	Wheat	Wheat	Leaf rust	China	Huazhong Univ Sci & Technol, China-UK HUST-RRes Genet Engineer & Genom Joint Lab	Luo L, Zhang JR, Yang GX et al. 2008. Expression of puroindoline a enhances leaf rust resistance in transgenic tetraploid wheat. Mol Biol Rep 35(2): 195-200.
3.	Wheat	Wheat	Leaf rust	Canada Switzerland France	Agric & Agri-Food Canada, Cereal Res Ctr, Canada Univ Zürich, Inst Plant Biol, Switzerland Inst Natl Recherche Agronomique, Amélioration et Santé des Plantes, France	Cloutier S, McCallum BD, Loutre C et al. 2007. Leaf rust resistance gene *Lr1*, isolated from bread wheat (*Triticum aestivum* L.) is a member of the large psr567 gene family. Plant Mol Biol 65(1-2): 93-106. **(also in Cloning of resistance gene and MAS, sections)**
4.	Wheat	Wheat	Leaf rust + Powdery mildew	Japan	Univ Tsukuba, Graduate School Life & Environm Sci Natl Inst Agrobiol Sci,Plant Genome Res Unit	BahriniI, Ogawa T, Kobayashi F et al. 2011. Overexpression of the pathogen-inducible wheat *TaWRKY45* gene confers disease resistance to multiple fungi in transgenic wheat plants. Breed Sci 61(4): 319-26.
5.	Wheat	*X. oryzae pv. oryzicola*	Powdery mildew	China	National Ministry of Education Key Laboratory of Integrated Management of Crop Diseases and Insect Pests, Nanjing Agricultural University, China	Wang DF, Wang YJ, Fu MQ, Mu SY, Han B, Ji HT, Cai HS, Dong HS and Zhang CL (2014). Transgenic Expression of the Functional Fragment Hpa1(10-42) of the Harpin Protein Hpa1 Imparts Enhanced Resistance to Powdery Mildew in Wheat. Plant Disease 98 (4): 448-455.
6.	Wheat	Rice	Stripe rust	China	Northwest Univ, Inst Life Sci, Key Lab Resour Biol & Biotechnoln Western China (Minist Educ) Ankang Univ, Inst Agric & Life Sci	Huang X, Wang J, Du Z et al. 2013. Enhanced resistance to stripe rust disease in transgenic wheat expressing the rice chitinase gene *RC24*. Transgenic Res 22(5): 939-47.
7.	Wheat	Wheat	Stripe rust	China	Nanjing Agric Univ, Cytogenet Inst, Natl Key Lab Crop Genet & Germplasm Enhancement Northwest A&F Univ: State Key Lab Crop Stress Biol Arid Areas; Coll Plant Protect	Jiang ZN, Ge S, Xing LP et al. 2013. RLP1.1, a novel wheat receptor-like protein gene, is involved in the defence response against *Puccinia striiformis* f. sp. *tritici*. J Exp Bot 64(12): 3735-46.
8.	Wheat	Synthetic derivate of dermaseptin from *Phyllomedusa bicolor*	Fusarium head blight	Canada	Agric & Agri-Food Canada, Lethbridge Res Ctr Univ Victoria, Dept Biochem & Microbiol	Badea A, Eudes F, Laroche A et al. 2008. Expression of 10R and MsrA2 peptides in transgenic wheat enhances resistance to Fusarium head blight. Cereal Res Commun 36 (Suppl. B): 279-80.
9.	Wheat	Maize	Fusarium head blight	Italy	Consiglio per la Ricerca e la Sperimentazione in Agricoltura (CRA), Maize Section Univ di Milano, DISMA, Fac di Agraria	Balconi C, Lanzanova C, Conti E et al. 2007. Fusarium head blight evaluation in wheat transgenic plants expressing the maize *b-32* antifungal gene. Eur J Plant Pathol 117: 129-40.
10.	Wheat	Barley	Fusarium head blight	USA	Univ of Minnesota: Dept of Agron & Plant Genet, Dept of Plant Pathol	Shin SY, Mackintosh CA, Lewis J et al. 2008. Transgenic wheat expressing a barley class II chitinase gene has enhanced resistance against *Fusarium graminearum*. J Exp Bot 59(9): 2371-78.
11.	Wheat	Bean	Fusarium head blight	Italy	Sapienza Univ di Roma, Dip di Biologia e Biotecnologie Charles Darwin Univ degli Studi di Padova, Dip Territorio e Sistemi Agro-Forestali, sez. Patologia Vegetale Univ degli Studi della Tuscia, Dip di Agrobiologia e Agrochimica	Ferrari S, Sella L, Janni M et al. 2012. Transgenic expression of polygalacturonase-inhibiting proteins in *Arabidopsis* and wheat increases resistance to the flower pathogen *Fusarium graminearum*. Plant Biol (Stuttg) 14(s1):31-38.

12.	Wheat	Bovine	Fusarium head blight + other pathogenes	USA	Univ Nebraska-Lincoln, Dept of Plant Pathol USDA-ARS, Sustainable Agric Systems Lab Univ of Nebraska Lincoln, Dept of Agron & Horticul	Han JG, Lakshman DK, Galvez LC et al. 2012. Transgenic expression of lactoferrin imparts enhanced resistance to head blight of wheat caused by *Fusarium graminearum*. BMC Plant Biol 12: 33. Lakshman DK, Natarajan S, Mandal S, Mitra A. 2013. Lactoferrin-derived resistance against plant pathogens in transgenic plants. J Agric Food Chem 61(48): 11730-35.[l]
13.	Wheat	Chicken + *Aspergillus giganteus*	Fusarium head blight	China Germany	Huazhong Agric Univ: Coll Life Sci & Technol, Mol Biotechnol Lab Triticeae Crops; Coll Plant Sci & Technol, China RWTH Aachen, Inst Mol Biotechnol, Germany	Li HP, Zhang JB, Shi RP et al. 2008. Engineering Fusarium head blight resistance in wheat by expression of a fusion protein containing a *Fusarium*-specific antibody and an antifungal peptide. Mol Plant Microbe Interact 21(9): 1242-48.
14.	Wheat	Wheat + Barley	Fusarium head blight	USA	Univ Minnesota: Dept Agron & Plant Genet; Dept Plant Pathol Utah State Univ, Dept Biol Michigan State Univ, Dept Crop & Soil Sci	Mackintosh CA, Lewis J, Radmer LE et al. 2007. Overexpression of defense response genes in transgenic wheat enhances resistance to Fusarium head blight. Plant Cell Rep 26(4): 479-88.
15.	Wheat	Wheat	Fusarium head blight	Italy France	la Univ Tuscia, Natura & l'Energia, (DAFNE), Dept Sci & Tecnologie per l'Agricoltura, le Foreste, Italy Univ degli studi Padova, Agripolis, Dept TeSAF, Italy Univ d'Aix-Marseille, ISM2/BioSci UMR CNRS7313, France	Moscetti I, Tundo S, Janni M et al. 2013. Constitutive expression of the xylanase inhibitor TAXI-III delays Fusarium head blight symptoms in durum wheat transgenic plants. Mol Plant Microbe Interact 26(12): 1464-72.
16.	Wheat	*Actinidia chinensis*	Fusarium head blight	Italy	Univ Tuscia, Dep Agrobiol & Agrochem Univ Rome "Sapienza", Dept Biol & Biotechnol "Charles Darwin" Univ Padua, Dept Land, Environ, Agric & Forestry	Volpi C, Janni M, Lionetti V et al. 2011. The ectopic expression of a pectin methyl esterase inhibitor increases pectin methyl esterification and limits fungal diseases in wheat. Mol Plant Microbe Interact 24 (9): 1012-19.
17.	Wheat	*Gastrodia*	Fusarium head blight + Sharp eyespot	China	Jiangsu Acad Agric Sci, Provincial Key Lab for Agrobiol Chinese Acad Agric Sci (CAAS), Inst of Crop Sci, Key Lab of Crop Genet & Breed of the Agr Minist, Natl Key Facility for Crop Gene Resour & Genetic Improv	Zhou MP, Yang XM, Yao JB et al. 2012. Enhancement of resistance to Fusarium head blight and sharp eyespot in *Gastrodianin* transgenic wheat. Acta Agron Sin 38(9): 1617-24.
18.	Wheat	Radish	Fusarium head blight + Sharp eyespot	China	CAAS, Key Lab of Crop Genet & Breed, Natl Key Facility for Crop Gene Resour & Genetic Improv Shandong Agric Univ, Agron Coll Jiangsu Acad Agric Sci, Biotechnol Inst	Li Z, Zhou MP, Zhang ZY et al. 2011. Expression of a radish defensin in transgenic wheat confers increased resistance to *Fusarium graminearum* and *Rhizoctonia cerealis*. Funct Integr Genomics 11(1) : 63-70.
19.	Wheat	Wheat	Fusarium head blight + Common root rot	China	CAAS, Inst of Crop Sci, Key Lab of Crop Genet & Breed of the Agr Minist, Natl Key Facility for Crop Gene Resour & Genetic Improv Jiangsu Acad Agric Sci	Zhu XL, Li Z, Xu HJ et al. 2012. Overexpression of wheat lipid transfer protein gene *TaLTP5* increases resistances to *Cochliobolus sativus* and *Fusarium graminearum* in transgenic wheat. Funct Integr Genomics 12(3): 481-88.
20.	Wheat	Wheat + Barley	Fusarium head blight + Powdery mildew + Stripe rust	Switzerland	Stn de recherche Agroscope Changins-Wadenswil	Mascher F, Matasci C, Kneubuehler Y et al. 2012. The resistance of transgenic wheat lines against fungal infections in field trials. Agrarforschung Schweiz 3(6): 298-305.

21.	Wheat	Wheat	Powdery mildew	China	Nanjing Agric Univ, State Key Lab of Crop Genet & Germplasm Enhancement	Wang HZ, Xing LP, Chen PD. 2007. Transformation of powdery mildew resistance-related genes of wheat. Yi Chuan (=Hereditas) 29(2): 243-49.
22.	Wheat	Wheat	Powdery mildew	China	Nanjing Agric Univ, Natl Key Lab of Crop Genet & Germplasm Enhancement	Xing LP, Wang HZ, Jiang ZN et al. 2008. Transformation of wheat thaumatin-like protein gene and diseases resistance analysis of the transgenic plants. Acta Agron Sin 34: 349-54.
23.	Wheat	Wheat	Powdery mildew	Switzerland France	Univ Zürich, Inst Plant Biol, Switzerland ETH Zürich, Dept Biol, Plant Biotechnol, Switzerland INRA UMR 1095, Genet, Diversity & Ecophysiol Cereals, France Agroscope Reckenholz-Tänikon Res Stn ART, Switzerland	Brunner S, Stirnweis D, Diaz Quijano C et al. 2012. Transgenic *Pm3* multilines of wheat show increased powdery mildew resistance in the field. Plant Biotechnol J 10(4): 398-409.
24.	Wheat	*Thinopyrum intermedium*	Take-all	China	CAAS, Natl Key Facil Crop Gene Resour & Genet Improv, Key Lab Biol & Genet Improv of Triticeae Crops, Agric Minist,Inst Crop Sci Northwest A&F Univ, Coll Agron Jiangsu Acad Agr Sci, Inst Biotechnol	Liu X, Yang LH, Zhou XY et al. 2013. Transgenic wheat expressing *Thinopyrum intermedium* MYB transcription factor *TiMYB2R-1* shows enhanced resistance to the take-all disease. J Exp Bot 64(8): 2243-53.
25.	Wheat	Potato	Take-all	China	CAAS, Natl Key Facil Crop Gene Resour & Genet Improv, Key Lab Biol & Genet Improv Triticeae Crops, Agric Minist,Inst Crop Sci Cent South Univ, Forestry & Technol	Rong W, Qi L, Wang JF, Du LP et al. 2013. Expression of a potato antimicrobial peptide SN1 increases resistance to take-all pathogen *Gaeumannomyces graminis* var. *tritici* in transgenic wheat. Funct & Integr Genomics 13(3): 403-09.
26.	Barley		Rusts	Netherlands Malaysia	Univ Malaysia Sarawak, Dept Plant Sci & Environm Ecol, Fac Resour Sci & Technol, Malaysia Leibniz Inst Plant Genet & Crop Plant Res (IPK), Plant Reproductive Biol, Germany Wageningen Univ, Lab Plant Breed, Netherlands INRA-AgroParisTech, UR1290 BIOGER-CPP, France	Yeo FK, Hensel G, Vozabova T et al. 2013. Golden susPtrit: a genetically well transformable barley line for studies on the resistance to rust fungi. Theor Appl Gene 127(2): 325-37.
27.	Barley	*Drosophila melanogaster*	Fusarium head blight + Fusarium root rot + Powdery mildew	Germany	Justus Liebig Univ, Inst Phytopathol & Applied Zoology, Res Ctr BioSystems, Land Use & Nutrition, Germany Washington State Univ, Dept Crop & Soil Sci, USA	Rahnamaeian M, Langen G, Imani J et al. 2009. Insect peptide metchnikowin confers on barley a selective capacity for resistance to fungal ascomycetes pathogens. J Exp Bot 60(14): 4105-14.
28.	Barley	*Drosophila melanogaster*	Powdery mildew	Iran	Shahid Bahonar Univ, Coll Agric, Dept of Plant Biotechnol	Rahnamaeian M, Vilcinskas A. 2012. Defense gene expression is potentiated in transgenic barley expressing antifungal peptide Metchnikowin throughout powdery mildew challenge. J Plant Res 125(1): 115-24.
29.	Barley	Wheat	Powdery mildew + Barley leaf rust	Australia Switzerland Germany	CSIRO Plant Ind, Australia, Australia Univ Zürich, Inst Plant Biol, Switzerland Leibniz Inst, Plant Genet & Crop Plant Res IPK Gat, Germany	Risk JM, Selter LL, Chauhan H et al. 2013. The wheat *Lr34* gene provides resistance against multiple fungal pathogens in barley. Plant Biotechnol J 11(7): 847-854.

30.	Maize	Totivirus	Common smut	USA	Donald Danforth Plant Sci Ctr Univ Georgia, Dept Plant Pathol	Allen A, Islamovic E, Kaur J et al. 2011. Transgenic maize plants expressing the totivirus antifungal protein, KP4, are highly resistant to corn smut. Plant Biotechnol J 9(8): 857-64.
31.	Maize	Maize + Wheat	Fusarioses Fall armyworm Corn earworm	USA	USDA-ARS, Crop Bioprotect Res Unit, Natl Ctr Agricultur Utilization Res	Dowd PF, Johnson ET, Price NP. 2012. Enhanced pest resistance of maize leaves expressing monocot crop plant-derived ribosome-inactivating protein and agglutinin. J Agric Food Chem 60(43): 10768-75.
32.	Maize	*Bacillus thuringiensis*	Corn earworm	China	China Agricul Univ, Coll Agric & Biotechnol CAAS: Inst Crop Sci; Inst Plant Protection, State Key Lab Biol Plant Dis & Insect Pests	Zhang YW, Liu YJ, Ren Y et al. 2013. Overexpression of a novel *Cry1Ie* gene confers resistance to Cry1Ac-resistant cotton bollworm in transgenic lines of maize. Plant Cell Tiss Organ Cult 15(2): 151-58.
33.	OSR	Sweet potato + *Paecilomyces javanicus*	Sclerotinia + *Plutella xylostella*	China	Jiading Agro-tech Extens Ctr Shanghai Municipal Zhejiang Univ, Dept of Agron	Liu HB, Guo X, Naeem MS et al. 2011. Transgenic *Brassica napus* L. lines carrying a two gene construct demonstrate enhanced resistance against *Plutella xylostella* and *Sclerotinia sclerotiorum*. Plant Cell Tiss Organ Cult 106(1): 143-51.
34.	OSR	*Xanthomonas oryzae* pv. *oryzicola*	Sclerotinia	China	Nanjing Agric Univ, Min Agric, Key Lab Monitoring & Management of Plant Dis & Insect	Ma LL, Huo R, Gao XW et al. 2008. Transgenic rape with *hrf2* gene encoding harpin$_{Xooc}$ resistant to *Sclerotinia sclerotinorium*. Agr Sci China 7(4): 455-61. Huo R, Wang Y, Ma LL et al. 2010. Assessment of inheritance pattern and agronomic performance of transgenic rapeseed having harpin$_{Xooc}$-encoding *hrf2* gene. Transgenic Res 19(5): 841-47.[ii]
35.	OSR	Wheat	Sclerotinia	China	SAAS (Sichuan Acad Agric Sci), Inst of Plant Protect	Liu Y, Ke SY. 2007. Transfer of oxalate oxidase gene into double-low *Brassica napus* by *Agrobacterium*-mediated transformation. Southwest China J Agric Sci 20(6): 1176-79.
36.	OSR	*Oryza sativa* cv. IAPAR 9	Sclerotinia	China Russia	Yangzhou Univ , Jiangsu Provincial Key Lab of Crop Genet & Physiol, China Chinese Acad Sci (CAS), Inst of Genet & Develop Biol,China Russian Acad Sci, Siberian Branch, Inst of Mol & Cell Biol, Russia	Fan Y, Du K, Gao Y et al. 2013. Transformation of *LTP* gene into *Brassica napus* to enhance its resistance to *Sclerotinia sclerotiorum*. Russ J Genet 49(4): 380-87.
37.	OSR	*Leonurus japonicus*	Sclerotinia	China	Southwest Univ, School of Life Sci, Minist Educ, State Key Lab of Eco-Environ & Bio-Resour of Three Gorges Reservoir Region, Key Lab of Eco-Envirns of Three Gorges Reservoir Region Southwest Univ , Biotechnol Res Ctr, Key Lab of Biotechnol & Crop Quality Improv of Minist Agric of China	Jiang Y, Fu X, Wen M et al. 2013. Overexpression of an nsLTPs-like antimicrobial protein gene (*LJAMP2*) from motherwort (*Leonurus japonicus*) enhances resistance to *Sclerotinia sclerotiorum* in oilseed rape (*Brassica napus*). Physiol Mol Plant P 82: 81-87.
38.	OSR	OSR cv Xiangyou15	Sclerotinia	China	The Oil Crops Institute/National Oil Crops Improvement Center, Changsha, 410128, Hunan, China	HuangFu HY, Guan CY, Jin FR, Yin CF (2014). Prokaryotic expression and protein function of *Brassica napus* PGIP2 and its genetic transformation. Plant Biotechnology Reports 8 (2): 171-181
39.	OSR Sunflower	*Macadamia integrifolia*	Sclerotinia + Blackleg	Iran Russia	Cotton Res Inst Iran, Iran Russian State Agrarian Univ – MTTA, Dept of Agric Biotechnol, Russia	Ghasemi BK, Sheveloukha VS, Karlov GI. 2008. Design, construction and cloning of pCAMBIA-MiAMP1 vector for enhancing disease resistance in plants using *Agrobacterium*-mediated transformation. J

						Appl Biosci 10(2): 538-46.
40.	OSR	Barley	Clubroot	Germany	Schule Eschenweg Julius Kühn Inst (JKI)- Federal Res Ctr for Cultivated Plants: Inst for Biosafety in GMP; Inst for Breed Res on Horticultur & Fruit Crops; Inst for Breed Res on Agric Crops	Reiss E, Schubert J, Scholze P et al. 2009. The barley thaumatin-like protein Hv-TLP8 enhances resistance of oilseed rape plants to *Plasmodiophora brassicae*. Plant Breeding 128(2): 210-12.
41.	Grapevine		Downy mildew Powdery mildew	Australia France USA	CSIRO Plant Ind, Australia Montpellier SupAgro, UMR AGAP, France INRA: UMR1131 Sante Vigne & Qualite Vin; URGV; UMR AGAP, France Univ Strasbourg, Sante Vigne & Qualite Vin UMR1131, France USDA-ARS, Grape Genet Res Unit, USA Cornell Univ, Dept Horticul, NY Agricul Stn, USA	Feechan A, Anderson C, Torregrosa L et al. 2013. Genetic dissection of a TIR-NB-LRR locus from the wild North American grapevine species *Muscadinia rotundifolia* identifies paralogous genes conferring resistance to major fungal and oomycete pathogens in cultivated grapevine. Plant J 76(4): 661-74 **(also in mutagenesis section).**
42.	Grapevine	Inducible promoter from *Vitis pseudo-reticulata*	Powdery mildew	China	Min Agric, Key Lab Horticultur Plant Biol & Germplasm Utilization in Northwest China Northwest A&F Univ: Coll of Horticul; Key Lab of Agric Mol Biol of Shaanxi Province	Xu WR, Yu YH, Ding JH et al. 2010. Characterization of a novel stilbene synthase promoter involved in pathogen- and stress-inducible expression from Chinese wild *Vitis pseudoreticulata*. Planta 231(2): 475-87.
43.	Grapevine		Grapevine fanleaf virus	Italy Austria	Plant Virol Inst CNR IVV, Grugliasco Unit Univ Torino, Dept Arboriculture & Pomol Inst Appl Microbiol BOKU, Plant Biotechnol Unit, Vienna AOU San Giovanni Battista, SCDU Med Genet, Turin Plant Virol Inst CNR IVV, Grugliasco Unit	Gambino G, Perrone I, Carra A et al. 2010. Transgene silencing in grapevines transformed with gflv resistance genes: Analysis of variable expression of transgene, sirnas production and cytosine methylation.Transgenic Res 19 (1): 17-27
44.	Grapevine		Grapevine fanleaf virus	Tunisia Germany	CBBC, Lab Physiol Mol Vigne, Tunisia RLP AgroSci GmbH, Inst Plant Res, Neustadt, Germany	Jardak-Jamoussi R, Winterhagen P, Bouamama B et al. 2009. Development and evaluation of a gflv inverted repeat construct for genetic transformation of grapevine. Plant Cell Tissue and Organ Culture 97 (2): 187-196
45.	Potato	Potato	Late blight	China	CAAS, Inst of Vegetables & Flowers Inner Mongolia Univ of Sci & Technol, School of Mathematics, Physics & Biologic Engineer	Xin CH, Guo JB, Huang SW, Qu DY 2011. Optimization of genetic transformation system for potato variety ' Desiree' and obtainment of transgenic lines. China Vegetables 1(6): 15-21.
46.	Potato	Potato	Late blight	Japan	Nagoya Univ, Grad Sch Bioagr Sci	Kobayashi M, Yoshioka M, Asai S et al. 2012. StCDPD5 confers resistance to late blight pathogen but increases susceptibility to early blight pathogen in potato via reactive oxygen species burst. New Phytol 196(1): 223-37.
47.	Potato (+ tomato)	*Solanum venturii*	Late blight	UK Netherlands Poland	JIC, Sainsbury Lab, UK Wageningen UR Plant Breed, Netherlands Plant Breed & Acclimatization Inst, Res Ctr Młochów,	Foster SJ, Park TH, Pel M et al. 2009. *Rpi-vnt1.1*, a *Tm-2*^{2} homolog from *Solanum venturii*, confers resistance to potato late blight. Mol Plant Microbe Interact 22(5): 589-600.

					Poland	
48.	Potato	*Solanum bulbocastanum*	Late blight	USA	Univ Wisconsin-Madison, Dept Horticulture	Kramer LC, Choudoir MJ, Wielgus SM et al. 2009. Correlation between transcript abundance of the *RB* gene and the level of the RB-mediated late blight resistance in potato. Mol Plant Microbe Interact 22(4): 447-55.
				USA Italy	Univ Minnesota, Dept Plant Pathol, USA Univ Naples "Federico II", Dept Soil, Plant, Environ & Animal Production Sci, Italy Univ Wisconsin: Biotechnol Ctr; Dept Horticulture, USA	Bradeen JM, Iorizzo M, Mollov DS et al. 2009. Higher copy numbers of the potato *RB* transgene correspond to enhanced transcript and late blight resistance levels. Mol Plant Microbe Interact 22(4): 437-46.
				USA	USDA-ARS, Dept Plant Pathol Univ Wisconsin-Madison, Dept Horticul	Halterman DA, Kramer LC, Wielgus S, Jiang JM. 2008. Performance of transgenic potato containing the late blight resistance gene *RB*. Plant Dis 92(3): 339-43.
				Ireland Denmark	TEAGASC (Agric & Food Develop authority Ireland), Crops Res Ctr, Dept of Crop Sci, Ireland Univ Coll Dublin, Shool Biol & Environ Sci, Ireland Aarhus Univ, Fac of Agric Sci, Dept Genet & Biotechnol, Denmark	Wendt T, Doohan F, Mullins E. 2012. Production of *Phytophthora infestans*-resistant potato (*Solanum tuberosum*) *utilising Ensifer adhaerens* OV14. Transgenic Res 21(3): 567-78.
49.	Potato	Potato	Late blight	China	Minist Educ, Huazhong Agric Univ, Key Lab Horticultur Plant BiolDis Natl Ctr for Vegetable Improv, Potato Engineer & Technol Res Ctr of Hubei Province	Ni XM, Tian ZD, Liu J et al. 2010. Cloning and molecular characterization of the potato RING finger protein gene *StRFP1* and its function in potato broad-spectrum resistance against *Phytophthora infestans*. J Plant Physiol 167(6): 488-96.
50.	Potato	Potato	Late blight	Netherlands, China	Univ Wageningen & Res Ctr, Wacheningen UR Plant Breed, Netherlands Acad Agric Sci, Inst Vegetables & Flowers, China	Zhu SX, Li Y, Vossen JH et al. 2012. Functional stacking of three resistance genes against *Phytophthora infestans* in potato. Transgenic Res 21(1): 89-99. Zhu SX., Duwa, A., Su Q et al. 2013. Vector integration in triple R gene transformants and the clustered inheritance of resistance against potato late blight. Transgenic Res 22(2): 315-25.[iii]
51.	Potato	Synthesized analog of peptide from *Galleria mellonella*	Late blight	Czech Republic	ASCR: Biol Ctr, Inst Entomol; Inst Experim Botany Potato Res Inst Ltd. Univ South Bohemia, Fac Sci	Kodrik D, Kludkiewicz B, Navratil O et al. 2013. Protease inhibitor from insect silk-activities of derivatives expressed in vitro and in transgenic potato. Appl Biochem Biotechnol 171(1): 209-24.
52.	Potato	Synthetic peptide	Late blight White rot	Russia	Russian Acad Sci, Shemyakin-Ovchinnikov Inst Bioorganic Chem (Pushchino Branch)	Zakharchenko NS, Rukavtsova EB, Gudkov AT et al. 2007. Expression of the artificial gene encoding anti-microbial peptide Cecropin P1 increases the resistance of transgenic potato plants to potato blight and white rot. Dokl Biol Sci 415: 267-69.
53.	Potato		Late blight	China Netherlands	Shandong Acad Agricul Sci, Key Lab Crop Genetic Improv & Biotechnol, China Wageningen UR Plant Breed,Netherlands Key Lab Horticul Crops Genet Improv Minist Agric, Sino-Dutch Joint CAAS , Inst Vegetables & Flowers, Lab of Horticultural Genom Technol, China	Li G, Huang S, Guo X et al. 2011. Cloning and characterization of *R3b*; members of the *R3* superfamily of late blight resistance genes show sequence and functional divergence. Mol Plant Microbe Interact 24(10): 1132-42**.** **(also in other transient assay section)**

					Huazhong Agric Univ, Minist Educ, Coll Horticul & Forestry, Dept Vegetable Crops, Key Lab Horticul Biol,China	
54.	Potato	*Nicotiana tabacum* + *Phyllomedusa sauvagii* + *Gallus gallus*	Late blight + *Rhizoctonia solani* + *Fusarium solani*	Argentina	Univ Buenos Aires, Fac Ciencias Exactas & Naturales: Dept Fisiol, Biol Mol & Celular, Lab Agrobiotecnol; Dept Biodiversidad & Biol Experim, Lab Sistemática Plantas Vasculares INGEBI-CONICET	Rivero M, Furman N, Mencacci N et al. 2012. Stacking of antimicrobial genes in potato transgenic plants confers increased resistance to bacterial and fungal pathogens. J Biotechnol 157(2): 334-43.
55.	Potato	*Camellia sinensis*	Late blight + *Macrophomina phaseolina*	India	CSIR-Inst Himalayan Bioresour Technol: Division Biotechnol; Hill Area Tea Sci Division	Acharya K, Pal AK, Gulati A et al. 2013. Overexpression of *Camellia sinensis* thaumatin-like protein, *CsTLP* in potato confers enhanced resistance to *Macrophomina phaseolina* and *Phytophthora infestans* infection. Mol Biotechnol 54(2): 609-22.
56.	Potato	Synthesized analog of peptide from *Xenopus laevis*	Late blight + *Ralstonia solanacearum*	China	Nanjing Agric Univ, Coll Life Sci	Hong YB, Liu SP, Zhu YP et al. 2013. Expression of the *MSI-99m* gene in transgenic potato plants confers resistance to *Phytophthora infestans* and *Ralstonia solanacearum*. Plant Mol Biol Rep 31(2): 418-24.
57.	Potato	Synthetic hybrid molecules based on cecropin A (giant silk moth) and melittin (melliferous bee)	Late blight + Early blight + *Erwinia carotovora*	Belarus	Natl Acad Sci Belarus, Inst Biophysics & Celle Engineer	Vutto NL, Gapeeva TA, Pundik AN et al. 2010. Transgenic Belarussian-bred potato plants expressing genes for antimicrobial peptides of the cecropin-melittin type. Russ J Genet (2010) 46: 1433-39.
58.	Potato	*Serratia plymuthica*	Early blight + *Fusarium oxysporum*	Belarus	Nat Acad Sci Belarus: Inst Genet & Cytol; Sci Res Ctr Potato & Vegetable Grow	Shakhbazov AV, Iakovleva GA, Rod'kina IA, Kartel NA. 2008. Pleiotropic effects of chitinase gene from *Serratia plymuthica* in transgenic potato. Tsitol Genet 42(2): 3-9.
59.	Potato	*Amaranthus caudatus*	Green peach aphid	China	CAS, State Key Lab Plant Genom, Inst Microbiol	Yang X, Zhang XR, Zhang MJ et al. 2011. Transgenic potato overexpressing the *Amaranthus caudatus* agglutinin gene to confer aphid resistance. Crop Sci 51(5): 2119-24.
60.	Potato	*Galanthus nivalis*	Green peach aphid	Norway	Norwegian Univ Life Sci, Dept Ecol & Nat Resour Management	Aasen SS, Hagvar EB. 2012. Effect of potato plants expressing snowdrop lectin (GNA) on the performance and colonization behaviour of the peach-potato aphid *Myzus persicae*. Acta Agr Scand Section B-Soil and Plant Science 62(4): 352-61.
61.	Potato	*Bacillus thuringiensis*	Colorado potato beetle	China	CAS, Inst Microbiol, State Key Lab Plant Genom Gansu Acad Agric Sci, Inst Plant Protect Acad Agric Sci Xinjiang Uygur Autonomous Reg, Inst Plant Protect	Zhou ZX, Pang JH, Guo WC et al. 2012. Evaluation of the resistance of transgenic potato plants expressing various levels of Cry3A against the Colorado potato beetle (*Leptinotarsa decemlineata* Say) in the laboratory and field. Pest Manag Sci 68(12): 1595-604.
62.	Potato	*Bacillus thuringiensis*	Colorado potato beetle	USA	Michigan State Univ, Dept Crop & Soil Sci, E Lansing	Cooper SG, Douches DS, Coombs JJ, Grafius EJ. 2007. Evaluation of natural and engineered resistance mechanisms in potato against Colorado potato beetle in a no-choice field study. J Econ Entomol 100(2): 573-79.
63.	Potato	*Bacillus thuringiensis*	Colorado potato beetle	Bulgaria Poland	AgroBioInst, Bulgaria Potato Lab, Bulgaria	Kamenova I, Batchvarova R, Flasinski S et al.2008. Transgenic resistance of Bulgarian potato cultivars to the Colorado potato beetle

				USA	Bulgarian Acad Sci, Inst Zool, Bulgaria Adam Mickiewicz Univ Poznan, Poland Monsanto Co, USA	based on Bt technology. Agron Sustain Dev 28(4): 481-88.
64.	Potato	*Bacillus thuringiensis*	Colorado potato beetle	Russia	Russian Acad Sci, Ctr Bioengineer	Skryabin K. 2010. Do Russia and Eastern Europe need GM plants? N Biotechnol 27(5): 593-95.
65.	Potato	synthetic chemodisruptive peptide	Golden nematode	UK	Univ Leeds, Ctr Plant Sci	Lilley CJ, Wang D, Atkinson HJ, Urwin PE. 2011. Effective delivery of a nematode-repellent peptide using a root-cap-specific promoter. Plant Biotechnol J 9 (2): 151-161
66.	Potato	synthetic chemodisruptive peptide + Proteinase inhibitor	Golden nematode	UK	Univ Leeds, Ctr Plant Sci	Green J, Wang D, Lilley CJ et al. 2012. Transgenic potatoes for potato cyst nematode control can replace pesticide use without impact on soil quality. Plos One 7(2): e30973.
67.	Potato	Potato	Potato virus Y (PVY)	South Korea	Chosun Univ: Dept Biotechnol; BK21 Res Team Protein Activity Control	Lee C, Park J, Hwang I et al. 2010. Expression of G-ry derived from the potato (*Solanum tuberosum* L.) increases PVY(O) resistance. J Agric Food Chem 58(12): 7245-51.
68.	Potato	Wild potato	PVY	USA	JR Simplot Company, Simplot Plant Sci	Duan H, Richael C, Rommens C M. 2012. Overexpression of the wild potato *eIF4E-1* variant *Eva1* elicits Potato virus Y resistance in plants silenced for native *eif4e-1*. Transgenic Res 21(5): 929-38.
69.	Potato + other crops	-	Insect + nematods + Fungi	Russia	Russian Acad Sci, Bach Inst Biochem	Mosolov VV, Valueva TA. 2008. Proteinase inhibitors in plant biotechnology: A review. Appl Biochem Micro+ 44(3): 233-40.
70.	Beet	*Pseudomonas syringae* pv. *phaseolicola*	Rhizomania disease (BNYVV)	Greece	Univ Agric: Dept Crop Sci; Dept Agricul Biotechnol	Pavli OI, Kelaidi GI, Tampakaki AP, Skaracis GN. 2011. The *hrpZ* gene of *Pseudomonas syringae* pv. *phaseolicola* enhances resistance to rhizomania disease in transgenic *Nicotiana benthamiana* and sugar beet. Plos One 6 (3): e17306.

Supplementary Material 4b: Cisgenesis

	Plant	Disease/Pest	Country	University or Lab	References
1.	Potato	Late blight	Netherlands	Univ Wageningen & Res Ctr, Lab of Plant Breed	Park TH, Vleeshouwers V, Jacobsen E et al. 2009. Molecular breeding for resistance to *Phytophthora infestans* (Mont.) de Bary in potato (*Solanum tuberosum* L.): a perspective of cisgenesis. Plant Breeding 128(2): 109-117.
2.	Potato	Late blight	Netherlands	Louis Bolk Inst Wageningen Univ, Crop & Weed Ecol	Lammerts van Bueren ETL, Tiemens-Hulscher M, Struik PC 2008. Cisgenesis does not solve the late blight problem of organic potato production: alternative breeding strategies. Potato Res 51(1): 89-99.
3.	Potato	Late blight	Netherlands	Univ Wageningen & Res Ctr, Plant Breed	Jacobsen E, Schouten HJ. 2009. Cisgenesis: an important sub-

invention for traditional plant breeding companies. Euphytica 170(1-2): 235-47.

Supplementary Material 4c: RNAi /silencing (stable and transient assays)

	Plant	Technique	Pest / Disease	Country	University or Lab	References
1.	Wheat	Barley stripe mosaic virus (BSMV) as a transient expression system in planta. BSMV-based virus induced gene silencing (VIGS) of pathogen gene	Leaf rust	Canada	Agric & Agri-Food Canada: Pacific Agri-Food Res Ctr; Cereal Res Ctr	Panwar V, McCallum B, Bakkeren G. 2013. Host-induced gene silencing of wheat leaf rust fungus *Puccinia triticina* pathogenicity genes mediated by the Barley stripe mosaic virus. Plant Mol Biol 81(6): 595-608.
2.	Wheat	BSMV-based VIGS of pathogen gene	Stripe rust	China Germany	Northwest A&F Univ, State Key Lab of Crop Stress Biol for Arid Areas: Coll of Plant Protect; Coll of Plant Sci Univ Hohenheim, Fak Agrarwissenschaften, Inst für Phytomedizin, Fachgebiet Phytopathologie, Germany	Zhang H, Guo J, Voegele RT et al. 2012. Functional characterization of calcineurin homologs *PsCNA1*/*PsCNB1* in *Puccinia striiformis* f. sp. *tritici* using a host-induced RNAi system. PLoS ONE 7(11): e49262.
3.	Wheat	BSMV-based VIGS of pathogen gene	Stripe rust	USA	Washington State Univ, Dept of Plant Pathol Univ of Northern Iowa, Dept of Biol	Yin C, Jurgenson JE, Hulbert SH. 2011. Development of a host-induced RNAi system in the wheat stripe rust fungus *Puccinia striiformis* f. sp. *tritici*. Mol Plant Microbe Interact 24(5): 554-61.
4.	Wheat	BSMV-based VIGS of plant gene (- effect on plant resistance)	Stripe rust	China	Northwest A&F Uni: State Key Lab Crop Stress Biol Arid Areas; Coll Agron; Coll Plant Protect	Zhang H, Hu YG, Yang BJ el al. 2013. Isolation and characterization of a wheat IF2 homolog required for innate immunity to stripe rust. Plant Cell Reports 32(5): 591-600.
5.	Wheat	BSMV-based VIGS of plant gene (- effect)	Stripe rust	China	Northwest A&F Univ: State Key Lab Crop Stress Biol Arid Areas; Coll Life Sci; Coll Plant Protect	Duan Y, Guo J, Shi X et al. 2013. Wheat hypersensitive-induced reaction genes TaHIR1 and TaHIR3 are involved in response to stripe rust fungus infection and abiotic stresses. Plant Cell Rep 32(2): 273-83.
6.	Wheat	BSMV-based VIGS of plant gene (+ effect)	Stripe rust	China	Northwest A&F Univ: State Key Lab Crop Stress Biol Arid Areas; Coll Plant Protect; Coll Life Sci	Feng H, Zhang Q, Li HY et al. 2013. vsiRNAs derived from the miRNA-generating sites of pri-tae-miR159a based on the BSMV system play positive roles in the wheat response to *Puccinia striiformis* f. sp. *tritici* through the regulation of *taMyb3* expression. Plant Physiol Bioch 68: 90-95.
7.	Wheat	BSMV-based VIGS of host gene (- effect)	Stripe rust	China	Northwest A&F Univ: State Key Lab Crop Stress Biol Arid Areas; Coll Plant Protect, Coll Life Sci	Feng H, Zhang Q, Wang QL et al. 2013. Target of tae-miR408, a chemocyanin-like protein gene (*TaCLP1*), plays positive roles in wheat response to high-salinity, heavy cupric stress and stripe rust. Plant Mol Biol 83(4-5): 433-43.
8.	Wheat	BSMV-based VIGS of plant gene (+ effect)	Stripe rust	China	Northwest A&F Univ: State Key Lab Crop Stress Biol Arid Areas; Coll Life Sci; Coll Plant Protect	Duan XY, Wang XJ, Fu YP et al. 2013. *Ta*eil1, a wheat homologue of *At*EIN3, acts as a negative regulator in the wheat-stripe rust fungus

						interaction. Mol Plant Pathol 14(7): 728-39.
9.	Wheat	BSMV-based VIGS of plant gene (+ effect)	Stripe rust	China	Northwest A&F Univ: State Key Lab Crop Stress Biol Arid Areas; Coll Plant Protect	Guo J, Bai PF, Yang Q et al. 2013. Wheat zinc finger protein TaLSD1, a negative regulator of programmed cell death, is involved in wheat resistance against stripe rust fungus. Plant Physiol Bioch 71: 164-72.
10.	Wheat	BSMV-based VIGS of plant gene (- effect)	Stripe rust	China	Northwest A&F Univ: State Key Lab Crop Stress Biol Arid Areas; Coll Plant Protect	Yang Y, Zhao J, Liu P et al. 2013. Glycerol-3-phosphate metabolism in wheat contributes to systemic acquired resistance against *Puccinia striiformis* f. sp. *tritici*. PLoS ONE 8(11): e81756.
11.	Wheat	BSMV-based VIGS of plant gene (- effect)	Stripe rust	China	CAAS: Inst Genet & Develop Biol, State Key Lab Plant Cell & Chromosome Engineer; Graduate School CAAS Northwest A&F Univ, Coll Plant Protect, Shaanxi Key Lab Mol Biol Agric	Wang GF, Wei X, Fan R et al. 2011. Molecular analysis of common wheat genes encoding three types of cytosolic heat shock protein 90 (Hsp90): Functional involvement of cytosolic Hsp90s in the control of wheat seedling growth and disease resistance. New Phytol 191(2): 418-31.
12.	Wheat	Agr*obacterium tumefaciens* (Agroinfiltration) Transient expression *in planta* for silencing of pathogen gene	Stripe rust Leaf rust Stem rust	Canada	Agric & Agri-Food Canada, Pacific Agri-Food Res Ctr	Panwar V, McCallum B, Bakkeren G. 2013. Endogenous silencing of *Puccinia triticina* pathogenicity genes through in planta-expressed sequences leads to the suppression of rust diseases on wheat. Plant J 73(3): 521-32.
13.	Wheat	Particle bombardment transient expression	Powdery mildew	Germany	Max Planck Inst Zuchtungsforsch, Dept Plant Microbe Interact	Panstruga R. (2004). A golden shot: How ballistic single cell transformation boosts the molecular analysis of cereal-mildew interactions. Mol Plant Pathol 5(2): 141-48. (Review)
14.	Wheat	Microprojectile bombardment transient expression for plant gene silencing (- effect on resistance)	Powdery mildew other invading fungi	Canada	Univ of Saskatchewan, Dept of Biol Natl Res Counci of Canada, Plant Biotechnol Inst,	Bhuiyan NH, Selvaraj G, Wei YD, King J. 2009. Gene expression profiling and silencing reveal that monolignol biosynthesis plays a critical role in penetration defence in wheat against powdery mildew invasion. J Exp Bot 60(2): 509-21. Bhuiyan NH, Selvaraj G, Wei YD, King J. 2009. Role of lignification in plant defense. Plan Signal Behav 4(2): 158-59.
15.	Wheat Barley	BSMV-based VIGS of pathogen gene	Powdery mildew	Germany UK	The Leibniz Inst Plant Genet & Crop Plant Res, Germany Scottish Crop Res Inst, UK JIC, UK	Nowara D, Gay A, Lacomme C et al. 2010. HIGS: Host induced gene silencing in the obligate biotrophic fungal pathogen *Blumeria graminis*. Plant Cell 22(9): 3130-41.
16.	Wheat	BSMV-based VIGS of the wheat *Mlo* gene	Powdery mildew	Hungary	Agricultural Biotechnology Center	Várallyay É, Giczey G, Burgyán J. 2012. Virus-induced gene silencing of *Mlo* genes induces powdery mildew resistance in *Triticum aestivum*. Arch Virol 157: 1345-1350
17.	Wheat	Stable transgenics	Hessian fly	USA	Kansas State Univ: Dept Entomol, Dept Plant Pathol; Dept Biochem USDA-ARS, Hard Winter Wheat Genet Res Unit Montana State Univ, Dept Plant Sci & Plant Pathol	Liu X, Khajuria C, Li J et al. 2013. Wheat *Mds-1* encodes a heat-shock protein and governs susceptibility towards the Hessian fly gall midge. Nat Commun 4: 2070.

18.	Wheat	BSMV-based VIGS of plant gene (- effect on resistance)	Aphids	USA South Africa	Colorado State Univ: Dept Soil & Crop Sci; Dept Bioagric Sci & Pest Management, USA Stellenbosch Univ, Dept Genet, South Africa Purdue Univ, Dept Agron, USA USDA-ARS, Crop Production & Pest Control Res Unit, USA	Van Eck L, Schultz T, Leach JE et al. 2010. Virus-induced gene silencing of *WRKY53* and an inducible *phenylalanine ammonia-lyase* in wheat reduces aphid resistance. Plant Biotechnol J 8(9): 1023-32.
19.	Wheat	Stable plant transgenics to alter pest gene expression	Grain aphid	China	China Agricul Univ: State Key Lab Agro-Biotechnol; Coll Agric & Biotechnol	Xu L, Duan X, Lv Y, Zhang X et al. 2014. Silencing of an aphid carboxylesterase gene by use of plant-mediated RNAi impairs *Sitobion avenae* tolerance of Phoxim insecticides. Transgenic Res 23(2) : 389-96.
20.	Wheat	Stable transgenics	Barley yellow dwarf virus	China	CAAS, Inst Plant Protect, State Key Lab Biol Plant Dis & Insect Pests	Yan F, Zhang WW, Xiao H et al. 2007. Transgenic wheat expressing virus-derived hairpin RNA is resistant to barley yellow dwarf virus. Yi Chuan (=Hereditas) 29(1): 97-102.
21.	Barley	BSMV-based VIGS of plant gene (- effect on resistance)	Stem rust	USA UK	N Dakota State Univ, Dept Plant Pathol, USA James Hutton Inst, UK Washington State Univ, Dept Crop & Soil Sci, USA Univ Minnesota, Dept Plant Pathol, USA	Wang X, Richards J, Gross T et al. 2013. The rpg4-mediated resistance to wheat stem rust (*Puccinia graminis*) in barley (Hordeum vulgare) requires Rpg5, a second NBS-LRR gene, and an actin depolymerization factor. Mol Plant Microbe In 26(4): 407-18 **(also in MAS section).**
22.	Barley	BSMV-based VIGS of plant gene (+ effect on resistance)	Stem rust	USA	Washington State Univ: Dept Crop & Soil Sci; School Mol Biosci; Dept Plant Pathol; USDA-ARS; Dept Plant Pathol Univ Minnesota,Dept Plant Pathol	Zhang L, Lavery L, Gill U et al. 2009. A cation/proton-exchanging protein is a candidate for the barley *NecS1* gene controlling necrosis and enhanced defense response to stem rust. Theor Appl Genet 118(2): 385-97 **(also in MAS section).**
23.	Barley	n/a	Stem rust	USA	North Dakota State Univ, Dept Plant Pathol	Arora D, Gross T, Brueggeman R. 2013. Allele characterization of genes required for *rpg4*-mediated wheat stem rust resistance identifies *Rpg5* as the *R* gene. Phytopathology 103(11): 1153-61.
24.	Barley	Stable plant transgenics silencing pathogen gene	Fusarium head blight	Germany France	Justus Liebig Univ: Inst Phytopathol & Applied Zoology; Ctr Bio Systems, Land Use & Nutrition, Inst Microbiol & Mol Biol, Germany Univ Nice-Sophia Antipolis, Inst Sophia Agrobiotech, Unité Mixte de Recherche 1355 Inst Natl Recherche Agronomique, Ctr Natl Recherche Sci, France	Koch A, Kumar N, Weber L et al. 2013. Host-induced gene silencing of cytochrome P450 lanosterol C14α-demethylase-encoding genes confers strong resistance to *Fusarium* species. Proc Natl Acad Sci USA 110(48): 19324-329.
25.	Barley	Stable transgenics silencing plant gene (+ effect)	Fusarium head blight + Powdery mildew	Germany USA	Justus Liebig Univ: Res Ctr BioSystems, Land Use & Nutrition; Dept Botany, Germany Boyce Thompson Inst Plant Res, USA Texas State Univ, Dept Biol, USA	Langen G, von Einem S, Koch A et al. 2014. The compromised recognition of Turnip crinkle virus 1 subfamily of morc ATPases regulates disease resistance in barley to biotrophic and necrotrophic pathogens. Plant Physiol 164(2): 866-78.
26.	Barley	Transient (VIGS) and stable transgenics silencing plant gene (+ effect)	Powdery mildew	Germany UK	Technische Univ München, Lehrstuhl Phytopathol, Germany SCRI , Plant Pathol, UK SASA, Virology & Zoology section, UK Inst Plant Genet & Crop Plant Res, Germany	Eichmann R, Bischof M, Weis C et al. 2010. BAX INHIBITOR-1 is required for full susceptibility of barley to powdery mildew. Mol Plant Microbe Interact 23(9): 1217-27.

27.	Barley	Particle bombardment transient expression silencing plant genes (- or + effects)	Powdery mildew	Germany Netherlands	The Leibniz Inst Plant Genet & Crop Plant Res, Germany WUR, Lab Plant Breed, Netherlands	Douchkov D, Johrde A, Nowara D et al. 2011. Convergent evidence for a role of WIR1 proteins during the interaction of barley with the powdery mildew fungus *Blumeria graminis*. J Plant Physiol 168(1): 20-29 **(also in MAS section).**
28.	Maize	Direct feeding of ds-RNA or production in transgenic plant silencing insect gene	Western corn rootworm	USA Belgium	Monsanto Co, USA Devgen NV, Technologiepark, Belgium Monsanto Co, USA	Baum JA, Bogaert T, Clinton W et al. 2007. Control of coleopteran insect pests through RNA interference. Nat Biotechnol 25(11): 1322-26. Bolognesi R, Ramaseshadri P, Anderson J et al. 2012. Characterizing the mechanism of action of double-stranded RNA activity against western corn rootworm (*Diabrotica virgifera virgifera* LeConte). PLoS ONE 7(10): e47534.
29.	Grapevine	Stable transgenics	Grapevine leafroll-associated virus-2	USA	Cornell Univ, NYSAES, Dept Plant Pathol USDA-ARS: US Vegetable Lab; Pacific Basin Agricul Res Ctr Univ Washington , Dept Lab Medicine	Ling KS, Zhu HY, Gonsalves D. 2008. Resistance to Grapevine leafroll associated virus-2 is conferred by post-transcriptional gene silencing in transgenic *Nicotiana benthamiana*. Transgenic Res 17(4): 733-40.
30.	Grapevine	Transient expression	Grapevine fanleaf virus	France	Univ Haute Alsace, Lab Vigne Biotechnol & Environm, F-68008 Colmar	Jelly N S, Schellenbaum P, Walter B, Maillot P. 2012. Transient expression of artificial micrornas targeting grapevine fanleaf virus and evidence for rna silencing in grapevine somatic embryos.Transgenic Res 21 (6): 1319-1327
31.	Grapevine	Transient expression	Grapevine fanleaf virus	USA	Cornell Univ NYSAES, Geneva, NY	Oliver J E and Fuchs M. 2011. Usefulness of a high-throughput transient expression system to test virus-derived genetic constructs for resistance against grapevine fanleaf virus. Phytopathology 101 (6): S132-S132
32.	Potato	Stable transgenics silencing plant gene	Late blight	Germany	Leibniz Inst of Plant Biochem, Dept of Stress & Develop Biol Martin Luther Univ Halle-Wittenberg: Inst Genet; Dept of Cellular Biochem; Biocenter	Eschen-Lippold L, Landgraf R, Smolka U et al. 2012. Activation of defense against *Phytophthora infestans* in potato by down-regulation of syntaxin gene expression. New Phytol 193(4): 985-96.
33.	Potato	Agro*bacterium tumefaciens* (agroinfiltration) transient assay for functional test	Late blight	USA	Univ Wisconsin-Madison: Dept of Horticul; Dept Agron	Bhaskar PB, Venkateshwaran M, Wu L et al. 2009. *Agrobacterium*-mediated transient gene expression and silencing: a rapid tool for functional gene assay in potato. PLoS ONE: 4(6): e5812.
34.	Potato	Stable transgenics (overexpression more resistant, RNAi less resistant	Late blight	China	Minist Educ, Huazhong Agric Univ, Key Lab of Horticultur Plant BiolDis Natl Ctr for Vegetable Improv, Potato Engineer & Technol Res Ctr of Hubei Province	Ni XM, Tian ZD, Liu J et al. 2010. Cloning and molecular characterization of the potato RING finger protein gene *StRFP1* and its function in potato broad-spectrum resistance against *Phytophthora infestans*. J Plant Physiol 167(6): 488-96.
35.	Potato	Stable transgenics silencing plant gene	Late blight Salt tolerance	China	Minist Educ, Huazhong Agric Univ, Key Lab of Horticultur Plant Biol	Ni XM, Tian ZD, Liu J et al. 2010. *StPUB17*, a novel potato UND/PUB/ARM repeat type gene, is associated with late blight

		(- effect)			Natl Ctr for Vegetable Improv, Potato Engineer & Technol Res Ctr of Hubei Province	resistance and NaCl stress. Plant Sci 178(2): 158-169.
36.	Potato	Agro*bacterium tumefaciens* (agroinfiltration) transient assay for silencing viral gene	Potato virus Y (PVY)	China	Guizhou Univ, Coll Life Sci	Li Q, Tao G, Qiu YB et al. 2009. RNAi vector targeting and interference effect determination of *PVY CP* gene. Genom Appl Biol 28(3) : 460-64.
37.	Potato	Stable transgenics for silencing viral gene	PVY	Hungary	Agricul Biotechnol Ctr Hungarian Acad Sci, Agricul Res Inst Corvinus Univ of Budapest, Dept Plant Pathol	Bukovinszki A, Diveki Z, Csanyi M et al. 2007. Engineering resistance to PVY in different potato cultivars in a marker-free transformation system using a 'shooter mutant' *A. tumefaciens*. Plant Cell Rep 26(4): 459-65.
38.	Potato	Stable transgenics for silencing viral gene	PVY + Potato leafroll virus (PLRV) + Potato virus A	UK South Korea	James Hutton Inst, UK Seoul Womens Univ, Dept Hort Sci, South Korea Natl Inst Hort & Herbal Sci, Rural Dev Adm, South Korea	Chung B, Yoon JY, Palukaitis P. 2013. Engineered resistance in potato against potato leafroll virus, potato virus A and potato virus Y. Virus Genes 47(1): 86-92.
39.	Potato	Stable transgenics for silencing viral gene	PVY + PLRV + Potato virus X	Pakistan	Natl Inst Biotechnol & Genetic Engineer, Agricul Biotechnol Division PAEC, Director General Agric & Biotechnol	Arif M, Azhar U, Arshad M et al. 2012. Engineering broad-spectrum resistance against RNA viruses in potato. Transgenic Res 21(2): 303-11.
40.	Potato	Stable transgenics for silencing viral gene	PLRV + Potato spindle tuber viroid	Russia	All-Russian Potato Res Inst All-RSIAB Shemyakin & Ovchinnikov Inst Bioorganic RAS	Khromova LM, Beketova MP, Shmyglya IV et al. 2007. Generation of potato transgenic lines resistant to potato leafroll virus and potato spindle tuber viroid. Potato production and innovative technologies. Wageningen Academic Publishers. 405-10.
41.	Potato	Potato virus X + Potato virus Y (PVY)	PVY Potato virus X	China	Shanxi Acad Agric Sci, Inst of Crop Genet	Bai YF, Guo ZH, Wang XQ et al. 2009. Generation of double-virus-resistant marker-free transgenic potato plants. Prog Nat Sci 19(5): 543-48.
42.	Potato	Potato leafroll virus (PLRV) + PVY	PLRV PVY	USA	USDA-ARS, Pacific West Area, IAREC, Vegetable & Forage Crops Res Unit, Res Geneticist; Res Plant Pathol	Arif M, Thomas PE, Crosslin JM, Brown CR. 2009. Development of molecular resistance in potato against potato leaf roll virus and potato virus Y through *Agrobacterium*-mediated double transgenesis. Pak J Bot 41(2): 945-54.
43.	Potato	PLRV + PVY	PLRV PVY	USA Pakistan	USDA-ARS, Pacific W Area, IAREC,Vegetable & Forage Crop Prod Res Unit, USA NW Frontier Prov Agricul Univ, Dept Plant Pathol, Pakistan	Arif M, Thomas PE, Crosslin JM, Brown CR. 2009. *Agrobacterium*-mediated transformation of potato using PLRV-REP and PVY CP genes and assessment of replicase mediated resistance against natural infection of PLRV. Pakistan J Bot 41(3): 1477-88.
44.	Beet	Beet necrotic yellow vein virus	Rhizomania disease (BNYVV)	Netherlands Greece	Wageningen Univ, Dept Plant Sci, Virol Lab, Netherlands Agric Univ Athens, Dept Crop Sci, Lab Plant Breed & Biometry, Greece Univ Crete, Dept Biol, Sect Biotechnol & Appl Biometry, Greece	Pavli OI, Panopoulos N J, Goldbach R, Skaracis GN. 2010. BNYVV-derived dsRNA confers resistance to rhizomania disease of sugar beet as evidenced by a novel transgenic hairy root approach. Transgenic Res 19(5): 915-22.

45.	Beet	Stable transgenics for silencing viral gene	Rhizomania disease (BNYVV)	Finland Sweden	Univ Helsinki, Dept Appl Biol, Finland Syngenta Seeds AB, Sweden Swedish Univ Agricul Sci, Dept Plant Biol & Forest Genet, Sweden	Lennefors BL, van Roggen PM, Yndgaard F et al. 2008. Efficient dsRNA-mediated transgenic resistance to Beet necrotic yellow vein virus in sugar beets is not affected by other soilborne and aphid-transmitted viruses. Transgenic Res 17(2): 219-28.

Supplementary Material 4d: Other transient assays

	Plant	Technique	Disease/Pest	Country	University or Lab	References
1.	Wheat	BSMV-based VIGS in wheat	Leaf rust	Switzerland Israel USA	Univ Zürich, Inst Plant Biol, Switzerland Univ Haifa, Inst Evolution, Israel Purdue Univ, Lilly Hall Life Sci, Dept Agron, USA	Loutre C, Wicker T, Travella S et al. 2009. Two different CC-NBS-LRR genes are required for *Lr10*-mediated leaf rust resistance in tetraploid and hexaploid wheat. Plant J 60(6): 1043-54.
2.	Wheat	BSMV-based VIGS in wheat	Leaf rust	China	Agr Univ Hebei, Coll Plant Protect, Biol Control Ctr Plant Dis & Pests Hebei Prov	Zhang LR, Yang WX, Liu DQ. 2011. *TaRAR1* is required for *Lr24*-mediated wheat leaf rust resistance. Agr Sci China 10(11): 1732-38.
3.	Wheat	Agroinoculation *Agrobacterium tumefaciens*	Wheat dwarf virus	Hungary	Agric Biotechnol Ctr Corvinus Univ Budapest, Fac Horticultur Sci Agricl Res Inst Hungarian Acad Sci	Benkovics AH, Vida G, Nelson D et al. 2010. Partial resistance to Wheat dwarf virus in winter wheat cultivars. Plant Pathol 59(6): 1144-1151.
4.	Grapevine	Agroinfiltration *Agrobacterium tumefaciens*	Downy mildew	France	Université de Haute Alsace, Laboratoire Vigne, Biotechnol & Environnement IBMP CNRS, Dépt Réseaux Métaboliques chez les Végétaux INRA & Univ Strasbourg, Lab Génétique & Amélioration Vigne	Le Henanff G, Heitz T, Mestre P et al. 2009. Characterization of *Vitis vinifera* NPR1 homologs involved in the regulation of pathogenesis-related gene expression. BMC Plant Biol 9: 54.
5.	Grapevine	Agroinfiltration *Agrobacterium tumefaciens*	Downy mildew	France	Univ Strasbourg, INRA: Lab Génétique & Amélioration Vigne; Laboratoire d'Oenologie INRA, CNRS, Lab Reproduction & Développement Plantes	Schmidlin L, Poutaraud A, Claudel P et al. 2008. A Stress-inducible resveratrol O-methyltransferase involved in the biosynthesis of pterostilbene in grapevine. Plant Physiol 148(3): 1630-39.
6.	Grapevine	Agroinfiltration *Agrobacterium tumefaciens*	Downy mildew	France	Inst Natl Recherche Agronomique & Université Louis Pasteur Strasbourg , Lab Génétique & Amélioration Vigne, UMR 1131 Santé Vigne et Qualité du Vin	Santos-Rosa M, Poutaraud A, Merdinoglu, D, Mestre P. 2008. Development of a transient expression system in grapevine via agro-infiltration. Plant Cell Rep 27(6): 1053-63.
7.	Grapevine	Agroinfiltration *Agrobacterium tumefaciens*	Powdery mildew	China	Northwest A&F Univ: Coll Horticul; Key Lab Horticultur Plant Germplasm Resour Utilization in Northwest China, Minist Agric; Shaanxi Key Lab Mol Biol Agric	Guan X, Zhao HQ, Xu Y, Wang YJ. 2011. Transient expression of glyoxal oxidase from the Chinese wild grape *Vitis pseudoreticulata* can suppress powdery mildew in a susceptible genotype. Protoplasma 248(2): 415-23.
8.	Grapevine	Agroinfiltration *Agrobacterium tumefaciens* agroinfection	Leafroll-associated virus	USA Spain	Oregon State Univ: Dept of Botany & Plant Pathol; Ctr Genome Res & Biocomputing, USA Univ Lleida, Ciencia Forestal, Dept Producio Vegetal, Spain	Liu YP, Peremyslov VV, Medina V, Dolja VV. 2009. Tandem leader proteases of grapevine leafroll-associated virus-2: Host-specific functions in the infection cycle. Virology 383(2): 291-99.

9.	Potato	Agroinfiltration *Agrobacterium tumefaciens*	Late blight	Netherlands	Univ Wageningen	Champouret N. 2010. Functional genomics of *Phytophthora infestans* effectors and *Solanum* resistance genes. PhD thesis. Wageningen University. 154pp.
10.	Potato	Agroinfection Agroinfiltration	Late blight	Netherlands	Univ Wageningen, Phytopathol Lab Ctr for BioSystems Genom	Van Poppel P, Jiang RHY, Sliwka J, Govers F. 2009. Recognition of *Phytophthora infestans* Avr4 by potato R4 is triggered by C-terminal domains comprising W motifs. Mol Plant Pathol 10(5): 611-20.
11.	Potato	Agroinfection Agroinfiltration Genetic mapping Bacterial artificial chromosome marker landing	Late blight	Netherlands China UK	Univ Wageningen, Phytopathol Lab, Netherlands Ctr BioSystems Genom, Netherlands CAAS, Inst of Vegetables & Flowers, China Scottish Crop Res Inst, Plant-Pathology Programme, UK	van Poppel P, Guo J, de Vondervoort P et al. 2008. The *Phytophthora infestans* avirulence gene *Avr4* encodes an RXLR-dEER effector. Mol Plant Microbe Interact 21(11): 1460-70.
12.	Potato		Late blight	China Netherlands	Shandong Acad Agricul Sci, Key Lab Crop Genetic Improv & Biotechnol, China Wageningen UR Plant Breed,Netherlands Sino-Dutch Joint CAAS, Inst Vegetables & Flowers, Key Lab Horticul Crops Genet Improv Minist Agric, Lab of Horticultural Genom Technol, China Huazhong Agric Univ, Minist Educ, Coll Horticul & Forestry, Dept Vegetable Crops, Key Lab Horticul Biol,China	Li G, Huang S, Guo X et al. 2011. Cloning and characterization of R3B; members of the R3 superfamily of late blight resistance genes show sequence and functional divergence. Mol Plant Microbe Interact 24(10): 1132-42 **(also in transgenesis section).**[vi]
13.	Beet	Agroinoculation Root agroinfection Agroinfiltration *Agrobacterium tumefaciens*	Rhizomania disease (BNYVV)	Italy France	Univ Bologna, DipSA Plant Pathol, Italy Univ Strasbourg, CNRS, Inst Biol Mol Plantes, France	Delbianco A, Lanzoni C, Klein E et al. 2013. Agroinoculation of Beet necrotic yellow vein virus cDNA clones results in plant systemic infection and efficient *Polymyxa betae* transmission. Mol Plant Pathol 14(4): 422-28.

Supplementary Material 4e: Cloning of resistance gene

	Plant	Origin of transfered genes	Pests/Diseases	Country	University or lab	References
1.	Wheat	Wheat	Leaf rust	Canada Switzerland France	Agric & Agri-Food Canada, Cereal Res Ctr, Canada Univ Zürich, Inst Plant Biol, Switzerland Inst Natl Recherche Agronomique, Amélioration et Santé des Plantes, France	Cloutier S, McCallum BD, Loutre C et al. 2007. Leaf rust resistance gene *Lr1*, isolated from bread wheat (*Triticum aestivum* L.) is a member of the large psr567 gene family. Plant Mol Biol 65(1-2): 93-106 **(also in MAS section).**
2.	Wheat	-	Fusarium head blight	USA Czech Republic France	Univ Minnesota, Dept Agron & Plant Genet, USA Kansas State Univ: USDA-ARS, Plant Pathol Dept, USA Inst Experim Botany, Czech Republic URGV-INRA, France	Liu SX,. Pumphrey MO, Gill BS et al. 2008. Toward positional cloning of *Fhb1*, a major QTL for Fusarium head blight resistance in wheat. Cereal Res Commun 36(Suppl. 6): 195-201.

3.	OSR Sunflower	*Macadamia integrifolia*	Sclerotinia + Blackleg	Iran Russia	Cotton Res Inst Iran, Iran Russian State Agrarian Univ – MTTA, Dept of Agric Biotechnol, Russia	Ghasemi BK, Sheveloukha VS, Karlov GI. 2008. Design, construction and cloning of pCAMBIA-MiAMP1 vector for enhancing disease resistance in plants using *Agrobacterium*-mediated transformation. J Appl Biosci 10(2): 538-46.
4.	Potato	Potato	Late blight	China	Minist Educ, Huazhong Agric Univ, Key Lab of Horticultur Plant BiolDis Natl Ctr for Vegetable Improv, Potato Engineer & Technol Res Ctr of Hubei Province	Ni XM, Tian ZD, Liu J et al. 2010. Cloning and molecular characterization of the potato RING finger protein gene *StRFP1* and its function in potato broad-spectrum resistance against *Phytophthora infestans*. J Plant Physiol 167(6): 488-96.
5.	Potato	-	Late blight	China Netherlands	Shandong Acad Agricul Sci, Key Lab Crop Genetic Improv & Biotechnol, China Wageningen UR Plant Breed,Netherlands Sino-Dutch Joint CAAS, Inst Vegetables & Flowers, Key Lab Horticul Crops Genet Improv Minist Agric, Lab of Horticultural Genom Technol, China Huazhong Agric Univ, Minist Educ, Coll Horticul & Forestry, Dept Vegetable Crops, Key Lab Horticul Biol,China	Li G, Huang S, Guo X et al. 2011. Cloning and characterization of R3B; members of the R3 superfamily of late blight resistance genes show sequence and functional divergence. Mol Plant Microbe Interact 24(10): 1132-42.[vii]
6.	Potato	-	Late blight	Netherlands UK	Wageningen UR Plant Breed, Netherlands Sainsbury Lab Colney Lane, UK	Pel MA, Foster SJ, Park TH et al. 2009. Mapping and cloning of late blight resistance genes from *Solanum venturii* using an interspecific candidate gene approach. Mol Plant Microbe Interact 22(5): 601-15.

Supplementary Material 4f: Mutagenesis

	Plant	Disease/Pest	Country	University or Lab	References
1.	Wheat (EMS-mutagenized)	Leaf rust Stem rust Stripe rust Powdery mildew	USA	Montana State Univ, Dept Plant Sci & Plant Pathol USDA-ARS, Cereal Dis Lab Washington State Univ, Dept Plant Pathol USDA-ARS, Wheat Genet Physiol Qual & Dis Res Unit	Campbell J, Zhang HT, Giroux MJ et al. 2012. A mutagenesis-derived broad-spectrum disease resistance locus in wheat. Theor Appl Genet 125(2): 391-404.
2.	Barley (natural, induced and site-directed mutant alleles tested in transient expression assay)	Powdery mildew	Germany	Max Planck Inst Plant Breed Res, Dept Plant Microbe Interactions	Reinstädler A, Müller J, Czembor JH et al. 2010. Novel induced *mlo* mutant alleles in combination with site-directed mutagenesis reveal functionally important domains in the heptahelical barley Mlo protein. BMC Plant Biol 10: 31.
3.	Potato (Site-directed mutagenesis	Potato virus Y	USA Korea	Cornell Univ, Dept Plant Breed, USA USDA-ARS, Dept Plant Pathol & Plant-Microbe Biol, USA Cornell Univ, USA	Cavatorta J, Perez KW., Gray SM et al. 2011. Engineering virus resistance using a modified potato gene. Plant Biotechnol J 9(9): 1014-21.

	followed by transgenesis)		Boyce Thompson Inst, USA Andong Natl Univ, Dept Horticul & Breed, Korea Univ Wisconsin, Dept Agron, Lab Genet, USA	

Supplementary Material 4g: Conventional breeding

	Plant	Disease/Pest	Country	University or Lab	References
1.	Wheat	Leaf rust	USA Australia	Kansas State Univ, Dept Plant Pathol, Throckmorton Plant Sci Ctr, Wheat Genet & Genomic Resour Ctr, USA Univ Sydney, Plant Breed Inst, Australia	Qi LL, Friebe B, Zhang P, Gill BS. 2007. Homoeologous recombination, chromosome engineering and crop improvement. Chromosome Res 15(1): 3-19.
2.	Wheat	Leaf rust	Sweden Mexico	CIMMYT, Mexico Swedish Univ Agr Sci, Dep Forest Mycol & Pathol, Sweden Campo Experim Valle Mexico INIFAP, Mexico	Herrera-Foessel SA, Singh RP, Huerta-Espino J et al. 2008. Genetic analysis of slow-rusting resistance to leaf rust in durum wheat. Crop Sci 48(6): 2132-40.
3.	Wheat	Leaf rust	Belarus	Natl Acad Sci Belarus, Inst Genet & Cytol	Buloichik AA, Borziak VS, Voluevich EA. 2010. Chromosomal location of specific and nonspecific components of polygenic resistance to brown rust in common wheat. Russ J Genet 46(4): 409-16.
4.	Wheat	Leaf rust Stripe rust	India Iran	Punjab Agricul Univ, Dept Plant Breed, Genet & Biotechnol, India Agricul Organization Kermanshah, Iran Directorate Wheat Res, Regional Res Stn, India Indian Inst Technol, India	Chhuneja P, Kaur S, Goel RK et al. 2008. Transfer of leaf rust and stripe rust resistance from *Aegilops umbellulata* Zhuk. to bread wheat (*Triticum aestivum* L.). Gen Resour Crop Evol 55(6): 849-59.
5.	Wheat	Leaf rust Stripe rust	India	Punjab Agr Univ, Sch Agr Biotechnol	Agarwal S, Saini RG. 2009. Undescribed wheat gene for partial leaf rust and stripe rust resistance from Thatcher derivatives RL6058 and 90RN2491 carrying *Lr34*. J Appl Genet 50(3): 199-204.
6.	Wheat	Leaf rust Stem rust	Brazil	Fundacao Univ Passo Fundo UPF Empresa Brasileira Pesquisa Agropecuaria Embrapa	Casassola A, Brammer SP. 2011. Chromosomes translocations between wheat and rye: an alternative to plant breeding. Ciencia Rural 41(8): 1307-14. (Review)
7.	Wheat	Leaf rust Stem rust Powdery mildew Loose smut	Russia	Siberian Branch of RAS, Inst Cytol & Genet	Laikova LI, Belan IA, Badaeva ED et al. 2013. Development and study of spring bread wheat variety Pamyati Maystrenko with introgression of genetic material from synthetic hexaploid *Triticum timopheevii* Zhuk. x *Aegilops tauschii* Coss. Russ J Genet 49(1): 89-97.
8.	Wheat	Leaf rust Stem rust Powdery mildew	Russia	Inst Cytol & Genet, Siberian Branch of RAS	Obukhova LV, Laikova LI, Shumnyi VK. 2010. Analysis of storage proteins (prolamines, puroindolines and Waxy) in common wheat lines *Triticum aestivum* L. x (*Triticum timopheevii* Zhuk. x *Triticum tauschii*) with complex resistance to fungal infections. Russ J Genet 46(6): 672-76.
9.	Wheat	Tan spot *Stagonospora nodorum* blotch Stem rust	USA	USDA-ARS, Northern Crop Sci Lab N Dakota State Univ, Dep Entomol	Friesen T L, Xu SS, Harris MO. 2008. Stem rust, tan spot, *Stagonospora nodorum* blotch, and hessian fly resistance in langdon durum-*Aegilops tauschii* synthetic hexaploid wheat lines. Crop Sci 48(3): 1062-70.

		Hessian fly			
10.	Wheat	Stripe rust Powdery mildew	China	Sichuan Agric Univ, State Key Lab Plant Breed & Genet Univ Electronic Sci & Technol China, School of Life Sci & Technol	Fu, S., Tang, Z., Ren, Z. and Zhang, H. (2010). Transfer to wheat (*Triticum aestivum*) of small chromosome segments from rye (*Secale cereale*) carrying disease resistance genes. J Appl Genet 51(2): 115-21.
11.	Wheat	Stripe rust	Australia	Univ Sydney, Plant Breed Inst	Pathan AK, Park RF, Wellings CR, Bariana HS. 2007. The expression and genetics of resistance to stripe (yellow) rust in three European and four New Zealand wheat cultivars. J Appl Genet 48(3): 199-210.
12.	Wheat	Fusarium head blight	Canada China	Agric & Agri-Food Canada, Eastern Cereal & Oilseed Res Ctr, Canada Sichuan Agric Univ, Triticeae Res Inst, Chengdu Acad Sci, China Univ Saskatchewan, Dept Plant Sci, Canada.	Zeng J, Cao W, Hucl P et al. 2013. Molecular cytogenetic analysis of wheat - *Elymus repens* introgression lines with resistance to Fusarium head blight. Genome 56(1): 75-82.
13.	Wheat	Fusarium head blight	USA	Univ Minnesota: Dept Agron & Plant Genet; USDA-ARS, Cereal Dis Lab Land Inst	Turner MK, DeHaan LR, Jin Y, Anderson JA. 2013. Wheatgrass-wheat partial amphiploids as a novel source of stem rust and Fusarium head blight resistance. Crop Science 53(5): 1994-2005.
14.	Wheat	Fusarium crown rot	Australia	Univ Southern Queensland, Ctr Systems Biol New South Wales Dept Primary Ind Plant Breed Inst	Martin A, Simpfendorfer S, Hare RA, Sutherland MW. 2013. Introgression of hexaploid sources of crown rot resistance into durum wheat. Euphytica 192(3): 463-70.
15.	Wheat	Tan spot *Stagonospora nodorum* blotch	USA	North Dakota State Univ, Dep Plant Sci USA-ARS: Forage & Range Res Lab; Norhern Crop Sci Lab	Oliver RE, Cai X, Wang RC et al. 2008. Resistance to tan spot and *Stagonospora nodorum* blotch in wheat-alien species derivatives. Plant Dis 92(1): 150-57.
16.	Wheat	Hessian fly Russian wheat aphid Sunn pest	Syria USA Marocco	Internatl Ctr Agricul Res Dry Areas (ICARDA), Syria Kansas State Univ: USDA-ARS; Dept Entomol, USA Inst Natl Recherche Agronomique (INRA), Marocco	El Bouhssini M, Ogbonnaya FC, Chen M et al. 2013. Sources of resistance in primary synthetic hexaploid wheat (*Triticum aestivum* L.) to insect pests: Hessian fly, russian wheat aphid and sunn pest in the fertile crescent. Genet Resour Crop Evol 60(2): 621-27.
17.	Wheat	Barley yellow dwarf virus	China	Northwest A&F Univ, Key Lab Integrated Pest Management Crops Northwes, Key Lab Plant Protect Resour & Pest Management, State Key Lab Crop Stress Biol Arid Areas,Minist	Song S, Tao Y, Zhang HW, Wu YF. 2013. *Psathyrostachys huashanica*, a potential resource for resistance to barley yellow dwarf virus-GAV. Eur J Plant Pathol 137(2): 217-21.
18.	Barley	Fusarium head blight	Canada	Univ Laval, Dept Phytologie, Fac Sci l'agriculture & l'alimentation	Marchand S, Fonquerne G, Clermont I et al. 2008. Androgenic response of barley accessions and F1s with Fusarium head blight resistance. Plant Cell Rep 27(3): 443-51.
19.	Sunflower	Rust White rust Verticillium wilt Powdery mildew Sunflower moth	Argentina	Ctr Recursos Nat Zona Semiarida CERZOS CONICET Univ Nacl Sur, Dept Agron	Gutierrez A, Cantamutto M, Poverene M. 2012. Disease tolerance in *Helianthus petiolaris*: A genetic resource for sunflower breeding. Plant Prod Sci 15(3): 204-08.
20.	Sunflower	Sunflower broomrape	Spain	Koipesol Semillas S.A. Inst de Agricultura Sostenible (IAS-CSIC)	Rodríguez-Ojeda MI, Pineda-Martos R, Alonso LC et al. 2013. A dominant avirulence gene in *Orobanche cumana* triggers *Or5* resistance in sunflower. Weed Res 53(5): 322-27.
21.	Potato	Potato virus Y Potato leafroll virus	USA	USDA-ARS: Aberdeen Res & Extension Ctr; Crop Genet & Production Res Unit	Novy RG, Gillen AM, Whitworth JL. 2007. Characterization of the expression and inheritance of potato leafroll virus (PLRV) and potato virus Y (PVY) resistance in three generations of germplasm derived from *Solanum tuberosum*. Theor Appl Genet 114(7): 1161-72.

22.	Grapevine	Grapevine fanleaf virus	France	INRA, UMR IBSV, F-06903 Sophia Antipolis, INRA, UMR EGFV, F-33883 Villenave Dornon INRA, UMR DiAPC, F-34060 Montpellier INRA, UMR IBSV, F-06903 Sophia Antipolis	Esmenjaud D, Van Ghelder C, Voisin R et al. 2010. Host suitability of vitis and vitis-muscadinia material to the nematode xiphinema index over one to four years. *Amer J of Enology and Viticulture* 61 (1): 96-101

Supplementary Material 4h: Molecular markers used to tag resistance genes and for MAS

	Plant	Pest / Disease	Country	University or Lab	References
1.	Wheat	Leaf rust	Australia	Univ Sydney, Plant Breed Inst	Dadkhodaie NA, Singh D, Park RF. 2011. Characterisation of resistance to leaf rust in an international bread wheat nursery. J Plant Pathol 93(3): 627-41.
2.	Wheat	Leaf rust	Turkey	Middle E Tech Univ: Biotechnol Program; Dept Chem Gaziosmanpasa Univ, Biotechnol Program Thrace Agric Res Inst	Yildirim K, Boylu B, Atici E et al. 2012. In Turkish wheat cultivars the resistance allele of *Lr34* is ineffective against leaf rust. Journal of Plant Diseases and Protection 119(4): 135-41.
3.	Wheat	Leaf rust	Argentina	CICVyA INTA, Inst Genèt EA Favret	Ingala L, Lopez M, Darino M et al. 2012. Genetic analysis of leaf rust resistance genes and associated markers in the durable resistant wheat cultivar Sinvalocho MA. Theor Appl Genet 124(7): 1305-14.
4.	Wheat	Leaf rust	Argentina	INTA : EEA Marcos Juarez; Inst Recursos Biológicos ; EEA Bordenave, Argentina Univ. of California, Dep Plant Sci, USA	Bainotti C, Fraschina J, Salines JH et al. 2009. Registration of 'BIOINTA 2004' Wheat. J Plant Registr 3(2): 165-69.
5.	Wheat	Leaf rust	China	Agric Univ Hebei, Dept Plant Pathol	Yan HF, Yang WX, Chen YF et al. 2009. Specificity and stability of E-chromosome specific SCAR marker from *Thinopyrum* spp. for *Lr19*. Acta Phytopath Sinica 39(1): 76-81.
6.	Wheat	Leaf rust	China	Agric Univ Hebei, Dept Plant Pathol, Lab Mol Phytopathol Biol Control Ctr Plant Dis &Pests of Hebei Province	Zhang N, Chen YT, Li YN et al. 2008. A novel STS marker for leaf rust resistance gene *Lr24* in wheat. Acta Agron Sin 34(2): 212-16.
7.	Wheat	Leaf rust	China	Agric Univ Hebei, Dept Plant Pathol, Lab Mol Phytopathol Biol Control Ctr Plant Dis &Pests of Hebei Province	Shi LH, Zhang N, Hu YY et al. 2011. Evaluation of wheat leaf rust resistance of 10 new wheat cultivars (lines). Sci Agric Sinica 44(14): 2900-08.
8.	Wheat	Leaf rust	China	Agric Univ Hebei, Dept Plant Pathol, Lab Mol Phytopathol Biol Control Ctr Plant Dis &Pests of Hebei Province	Zhang N, Ji HL, Yang WX, Liu DQ. 2009. Studies on gene *Lr24* conferring resistance to wheat leaf rust by TRAP analysis. Sci Agric Sinica 42(5): 1841-48.
9.	Wheat	Leaf rust	China	Agric Univ Hebei, Coll Plant Protect, Dept Plant Pathol, Lab Mol Phytopathol Biol Control Ctr Plant Dis & Pests of Hebei Province	Zhang N, Yang WX, Li YN et al. 2007. Developing molecular markers for leaf rust resistance gene *Lr45* in wheat based on SSR. Acta Agron Sin 33(4): 657-62.
10.	Wheat	Leaf rust	China	Agricul Univ Hebei, Dept Plant Pathol Biol Control Ctr Plant Dis & Plant Pests Hebei Province	Zhang N, Yang WX, Liu DQ. 2011. Identification and molecular tagging of leaf rust resistance gene (*Lr24*) in wheat. Agr Sci China 10(12): 1898-05.

11.	Wheat	Leaf rust	China	Agric Univ Hebei, Coll Plant Protect Biol Control Ctr Plant Dis & Plant Pests Hebei Province Natl Engineer Res Ctr Agricin No Mountainous Areas	Hu YY, Feng LN, Ji HL et al. 2011. SSR mapping of leaf rust resistance gene *LrY192* in *Aegilops tauschii* Y192. China Agr Sci 44(10): 2022-28.
12.	Wheat	Leaf rust	Germany Ethiopia	Univ Bonn: Inst Crop Sci & Resour Conservat: Phytomedicine; Crop Genet & Biotechnol, Germany Debre Zeit Agric Res Ctr, Ethiopia Max-Planck-Inst Plant Breed Res, Barley Genet Res Group, Germany	Mebrate SA, Oerke EC, Dehne HW, Pillen K. 2008. Mapping of the leaf rust resistance gene *Lr38* on wheat chromosome arm 6DL using SSR markers. Euphytica 162(3): 457-66.
13.	Wheat	Leaf rust	Hungary	Hungarian Acad Sci, Agricul Res Inst	Vida G, Gál M, Uhrin A et al. 2009. Application of marker assisted selection in wheat breeding for leaf rust resistance. Növényvédelem 45(12): 668-75.
14.	Wheat	Leaf rust	Hungary	Hungarian Acad Sci, Agricul Res Inst	Vida G, Gal M, Uhrin A et al. 2008. Molecular markers in the "real world": identification of resistance genes and marker assisted selection in wheat breeding for leaf rust resistance. Modern Variety Breeding For Present And Future Needs: Edings Of The 18th Eucarpia General Congress, Valencia, Spain.
15.	Wheat	Leaf rust	Hungary	Hungarian Acad Sci, Agricul Res Inst	Uhrin A, Lang L, Bedo Z. 2008. Comparison of PCR-based DNA markers for using different *Lr19* and *Lr24* leaf rust resistance wheat sources. Cereal Res Commun 36(4): 533-41.
16.	Wheat	Leaf rust	India	Punjab Agricul Univ	Chhuneja P, Vikal Y, Kaur S et al. 2011. Marker-assisted pyramiding of leaf rust resistance genes *Lr24* and *Lr28* in wheat (*Triticum aestivum*). Indian J Agr Sci 81(3): 214-18.
17.	Wheat	Leaf rust	India	Directorate of Wheat Res, Regional Stn	Datta D, Prashar M, Bhardwaj SC. 2007. Validation and incorporation of leaf rust resistance genes *Lr9*, *Lr19*, *Lr24* and *Lr26* through molecular markers in wheat (*Triticum aestivum* L.). Indian J Genet Pl Br 67(1): 7-11.
18.	Wheat	Leaf rust	India	Charan Singh Univ, Dept Genet & Plant Breed, Mol Biol Lab Indian Agrcul Res Inst, Div Genet	Kumar J, Mir RR, Kumar N et al. 2010. Marker-assisted selection for pre-harvest sprouting tolerance and leaf rust resistance in bread wheat. Plant Breeding 129(6): 617-21.
19.	Wheat	Leaf rust	India	Indian Agricul Res Inst, Div Genet Natl Res Ctr Plant Biotechnol	Bhawar KB, Vinod, Sharma JB et al. 2011. Molecular marker assisted pyramiding of leaf rust resistance genes *Lr19* and *Lr28* in bread wheat (*Triticum aestivum* L.) variety HD2687. Indian J Genet Pl Br 71(4): 304-11.
20.	Wheat	Leaf rust	India	Indian Agricul Res Inst, Natl Phytotron Facil, Div Genet	Samsampour D, Zanjani BM, Singh A et al. 2009. Marker assisted selection to pyramid seedling resistance gene *Lr24* and adult plant resistance gene *Lr48* for leaf rust resistance in wheat. Indian J Genet Pl Br 69(1): 1-9.
21.	Wheat	Leaf rust	Italy	Ist Sperimentale Cerealicoltura	Nocente F, Gazza L, Pasquini M. 2007. Evaluation of leaf rust resistance genes *Lr1*, *Lr9*, *Lr24*, *Lr47* and their introgression into common wheat cultivars by marker-assisted selection. Euphytica 155(3): 329-36.

22.	Wheat	Leaf rust	Switzerland	Agroscope Changins-Wadenswil Res Stn ACW, Plant Breed & Genet Resour Agroscope Liebefeld-Posieux Res Stn ALP	Moullet O, Fossati D, Mascher F et al. 2010. Use of marker-assisted selection (MAS) for pyramiding leaf rust resistance genes (*Lr9*, *Lr24*, *Lr22a*) in wheat. 60. Jahrestagung der Vereinigung der Pflanzenzüchter und Saatgutkaufleute Österreichs 2009. 143-46.
23.	Wheat	Leaf rust	Syria	Aleppo Univ, Fac Agr ICARDA	Kassem M, El-Ahmed A, Hakim MS et al. 2011. Identifying leaf rust resistance gene *Lr19* in durum wheat using simple sequence repeat (SSR) marker. Afr J Biotechnol 10(44): 8716-19.
24.	Wheat	Leaf rust	USA	N Carolina State Univ: Dept Crop Sci; USDA-ARS, Regional Small Grains Genotyping Lab Kansas State Univ, Deprt Plant Pathol, Wheat Genetic & Genomic Resour Ctr	Kuraparthy V, Sood S, Guedira GB, Gill BS. 2011. Development of a PCR assay and marker-assisted transfer of leaf rust resistance gene *Lr58* into adapted winter wheats. Euphytica 180(2): 227-34.
25.	Wheat	Leaf rust	USA	Kansas State Univ, Dept Plant Pathol, Wheat Genet & Genom Resour Ctr Montana State Univ, Dept Plant Sci & Plant Pathol	Gill BS, Huang L, Kuraparthy V et al. 2008. Alien genetic resources for wheat leaf rust resistance, cytogenetic transfer, and molecular analysis. Aust J Agr Res 59(3): 197-05.
26.	Wheat	Leaf rust	Canada Switzerland France	Agric & Agri-Food Canada, Cereal Res Ctr, Canada Univ Zürich, Inst Plant Biol, Switzerland Inst Natl Recherche Agronomique, Amélioration et Santé des Plantes, France	Cloutier S, McCallum BD, Loutre C et al. 2007. Leaf rust resistance gene *Lr1*, isolated from bread wheat (*Triticum aestivum* L.) is a member of the large psr567 gene family. Plant Mol Biol 65(1-2): 93-106.
27.	Wheat	Leaf rust	Canada	Agric & Agri-Food Canada, Cereal Res Ctr	Hiebert CW, Thomas JB, Somers DJ et al. 2007. Microsatellite mapping of adult-plant leaf rust resistance gene *Lr22a* in wheat. Theor Appl Genet 115(6): 877-84.
28.	Wheat	Leaf rust	China Switzerland	CAS, Inst Genet & Developl Biol, State Key Lab Plant Cell & Chromosome Engineer, China Graduate Univ CAS, China Univ Zürich, Inst Plant Biol, Switzerland	Qiu JW, Schurch AC, Yahiaoui N et al. 2007. Physical mapping and identification of a candidate for the leaf rust resistance gene *Lr1* of wheat Theor Appl Genet 115(2): 159-68.
29.	Wheat	Leaf rust	Australia India	Univ Sydney PBI-Cobbitty, Fac Agric, Food & Natural Resour, Australia Univ Adelaide, School Agric, Food & Wine, Australia Punjab Agricul Univ, Dept Plant Breed, Genet & Biotechnol, India	Bansal UK, Hayden MJ, Venkata BP et al. 2008. Genetic mapping of adult plant leaf rust resistance genes *Lr48* and *Lr49* in common wheat. Theor Appl Genet 117(3): 307-12.
30.	Wheat	Leaf rust	Italy	Univ Bologna, Dept Agroenvironm & Technol Società Produttori Sementi s.p.a.	Maccaferri M, Mantovani P, Tuberosa R et al. 2008. A major QTL for durable leaf rust resistance widely exploited in durum wheat breeding programs maps on the distal region of chromosome arm 7BL. Theor Appl Genet 117(8): 1225-40.
31.	Wheat	Leaf rust	Germany	Univ Bonn, Crop Genet & Biotechnol Unit, Inst Crop Sci & Resour Conservation Max-Planck-Inst Plant Breed Res Technical Univ Munich , Chair of Plant Breed Federal Ctr Breed Res Cultivated Plants (BAZ)	Naz AA, Kunert A, Lind V et al. 2008. AB-QTL analysis in winter wheat: II. Genetic analysis of seedling and field resistance against leaf rust in a wheat advanced backcross population. Theor Appl Genet 116(8): 1095-04.
32.	Wheat	Leaf rust	India	Punjab Agricul Univ, School Agricul Biotechnol	Riar AK, Kaur S, Dhaliwal HS et al. 2012. Introgression of a leaf rust resistance gene from *Aegilops caudata* to bread wheat. J Genet 91(2): 155-61.

33.	Wheat	Leaf rust	China	Northwest A&F Univ, Coll Agron, Shaanxi Key Lab Genet Engineer Plant Breed	Du WL, Wang J, Wang LM et al. 2013. Development and characterization of a *Psathyrostachys huashanica* Keng 7Ns chromosome addition line with leaf rust resistance. PLoS One 8(8): e70879.
34.	Wheat	Leaf rust	China	Agricul Univ Hebei, Biologic Control Ctr Plant Dis & Plant Pests Hebei, Dept Plant Pathol, Coll Plant Protect Zhoukou Acad Agricul Sci CAAS: Inst Crop Sci, Natl Wheat Improv Ctr/The Natl Key Facility Crop Gene Resour & Genetic Improv CIMMYT China Off	Zhao XL, Zheng TC., Xia XC et al. 2008. Molecular mapping of leaf rust resistance gene *LrZH84* in chinese wheat line Zhou 8425B. Theor Appl Genet 117 (7): 1069-75.
35.	Wheat	Leaf rust	USA	N Dakota State Univ, Dept Plant Scis USDA-ARS: Northern Crop Sci Lab; Cereal Dis Lab	Chu CG, Friesen TL, Xu SS et al. 2009. Identification of novel QTLs for seedling and adult plant leaf rust resistance in a wheat doubled haploid population. Theor Appl Genet 119(2): 263-69.
36.	Wheat	Leaf rust	USA	USDA-ARS, Cereal Dis Lab	Ordonez ME, Kolmer JA. 2009. Differentiation of molecular genotypes and virulence phenotypes of *Puccinia triticina* from common wheat in North America. Phytopathology 99 (6): 750-58.
37.	Wheat	Leaf rust	USA China	Oklahoma State Univ: Dept Plant & Soil Sci; Dept Entomol & Plant Pathol, USA Yangzhu Univ, Agricul Coll, China	Cao S, Carver BF, Zhu X et al. 2010. A single-nucleotide polymorphism that accounts for allelic variation in the *Lr34* gene and leaf rust reaction in hard winter wheat. Theor Appl Genet 121(2): 385-92.
38.	Wheat	Leaf rust	Canada	Agric & Agri-Food Canada, Cereal Res Ctr Univ Manitoba, Dept Plant Sci	Dakouri A, McCallum BD, Walichnowski AZ et al. 2010. Fine-mapping of the leaf rust *Lr34* locus in *Triticum aestivum* (L.) and characterization of large germplasm collections support the ABC transporter as essential for gene function.Theor Appl Genet 121(2): 373-84.
39.	Wheat	Leaf rust	Canada USA	Agric & Agri-Food Canada: Plant Gene Resour Canada, Saskatoon Res Ctr; Cereal Res Ctr, Canada Montana State Univ, Dept Plant Sci & Plant Pathol, USA	Fu YB, Peterson GW, McCallum BD et al. 2010. Population-based resequencing analysis of improved wheat germplasm at wheat leaf rust resistance locus *Lr21*. Theor Appl Genet 121(2): 271-81.
40.	Wheat	Leaf rust	India	Agharkar Res Inst, Genet & Plant Breed Group Directorate Wheat Res, Regional Stn	Bipinraj A, Honrao B, Prashar M et al. 2011. Validation and identification of molecular markers linked to the leaf rust resistance gene *Lr28* in wheat. J Appl Genet 52(2): 171-75.
41.	Wheat	Leaf rust	Ukraine	Ukrainian Acad Agricul Sci: Inst Plant Protect; Plant Breed & Genet Inst, Natl Ctr Seed & Cultivar Investigation; Remeslo Inst Wheat, Ukrainian Natl Acad Sci, Inst Food Biotechno & Genom	Karelov AV, Pirko Ia V, Kozub NA et al. 2011. Identification of allelic state of leaf rust-resistance *Lr34* gene in the cultivars of soft winter wheat of ukrainian breeding. Tsitol Genet 45(5): 3-10.
42.	Wheat	Leaf rust	Russsia	Russian Acad Sci, Siberian Branch: Inst Cytol & Genet; Siberian Inst Plant Growing & Breed	Adonina, IG, Petrash NV, Timonova EM et al. 2012. Construction and study of leaf rust-resistant common wheat lines with translocations of *Aegilops speltoides* Tausch. genetic material. Russ J Genet 48(4): 404-09.
43.	Wheat	Leaf rust	Mexico China Australia	CIMMYT, Mexico Campo Experim Valle Mexico INIFAP, Mexico CIMMYT China Off, China CSIRO Plant Ind, Australia	Herrera-Foessel SA, Singh RP, Huerta-Espino J et al. 2012. *Lr68*: A new gene conferring slow rusting resistance to leaf rust in wheat. Theor Appl Genet 124(8): 1475-86.

44.	Wheat	Leaf rust	India	Indian Agricul Res Inst: Natl Phytotron Facility; Division of Genet Guru Gobind Singh Indraprastha Univ, Univ School Biotechnol	Singh A, Pallavi JK, Gupta P, Prabhu KV. 2012. Identification of microsatellite markers linked to leaf rust resistance gene *Lr25* in wheat. J Appl Genet 53(1): 19-25.
45.	Wheat	Leaf rust	Canada	Agric & Agri-Food Canada, Cereal Res Ctr Univ Manitoba, Dept Plant Sci	Dakouri A, McCallum BD, Radovanovic N, Cloutier S 2013. Molecular and phenotypic characterization of seedling and adult plant leaf rust resistance in a world wheat collection. Mo Breeding 32(3): 663-77.
46.	Wheat	Leaf rust	China USA	Hebei Acad Agricul & Forestry Sci, Inst Millet Crops, China Kansas State Univ, Dep Agron, USA USDA-ARS, Hard Winter Wheat Genet Res Unit, USA	Liu ZL, Bowden RL, Bai GH. 2013. Molecular markers for leaf rust resistance gene *Lr42* in wheat. Crop Sci 53(4): 1566-70.
47.	Wheat	Leaf rust	Italy USA Czech Republic Mexico	Univ Bologna, Dept Agricul Sci (DipSA), Italy N Dakota State Univ, Dept Plant Sci, USA Società Produttori Sementi Bologna, Italy Inst Experim Botany, Czech Republic CIMMYT, Mexico USDA-ARS, Cereal Dis Lab, USA	Terracciano I, Maccaferri M, Bassi F et al. 2013. Development of COS-SNP and HRM markers for high-throughput and reliable haplotype-based detection of *Lr14a* in durum wheat (*Triticum durum* Desf.). Theor Appl Genet 126(4): 1077-101.
48.	Wheat	Leaf rust	China	Hebei AgriculUniv, Dept Plant Pathol, Coll Plant Protect, Biol Control Ctr Plant Dis & Plant Pests Hebei CAAS, Inst Crop Sci, Natl Wheat Improv Ctr, Natl Key Facil Crop Gene Resour & Genet Improv CIMMYTChina Off, c/o CAAS	Zhou H X, Xia XC, He ZH et al. 2013. Molecular mapping of leaf rust resistance gene *LrNJ97* in chinese wheat line Neijiang 977671.Theor Appl Genet 126(8): 2141-47.
49.	Wheat	Leaf rust	China	Biologic Control Ctr Plant Dis & Plant Pests of Hebei, Agricul Univ Hebei, Dept Plant Pathol, Coll Plant Protect CAAS, Inst Crop Sci, Natl Wheat Improv Ctr CIMMYT China Off	Zhou Y, Xia X, He Z et al. 2013. Fine mapping of leaf rust resistance gene *Lrzh84* using expressed sequence tag and sequence-tagged site markers, and allelism with other genes on wheat chromosome 1B. Phytopathology 103(2): 169-74.
50.	Wheat	Leaf rust	Uruguay USA	Natl Inst AgriculRes La Estanzuela, Uruguay USDA-ARS, Cereal Dis Lab, USA	Germán SE, Kolmer JA. 2014. Leaf rust resistance in selected late maturity, common wheat cultivars from Uruguay. Euphytica 195(1): 57-67.
51.	Wheat	Leaf rust	Russia Germany	Russian Acad Sci, Siberian Branch, Inst Cytol & Genet, Russia Leibniz Inst Plant Genet & Crop Plant Res (IPK), Germany	Timonova EM, Leonova IN, Röder MS, Salina EA. 2013. Marker-assisted development and characterization of a set of *Triticum aestivum* lines carrying different introgressions from the *T. timopheevii* genome. Mol Breeding 31(1): 123-36.
52.	Wheat	Leaf rust	USA India	Kansas State Univ: Dept Plant Pathol, Wheat Genet & Genom Resources Ctr; USDA-ARS, Plant Sci & Entomol Res Unit, USA Punjab Agr Univ, Dept Plant Breeding Genet & Biotechnol,India Indian Inst Technol, Dept Biotechnol,India	Kuraparthy V, Sood S, Chhuneja P et al. 2007. A cryptic wheat-*Aegilops triuncialis* translocation with leaf rust resistance gene *Lr58*. Crop Sci 47(5): 1995-2003.
53.	Wheat	Leaf rust	Russia Germany	Inst Cytol & Genet, Russia Nordsaat Saatzuchtgesellschaft MBH, Germany Leibniz Inst Plant Genet & Crop Plant Res (IPK), Germany	Leonova IN, Laikova LI., Popova OM et al. 2007. Detection of quantitative trait loci for leaf rust resistance in wheat—*T. timopheevii*/*T.tauschii* introgression lines. Euphytica 155(1-2): 79-86.

54.	Wheat	Leaf rust	Russia Germany	Russian Acad Sci, Siberian Branch, Inst Cytol & Genet, Russia Leibniz Inst Plant Genet & Crop Plant Res, Germany	Leonova IN, Roder MS, Kalinina NP, Budashkina EB. 2008. Genetic analysis and localization of loci controlling leaf rust resistance *of Triticum aestivum* x *Triticum timopheevii* introgression lines. Russ J Genet 44(12): 1431-37.
55.	Wheat	Leaf rust	Russia Germany	Russian Acad Sci, Inst Cytol & Genet, Russia JKI, Inst Plant Protect Field Crops & Grassland, Fed Res Ctr Cultivated Plants, Germany	Leonova IN, Budashkina EB, Flath K et al. 2010. Microsatellite mapping of a leaf rust resistance gene transferred to common wheat from *Triticum timopheevii*. Cereal Res Commun 38(2): 211-19.
56.	Wheat	Leaf rust	Japan Switzerland	Yokohama City Univ, Kihara Inst Biol Res, Japan Univ Zürich, Inst Plant Biol, Switzerland Meiji Univ, Bioinformat Lab, Fac Agr, Japan Natl Inst Genet, Genome Biol Lab, Japan.	Manickavelu A, Kawaura K, Oishi K et al. 2010. Comparative gene expression analysis of susceptible and resistant near-isogenic lines in common wheat infected by *Puccinia triticina*. DNA Res 17(4): 211-22.
57.	Wheat	Leaf rust	Russia	Russian Acad Agricul Sci: All-Russia Scientific Inst Plant Protect; Vavilov Res Inst Plant Ind Siberian Branch of RAS, Inst Cytol & Genet	Gultyaeva EI, Orina AS, Gannibal PB et al. 2014. The Effectiveness of molecular markers for the identification of *Lr28*, *Lr35*, and *Lr47* genes in common wheat. Russ J Genetics 50(2): 131-39.
58.	Wheat	Leaf rust	Russia	Agric Res Inst Central Non-Chernozem Zone All-Russian Inst Phytopathol, Bol'shie Vyazemy	Gainullin NR, Lapochkina IF, Zhemchuzhina AI et al. 2007. Phytopathological and molecular genetic identification of leaf rust resistance genes in common wheat accessions with alien genetic material. Russ J Genet 43(8): 875-81.
59.	Wheat	Leaf rust	Mexico Australia	Dept Forest Mycol & Pathol, Swedish Univ Agricul Sci (SLU), Sweden CIMMYT, Mexico Campo Experim Valle Mexico INIFAP, Mexico CSIRO, Plant Ind, Australia	Herrera-Foessel SA, Singh RP, Huerta-Espino J et al. 2007. Identification and mapping of *Lr3* and a linked leaf rust resistance gene in durum wheat. Crop Sci 47(4): 1459-66.
60.	Wheat	Leaf rust	Argentina	CICVyA INTA, Inst Genèt EA Favret EE INTA Marcos Juàrez	Ingala L, Saione H, Helguera M et al. 2007. Inheritance of adult plant resistance genes and associated markers from a durable resistant cultivar to leaf rust. In: Buck HT et al. (eds.): Wheat Production in Stressed Environments. Developments in Plant Breeding 12: 59-63.
61.	Wheat	Leaf rust	Pakistan	Univ Agr Faisalabad, Dept Plant Breeding & Genet	Malik TA, Iqbal A, Chowdhry MA et al. 2007. DNA marker for leaf rust disease in wheat. Pak J Bot 39(1): 239-43.
62.	Wheat	Leaf rust	Australia	Univ Sydney, Plant Breed Inst Cobbitty	Singh D, Park RF, McIntosh RA. 2007. Characterisation of wheat leaf rust resistance gene *Lr34* in Australian wheats using components of resistance and the linked molecular marker csLV34. Aust J Agr Res 58(11): 1106-14.
63.	Wheat	Leaf rust	Germany Hungary Poland	Polish Acad Sci, Inst Plant Genet, Poland Fed Ctr Breeding Res Cultivated Plants, Inst Epidemiol & Resistance Resour, Germany Polonia Univ, Lab Populat Genet, Poland Hungarian Acad Sci, Agr Res Inst, Hungary	Blaszczyk L, Kramer I, Ordon F et al. 2008. Validity of selected DNA markers for breeding leaf rust resistant wheat. Cereal Res Commun 36(2): 201-13.
64.	Wheat	Leaf rust	USA	USDA-ARS: Plant Sci & Entomol Unit; Cereal Crops Res Unit Kansas State Univ, Dept Plant Pathol	Bremenkamp-Barrett B, Faris JD, Fellers JP. 2008. Molecular mapping of the leaf rust resistance gene *Lr17a* in wheat. Crop Sci 48(3): 1124-28.

65.	Wheat	Leaf rust	Brazil	Univ Fed Rio Grande do Sul, Programa Posgrad Biol Celular & Mol, Ctr Biotecnol Rio Grande Sul Pioneer Sementes Ltda, Ctr Pesquisa Passo Fundo Univ Fed Rio Grande do Sul, Dept Plantas Lavoura Embrapa Trigo	Da Silva PR, Milach SCK, Sortica VD et al. 2008. Validation of molecular markers associated to leaf rust resistance genes in wheat. Pesquisa Agropecuaria Brasileira 43(10): 1357-63.
66.	Wheat	Leaf rust	Sweden Mexico	Swedish Univ Agr Sci, SLU, Dept Forest Mycol & Pathol, Sweden CIMMYT, Mexico Campo Experim Valle Mexico INIFAP, Mexico	Herrera-Foessel SA, Singh RP, Huerta-Espino J et al. 2008. Molecular mapping of a leaf rust resistance gene on the short arm of chromosome 6B of durum wheat. Plant Dis 92(12): 1650-54.
67.	Wheat	Leaf rust	Canada	Agric & Agri-Food Canada, Cereal Res Ctr	Hiebert CW, Thomas JB, McCallum BD et al. 2008. Genetic mapping of the wheat leaf rust resistance gene *Lr60* (*LrW2*). Crop Sci 48(3): 1020-26.
68.	Wheat	Leaf rust	Hungary	Cereal Res Non Profit Co	Tar M, Purnhauser L, Csosz M. 2008. Identification and localization of molecular markers linked to the *Lr52* leaf rust resistance gene of wheat. Cereal Res Commun 36(3): 409-15.
69.	Wheat	Leaf rust	Czech Republic	Res Inst Crop Prod	Hanzalova A, Sumikova T, Bartos P. 2009. Determination of leaf rust resistance genes *Lr10*, *Lr26* and *Lr37* by molecular markers in wheat cultivars registered in the Czech Republic . Czech J Genet Plant Breed 45(2): 79-84.
70.	Wheat	Leaf rust	Italy Spain Egypt	CRA Cereal Res Ctr SS, Italy CSIC, Inst Sustainable Agr, Spain IFAPA CICE, CIFA Alameda Obispo, Spain Kafr El Sheikh Univ, Dept Agr Bot, Egypt Univ Bari, Dept Environm & Agroforestry Biol & Chem, Italy CRA Genom Res Ctr, Italy	Marone D, Del Olmo AI, Laido G et al. 2009. Genetic analysis of durable resistance against leaf rust in durum wheat. Mol Breeding 24(1): 25-39.
71.	Wheat	Leaf rust	Australia UK Kenya	Univ Sydney, Plant Breed Inst Cobbitty, Australia JIC, UK CIMMYT Nairobi, Kenya	Singh D, Simmonds J, Park RF et al. 2009. Inheritance and QTL mapping of leaf rust resistance in the European winter wheat cultivar 'Beaver'. Euphytica 169(2): 253-61.
72.	Wheat	Leaf rust	USA	Kansas State Univ: Dept Agron; USDA-ARS, Plant Sci & Entomol Res Unit Oklahoma State Univ, Dept Plant & Soil Sci	Sun XC, Bai GH, Carver B. 2009. Molecular markers for wheat leaf rust resistance gene Lr41. Mol Breeding 23(2): 311-21.
73.	Wheat	Leaf rust	Hungary UK China	Hungarian Acad Sci, Agr Res Inst, Hungary Univ Dundee, SCRI, UK Northwest A&F Univ, China	Vida G, Gal M, Uhrin A et al. 2009. Molecular markers for the identification of resistance genes and marker-assisted selection in breeding wheat for leaf rust resistance. Euphytica 170(1-2): 67-76.
74.	Wheat	Leaf rust	USA	USDA-ARS, Cereal Dis Lab Univ Minnesota: Dept Agron & Plant Genet; Dept Plant Pathol	Kolmer JA, Anderson JA, Flor JM. 2010. Chromosome location, linkage with simple sequence repeat markers, and leaf rust resistance conditioned by gene *Lr63* in wheat. Crop Sci 50(6): 2392-95.
75.	Wheat	Leaf rust	Italy Mexico USA Poland	Univ Bologna, Dept Agroenvironm Sci & Technol, Italy Società Produttori Sementi Bologna, Italy CIMMYT, Mexico USDA-ARS, Cereal Dis Lab, USA	Maccaferri M, Sanguineti MC, Mantovani P et al. 2010. Association mapping of leaf rust response in durum wheat. Mol Breeding 26(2): 189-228.

			Israel	IHAR, Dept Genet & Plant Breeding, Poland Tel Aviv Univ, Dept Plant Sci, Israel	
76.	Wheat	Leaf rust	India Iran	Indian Agr Res Inst, Natl Phytotron Facil, Div Genet, India Zanjan Univ, Fac Agr, Iran	Samsampour D, Zanjani BM, Pallavi JK et al. 2010. Identification of molecular markers linked to adult plant leaf rust resistance gene *Lr48* in wheat and detection of *Lr48* in the Thatcher near-isogenic line with gene *Lr25*. Euphytica 174(3): 337-42.
77.	Wheat	Leaf rust	USA	USDA-ARS, Hard Winter Wheat Genet Res Unit Kansas State Univ, Dep Agron Oklahoma State Univ, Dep Plant & Soil Sci	Sun XC., Bai GH, Carver BF, Bowden R. 2010. Molecular mapping of wheat leaf rust resistance gene *Lr42*. Crop Sci 50(1): 59-66.
78.	Wheat	Leaf rust	Canada	Agric & Agri-Food Canada: Res Branch, Cereal Res Ctr; Res Branch, Semiarid Prairie Agr Res Ctr	Thomas J., Nilmalgoda S, Hiebert C et al. 2010. Genetic markers and leaf rust resistance of the wheat gene *Lr32*. Crop Sci 50(6): 2310-17.
79.	Wheat	Leaf rust	Turkey	Ege Univ, Fac Agr, Dept Field Crops	Tonk, F. A. and Yüce, S. (2010). A preliminary study for identification of candidate AFLP markers for leaf rust resistance gene *Lr13* by using near-isogenic lines of spring wheat cv. Thatcher. Turkish J Field Crops 15(1): 34-39.
80.	Wheat	Leaf rust	China	China Agr Univ: State Key Lab Agrobiotechnol; Coll Agron & Biotechnol; Key Lab Crop Genom & Genet Improvement, Minist Agr; Beijing Key Lab Crop Genet Improv, Minist Agr; Key Lab Crop Heterosis Res & Utilizat, Minist Educ Dezhou Univ, Dept Biologic Sci	Wang YJ, Peng HR, Liu G et al. 2010. Identification and molecular mapping of a leaf rust resistance gene in spelt wheat landrace Altgold. Euphytica 174(3): 371-75.
81.	Wheat	Leaf rust	Germany	JKI, Inst Resistance Res & Stress Tolerance, Fed Res Ctr Cultivated Plants	Serfling A, Kramer I, Lind V et al. 2011. Diagnostic value of molecular markers for *Lr* genes and characterization of leaf rust resistance of German winter wheat cultivars with regard to the stability of vertical resistance. Eur J Plant Pathol 130(4): 559-75.
82.	Wheat	Leaf rust	India	Indian Agr Res Inst, Natl Phytotron Facil Guru Gobind Singh Indraprastha Univ, Univ Sch Biotechnol	Singh A, Pallavi JK, Gupta P, Prabhu KV. 2011. Identification of microsatellite markers linked to leaf rust adult plant resistance (APR) gene *Lr48* in wheat. Plant Breeding 130(1): 31-34.
83.	Wheat	Leaf rust	USA	Kansas State Univ: Dept Plant Pathol; USDA-ARS Hard Winter Wheat Genet Res Unit	Singh S, Bowden RL. 2011. Molecular mapping of adult-plant race-specific leaf rust resistance gene Lr12 in bread wheat. Mol Breeding 28(2): 137-42.
84.	Wheat	Leaf rust	Argentina	INTA EEA Marcos Juarez: Grp Biotecnol & Recursos Genet; Grp Mejoramiento Trigo INTA EEA Bordenave, Area Fitopatol	Vanzetti LS, Campos P, Demichelis M et al. 2011. Identification of leaf rust resistance genes in selected Argentinean bread wheat cultivars by gene postulation and molecular markers. Electronic Journal of Biotechnology 14(3): http://dx.doi.org/10.2225/vol14-issue3-fulltext-14.
85.	Wheat	Leaf rust	China	Hebei Agr Univ, Dept Plant Pathol, Coll Plant Protect, Biol Control Ctr Plant Dis & Plant Pests Hebei CAAS, Inst Crop Sci, Natl Wheat Improvement Ctr, Natl Key Facil Crop Gene Resources & Genet Improv CIMMYT China Off	Zhang H, Xia XC, He ZH et al. 2011. Molecular mapping of leaf rust resistance gene *LrBi16* in Chinese wheat cultivar Bimai 16. Mol Breeding 28 (4): 527-34.

86.	Wheat	Leaf rust	Brasil	Univ Estadual Centro Oeste, Dept Ciencias Biol, Lab Genet & Biol Mol Vegetal EMBRAPA Trigo, Ctr Nacl Pesquisa Trigo Univ Fed Rio Grande do Sul Pioneer Sementes Ltda, Ctr Pesquisa Passo Fundo OR Melhoramento de Sementes Ltda	Da-Silva PR, Brammer SP, Guerra D et al. 2012. Monosomic and molecular mapping of adult plant leaf rust resistance genes in the Brazilian wheat cultivar Toropi. Genet Mol Res 11(3): 2823-34.
87.	Wheat	Leaf rust	India	Sher E Kashmir Univ Agr Sci & Technol Kashmir, Fac Agr Cent Univ Punjab, Sch Biosci	Khan MA, Kamaluddin, Saini RG. 2012. Chromosomal location of non-hypersensitive leaf rust resistance genes in bread wheat cultivar PBW65 using microsatellite markers. Indian J Biotechnol 11(4): 412-15.
88.	Wheat	Leaf rust	Germany Australia	Bavarian State Res Ctr Agr, Inst Crop Sci & Plant Breeding, Germany Univ Sydney, Plant Breeding Inst, Australia Praxis Humangenetik & Prävention, Germany	Mohler V, Singh D, Singrün C, Park RF. 2012. Characterization and mapping of *Lr65* in spelt wheat 'Altgold Rotkorn'. Plant Breeding 131(2): 252-257.
89.	Wheat	Leaf rust	Pakistan	Quaid-i-Azam Univ: Dept Plant Sci; Dept Biotechnol	Rasheed A, Mumtaz AS, Shinwari ZK. 2012. Genetic characterization of novel *Lr* gene stack in spring wheat variety Chakwal86 and its effectiveness against leaf rust in rain fed areas of Pakistan. Pak J Bot 44(2): 507-10.
90.	Wheat	Leaf rust	Canada	Agric & Agri-Food Canada: Semiarid Prairie Agr Res Ctr; Cereal Res Ctr Univ Saskatchewan, Dept Plant Sci Lethbridge Res Ctr	Singh A, Pandey MP, Singh AK et al. 2012. Molecular mapping of leaf rust and stripe rust resistance QTL in durum wheat. Can J Plant Sci 92(3): 606. (
91.	Wheat	Leaf rust	Hungary	Hungarian Acad Sci, Agr Res Inst	Uhrin A, Szakacs E, Lang L et al. 2012. Molecular cytogenetic characterization and SSR marker analysis of a leaf rust resistant wheat line carrying a 6G(6B) substitution from *Triticum timopheevii* (Zhuk.). Euphytica 186(1): 45-55.
92.	Wheat	Leaf rust	India Australia	Natl Chem Lab, PMB Unit, Div Biochem Sci, India Univ Sydney, Plant Breed Inst Cobbitty, Fac Agr & Environm, Australia Punjab Agr Univ, Dept Plant Breed Genet & Biotechnol, India.	Dholakia BB, Rajwade AV, Hosmani P et al. 2013. Molecular mapping of leaf rust resistance gene *Lr15* in hexaploid wheat. Mol Breeding 31(3): 743-47.
93.	Wheat	Leaf rust	USA	N Carolina State Univ, Dept Crop Sci, Raleigh, USDA-ARS Montana State Univ, Dept Plant Sci & Plant Pathol	Neelam K, Brown-Guedira G, Huang L. 2013. Development and validation of a breeder-friendly KASPar marker for wheat leaf rust resistance locus *Lr21*. Mol Breeding 31(1): 233-37.
94.	Wheat	Leaf rust	USA Australia	Univ Minnesota, Dept Plant Pathol, USA Divers Arrays P L, Australia	Olivera PD, Kilian A, Wenzl P, Steffenson BJ. 2013. Development of a genetic linkage map for Sharon goatgrass (*Aegilops sharonensis*) and mapping of a leaf rust resistance gene. Genome 56(7): 367-76.
95.	Wheat	Leaf rust	China	Agr Univ Hebei, Coll Plant Protect, Biol Control Ctr Plant Dis & Plant Pest Hebei, Dept Plant Pathol	Shi LH, Zhang N, Hu YY et al. 2013. Postulation of leaf rust resistance genes in seven Chinese spring wheat cultivars. J Integr Agric 12(9): 1580-88.
96.	Wheat	Leaf rust	Australia Germany	Univ Sydney, Plant Breed Inst, Australia Bavarian State Res Ctr Agr, Inst Crop Sci & Plant Breed, Germany	Singh D, Mohler V, Park RF. 2013. Discovery, characterisation and mapping of wheat leaf rust resistance gene *Lr71*. Euphytica 190(1): 131-36.
97.	Wheat	Leaf rust	Argentina	CICVyA INTA, Inst Genèt EA Favret, Argentina	Dieguez MJ, Pergolesi MF, Velasquez SM et al. 2014. Fine mapping of *LrSV2*, a race-specific adult plant leaf rust resistance gene on wheat

			France	Lab Fisiol Biol Mol IFIByNE (CONICET) FCEyN-UBA, Argentina INRA UMR Genet, Diversity & Ecophysiol Cereals, France	chromosome 3BS. Theor Appl Genet 127(5): 1133-41.
98.	Wheat	Leaf rust	Egypt Saudi Arabia	Agr Res Ctr, Plant Pathol Res Inst, Egypt King Saud Univ, Dept Bot & Microbiol, Coll Sci, Saudi Arabia	Imbaby IA, Mahmoud MA, Hassan MEM, Abd-El-Aziz ARM. 2014. Identification of leaf rust resistance genes in selected Egyptian wheat cultivars by molecular markers. Scientific World Journal 2014 : Article ID 574285.
99.	Wheat	Leaf rust	China	NW A&F, Coll Agron	Pang Y, Chen X, Zhao J et al. 2014. Molecular cytogenetic characterization of a wheat - *Leymus mollis* 3D(3Ns) substitution line with resistance to leaf rust. J Genet Genomics 41(4): 205-14.
100.	Wheat	Leaf rust	South Africa USA	ARC-Small Grain Inst, Germplasm Development, South Africa Univ Minnesota: USDA-ARS , Cereal Disease Lab; Agron & Plant Genet, USA	Tsilo TJ, Kolmer J, Anderson JA. 2014. Molecular mapping and improvement of leaf rust resistance in wheat breeding lines. Phytopathology. in press.
101.	Wheat	Leaf rust	China	Agr Univ Hebei, Biol Control Ctr Plant Dis & Plant Pests Hebei, Coll Plant Protect, Dept Plant Pathol CAAS: Natl Wheat Improvement Ctr, Inst Crop Sci; Inst Plant Protect, State Key Lab Biol Plant Dis & Insect Pest CIMMYT China Off	Xing LF, Wang CF, Xia XC et al. 2014. Molecular mapping of leaf rust resistance gene *LrFun* in Romanian wheat line Fundulea 900. Mol Breeding 33(4): 931-37.
102.	Wheat	Stem rust	Australia USA	CSIRO Plant Ind, Australia Univ Sydney, Plant Breed Inst Cobbitty, Australia Univ Calif Davis, Dept Plant Sci, USA	Periyannan S, Bansal U., Bariana H et al. 2014. Identification of a robust molecular marker for the detection of the stem rust resistance gene *Sr45* in common wheat. Theor Appl Genet 127(4): 947-55.
103.	Wheat	Stem rust	USA China	Kansas State Univ: Wheat Genet & Genom Resour Ctr; Dept Plant Pathol, Throckmorton Plant Sci Ctr, USA USDA-ARS, No Crop Sci Lab, USA Northwest A&F Univ, Coll Agron, China	Liu C, Qi LL, Liu WX et al. 2011. Development of a set of compensating *Triticum aestivum* - *Dasypyrum villosum* Robertsonian translocation lines. Genome 54(10): 836-44.
104.	Wheat	Stem rust	Australia USA China	Commonwealth Scientific & Industrial Res Organization (CSIRO) Plant Ind, Australia Univ Sydney, Plant Breed Inst, Australia Univ California, Dept Plant Sci, USA Montana State Univ, Dept Plant Sci & Plant Pathol, USA CAAS, Inst Crop Sci, China Northwest A&F Univ,State Key Lab Crop Stress Biol Arid Areas & Coll Life Sci, China	Periyannan S, Moore J, Ayliffe M et al. 2013. The gene *Sr33*, an ortholog of barley *Mla* genes, encodes resistance to wheat stem rust race Ug99. Science 341(6147): 786-88.
105.	Wheat	Stem rust	USA	Kansas State Univ , Dept of Plant Pathology Univ California, Dept Plant Sci ASDA-ARS, Cereal Dis Lab	Saintenac C, Zhang W, Salcedo A et al. 2013. Identification of wheat gene *Sr35* that confers resistance to Ug99 stem rust race group. Science 341 (6147): 783-86.
106.	Wheat	Stem rust	USA	Kansas State Univ: Dept Plant Pathol; Dept Agron USDA-ARS, Cereal Dis Lab Univ Minnesota Washington State Univ, Dept Crop & Soil Sci	Olson EL, Rouse MN, Pumphrey M O et al. 2013. Simultaneous transfer, introgression, and genomic localization of genes for resistance to stem rust race TTKSK (Ug99) from *Aegilops tauschii* to wheat. Theor Appl Genet 126(5): 1179-88.

			USDA-ARS, Hard Winter Wheat Genet Res Unit	
107. Wheat	Stem rust	USA	Kansas State Univ: Dept Plant Pathol; USDA-ARS, Hard Winter Wheat Genet Res Unit USDA-ARS, Cereal Dis Lab N Carolina State Univ, USDA-ARS, Plant Sci Res Unit	Bernardo AN, Bowden R L, Rouse MN et al. 2013. Validation of molecular markers for new stem rust resistance genes in U.S. hard winter wheat. Crop Sci 53(3): 755-64.
108. Wheat	Stem rust	USA	USDA-ARS, No Crop Sci Lab N Dakota State Univ, Dept Plant Sci USDA-ARS, Cereal Dis Lab	Klindworth DL, Niu ZX, Chao SM et al. 2012. Introgression and characterization of a goatgrass gene for a high level of resistance to ug99 stem rust in tetraploid wheat. G3: Genes, Genomes, Genetics 2(6): 665-73.
109. Wheat	Stem rust	USA Australia	USDA-ARS, No Crop Sci Lab, USA Kansas State Univ: Dept Plant Pathol, Wheat Genet & Genom Resour Ctr; USDA-ARS, Hard Winter Wheat Genet Res Unit, USA Washington State Univ, Dept Crop & Soil Sci, USA Univ Sydney, Plant Breed Inst, Australia Univ Minnesota, USDA-ARS, Cereal Dis Lab, USA	Qi LL, Pumphrey MO, Friebe B et al. 2011. A novel Robertsonian translocation event leads to transfer of a stem rust resistance gene (*Sr52*) effective against race Ug99 from *Dasypyrum villosum* into bread wheat. Theor Appl Genet 123(1): 159-67.
110. Wheat	Stem rust	Australia USA	Univ Sydney, Plant Breed Inst Cobbitty, Australia CSIRO Plant Ind, Australia Washington State Univ, Dept Crop & Soil Sci, USA	Periyannan SK, Bansal UK., Bariana HS et al. (2011. A robust molecular marker for the detection of shortened introgressed segment carrying the stem rust resistance gene *Sr22* in common wheat. Theor Appl Genet 122(1): 1-7.
111. Wheat	Stem rust	USA	USDA-ARS, No Crop Sci Lab Univ Minnesota, USDA-ARS, Dept Agric, Cereal Dis Lab N Dakota State Univ, Dept Plant Sci	Niu ZX, Klindworth DL, Friesen TL et al. 2011. Targeted introgression of a wheat stem rust resistance gene by DNA marker-assisted chromosome engineering. Genetics 187(4): 1011—21.
112. Wheat	Stem rust	USA	Kansas State Univ, Wheat Genet & Genom Resour Ctr, Dept Plant Pathol, Throckmorton Plant Sci Ctr USDA-ARS, Hard Winter Wheat Genet Res Unit Washington State Univ, Dept Crop & Soil Sci, Spring Wheat Breed & Genet Univ Minnesota, USDA-ARS, Cereal Dis Lab	Liu WX, Jin Y, Rouse M et al. 2011. Development and characterization of wheat-*Ae*. *searsii* Robertsonian translocations and a recombinant chromosome conferring resistance to stem rust. Theor Appl Genet 122(8): 1537-45.
113. Wheat	Stem rust	USA Canada	USDA-ARS, Cereal Crops Res Unit, State Univ Stn, USA N Dakota State Univ: Dept Entomol; Dept Plant Sci; Dept Plant Pathol, USA Agric & Agri-Food Canada SPARC, Canada Univ Minnesota, USDA-ARS, Cereal Dis Lab, USA	Yu GT, Zhang QJ, Klindworth DL et al. 2010. Molecular and cytogenetic characterization of wheat introgression lines carrying the stem rust resistance gene *Sr39*. Crop Sci 50(4): 1393-1400.
114. Wheat	Stem rust	USA	N Carolina State Univ: USDA-ARS Plant Sci Res; Dept Crop Sci Kansas State Univ: Dept Plant Pathol; USDA-ARS Plant Sci & Entomol Res, Dept Plant Pathol Univ Minnesota: USDA-ARS, Cereal Dis Lab; Dept Plant Pathol	Olson EL, Brown-Guedira G, Marshall D et al. 2010. Development of wheat lines having a small introgressed segment carrying stem rust resistance gene *Sr22*. Crop Sci 50 (5): 1823-30.

115. Wheat	Stem rust	Australia Switzerland	Univ Sydney, Fac Agric Food & Nat Resour, Plant Breed Inst Cobbitty, Australia Univ Zürich, Inst Plant Biol, Switzerland	Bansal UK, Bossolini E, Miah H et al. 2008. Genetic mapping of seedling and adult plant stem rust resistance in two European winter wheat cultivars. Euphytica 164(3): 821-28.
116. Wheat	Stem rust	Mexico Kenya	CIMMYT, Mexico CIMMYT, Kenya INIFAP CEVAMEX, Mexico CINVESTAV IPN, Mexico	Singh S, Singh RP, Bhavani S et al. 2013. QTL mapping of slow-rusting, adult plant resistance to race Ug99 of stem rust fungus in PBW343/Muu RIL population. Theor Appl Genet 126(5): 1367-75.
117. Wheat	Stem rust	Kenya Mexico Switzerland	Kenyan Agricul Res Inst,, Kenya CIMMYT, Mexico Campo Experim Valle Mexico INIFAP, Mexico Univ Zürich, Inst Plant Biol, Switzerland	Njau PN, Bhavani S, Huerta-Espino J et al. 2013. Identification of QTL associated with durable adult plant resistance to stem rust race Ug99 in wheat cultivar 'Pavon 76'. Euphytica 190(1): 33-44.
118. Wheat	Stem rust	Iran	Seed & Plant Improv Inst, Cereals Res Dept	Mohammadi M, Torkamaneh D, Patpour M. 2013. Seedling stage resistance of Iranian bread wheat germplasm to race Ug99 of *Puccinia graminis* f. sp *tritici*. Plant Dis 97(3): 387-92.
119. Wheat	Stem rust	USA	Kansas State Univ: Dept Plant Pathol, Wheat Genet & Genom Resour Ctr, Throckmorton Plant Sci Ctr; USDA-ARS,Throckmorton Plant Sci Ctr, Hard Winter Wheat Genet Res Unit Univ Minnesota, USDA-ARS, Cereal Dis Lab	Liu WX, Danilova TV, Rouse MN et al. 2013. Development and characterization of a compensating wheat-*Thinopyrum intermedium* Robertsonian translocation with *Sr44* resistance to stem rust (Ug99). Theor Appl Genet 126(5): 1167-77.
120. Wheat	Stem rust	Italy Ethiopia Mexico	Univ Bologna, Dept Agricul Sci, Italy Sinana Agricul Res Ctr, Ethiopia Debre Zeit Agricul Res Ctr, Ethiopia CIMMYT, Mexico	Letta T, Maccaferri M, Badebo A et al. 2013. Searching for novel sources of field resistance to Ug99 and Ethiopian stem rust races in durum wheat via association mapping. Theor Appl Genet 126(5): 1237-56.
121. Wheat	Stem rust	Germany Ethiopia Mexico	Leibniz Inst Plant Genet & Crop Plant Res IPK, Germany Univ Kassel, Dept Agrobiodivers, Inst Crop Sci, Germany Debre Zeit Agricul Res Ctr, Ethiopian Inst Agricul Res, Ethiopia CIMMYT, Mexico	Haile JK, Hammer K, Badebo A et al. 2013. Haplotype analysis of molecular markers linked to stem rust resistance genes in Ethiopian improved durum wheat varieties and tetraploid wheat landraces. Genet Resour Crop Evol 60(3): 853-64.
122. Wheat	Stem rust	Germany Ethiopia Syria	Leibniz Inst Plant Genet & Crop Plant Res IPK, Germany Univ Kassel, Dept Agrobiodivers, Inst Crop Sci, Germany Debre Zeit Agricul Res Ctr, Ethiopian Inst Agricul Res, Ethiopia ICARDA BIGM, ICARDA, Durum Improv Program, Syria	Haile JK, Hammer K, Badebo A et al. 2013. Genetic diversity assessment of Ethiopian tetraploid wheat landraces and improved durum wheat varieties using microsatellites and markers linked with stem rust resistance. Genet Resour Crop Evol 60(2): 513-27.
123. Wheat	Stem rust	Iran Canada	Minist Jahad Agric, Cereal Res Dept, Seed & Plant Improv Inst, AREEO, Iran Agric & Agri-Food Canada, Cereal Res Ctr, Canada	Ghazvini H, Hiebert CW, Thomas JB, Fetch T. 2013. Development of a multiple bulked segregant analysis (MBSA) method used to locate a new stem rust resistance gene (*Sr54*) in the winter wheat cultivar Norin 40. Theor Appl Genet 126(2): 443-49.
124. Wheat	Stem rust	USA Mexico Kenya India	Cornell Univ, Dept Plant Breed & Genet, USA CIMMYT, Mexico Kenya Agricul Res Inst, Kenya Directorate Wheat Res, India	Yu LX, Morgounov A, Wanyera R et al. 2012. Identification of Ug99 stem rust resistance loci in winter wheat germplasm using genome-wide association analysis. Theor Appl Genet 125(4): 749-58.

125. Wheat	Stem rust	USA	USDA-ARS, Cereal Dis Lab Univ Minnesota: Dept Plant Pathol; Dept Agron & Plant Genet USDA-ARS, Biosci Res Lab	Rouse MN, Nava IC, Chao SM et al. 2012. Identification of markers linked to the race Ug99 effective stem rust resistance gene *Sr28* in wheat (*Triticum aestivum* L.). Theor Appl Genet 125(5): 877-85.
126. Wheat	Stem rust	South Africa USA	Univ Free State, Dept Plant Sci, South Africa Univ Minnesota, USDA-ARS, Cereal Dis Lab, USA CenGen, South Africa	Pretorius ZA, Jin Y, Bender CM et al. 2012. Seedling resistance to stem rust race Ug99 and marker analysis for *Sr2*, *Sr24* and *Sr31* in South African wheat cultivars and lines. Euphytica 186(1): 15-23.
127. Wheat	Stem rust	Germany Syria Ethiopia	Leibniz Inst Plant Genet & Crop Plant Res IPK, Germany ICARDA BIGM, ICARDA, Durum Improv Program, Syria Univ Kassel, Inst Crop Sci, Dept Agrobiodivers, Germany Debre Zeit Agricul Res Ctr, Ethiopian Inst Agricul Res, Ethiopia	Haile JK, Nachit MM, Hammer K et al. 2012. QTL mapping of resistance to race Ug99 of *Puccinia graminis* f. sp *tritici* in durum wheat (*Triticum durum* Desf.). Mol Breeding 30(3): 1479-93.
128. Wheat	Stem rust	Canada USA South Africa	Agric & Agri-Food Canada, Cereal Res Ctr, Canada Univ Minnesota: Dept Agron & Plant Genet; USDA-ARS, Cereal Dis Lab, USA USDA-ARS, Natl Ctr Cool & Cold Water Aquacul, USA Small Grain Inst, Agricul Res Council, South Africa	Ghazvini H, Hiebert CW, Zegeye T et al. 2012. Inheritance of resistance to Ug99 stem rust in wheat cultivar Norin 40 and genetic mapping of *Sr42*. Theor Appl Genet 125(4): 817-24.
129. Wheat	Stem rust	Canada	Agric & Agri-Food Canada, Cereal Res Ctr	Ghazvini H, Hiebert CW, Thomas J et al. 2012. Linkage maps of two new stem rust resistance genes on chromosomes 2b and 6a of wheat line Tr129. Can J Plant Sci 92(3): 602-03.
130. Wheat	Stem rust	Pakistan	NARC: PARC Inst Adv Studies Agric, Dept Plant Genom & Biotechnol; Crop Dis Res Programme	Ejaz M, Iqbal M, Shahzad A et al. 2012. Genetic variation for markers linked to stem rust resistance genes in Pakistani wheat varieties. Crop Sci 52(6): 2638-48.
131. Wheat	Stem rust	Australia India Kenya	Univ Sydney, Fac Agric & Environm, Dept Plant & Food Sci, Plant Breed Inst Cobbitty, Australia Natl Chem Lab, India CIMMYT, Kenya Natl Plant Breed Res Ctr, Kenya Agricul Res Inst, Kenya	Bansal UK, Zwart R, Bhavani S et al. 2012. Microsatellite mapping identifies TTKSK-effective stem rust resistance gene in wheat cultivars VL404 and Janz. Mol Breeding 30(4): 1757-65.
132. Wheat	Stem rust	USA Mexico	Cornell Univ, Dept Plant Breed & Genet, USA Univ Nebraska-Lincoln, Dept Agron & Hort, USA CIMMYT, Mexico Campo Expt Valle Mexico INIFAP, Mexico	Yu LX, Lorenz A, Rutkoski J et al. 2011. Association mapping and gene-gene interaction for stem rust resistance in CIMMYT spring wheat germplasm. Theor Appl Genet 123(8): 1257-68.
133. Wheat	Stem rust	USA	USDA-ARS, Biosci Res Lab Univ Calif Davis, Dept Plant Sci Univ Minnesota: Dept Plant Pathol; USDA-ARS, Cereal Dis Lab N Dakota State Univ, Dept Plants Sci	Simons K, Abate Z, Chao SM et al. 2011. Genetic mapping of stem rust resistance gene *Sr13* in tetraploid wheat (*Triticum turgidum* ssp. *durum* L.). *Theor Appl Genet* 122(3): 649-58.
134. Wheat	Stem rust	USA	Cornell Univ, Dept Plant Breed & Genet, Ithaca	Rutkoski JE, Heffner EL, Sorrells ME. 2011. Genomic selection for durable stem rust resistance in wheat. Euphytica 179(1): 161-73.

135. Wheat	Stem rust	Hungary	Cereal Res Non Profit Ltd. Co Hungarian Acad Sci, Agricul Res Inst	Purnhauser L, Bona L, Lang L. 2011. Identification of *Sr31* and *Sr36* stem rust resistance genes in wheat cultivars registered in Hungary. Cereal Res Commun 39(1): 53-66.
136. Wheat	Stem rust	Italy	CRA Res Unit Cereal Qual Improv	Nocente F, Sereni L, Matere A, Pasquini M. 2011. Recent occurrence of *Puccinia graminis* f. sp. *tritici* in Italy: Pathogen virulence composition and seedling resistance of durum and common wheat. Cereal Res Commun 39(1): 77-87.
137. Wheat	Stem rust	Australia	CSIRO Plant Ind	Mago R, Lawrence GJ, Ellis JG. 2011. The application of DNA marker and doubled-haploid technology for stacking multiple stem rust resistance genes in wheat. Mol Breeding 27(3): 329-35.
138. Wheat	Stem rust	Australia Mexico USA	CSIRO Plant Ind, Australia Murdoch Univ, Ctr Comparat Genom, Australia CIMMYT Apdo, Mexico N Carolina State Univ, USDA-ARS, Eastern Reg Genotyping Lab, USA Univ Minnesota, USDA-ARS, Cereal Dis Lab, USA	Mago R, Brown-Guedira G, Dreisigacker S et al. 2011. An accurate DNA marker assay for stem rust resistance gene *Sr2* in wheat. Theor Appl Genet 122(4): 735-44.
139. Wheat	Stem rust	USA	Kansas State Univ, Dept Plant Pathol, Wheat Genet & Genom Resour Ctr Washington State Univ, Dept Crop & Soil Sci Univ Minnesota, USDA-ARS Cereal Dis Lab	Liu WX, Rouse M, Friebe B et al. 2011. Discovery and molecular mapping of a new gene conferring resistance to stem rust, *Sr53*, derived from *Aegilops geniculata* and characterization of spontaneous translocation stocks with reduced alien chromatin. Chromosome Res 19(5): 669-82.
140. Wheat	Stem rust	USA	USDA-ARS: Cereal Dis Lab; Plant Sci Res Unit	Kolmer JA, Garvin DF, Jin Y. 2011. Expression of a thatcher wheat adult plant stem rust resistance QTL on chromosome arm 2BL is enhanced by *Lr34*. Crop Sci 51(2): 526-33.
141. Wheat	Stem rust	USA	USDA-ARS, No Crop Sci Lab	Klindworth DL, Miller JD, Williams ND et al. 2011. Resistance to recombinant stem rust race TPPKC in hard red spring wheat. Theor Appl Genet 123(4): 603-13.
142. Wheat	Stem rust	Kazakhstan Turkey	Inst Plant Biol & Biotechnol, Lab Plant Breed & Genet, Kazakhstan CIMMYT Turkey, Turkey Inst Problems Biol Safety, Lab Plant Immun, Kazakhstan	Kokhmetova A, Morgounov A., Rsaliev S et al. 2011. Wheat germplasm screening for stem rust resistance using conventional and molecular techniques. Czech J Genet Plant Breed 47: S146-S154.
143. Wheat	Stem rust	Canada Kenya	Agric & Agri-Food Canada, Cereal Res Ctr, Canada Vineland Res & Innovat Ctr, Vineland Stn, Canada CIMMYT, Kenya Univ Saskatchewan, Dept Plant Sci, Canada	Hiebert CW, Fetch TG, Zegeye T et al. 2011. Genetics and mapping of seedling resistance to Ug99 stem rust in Canadian wheat cultivars 'Peace' and 'AC Cadillac'. Theor Appl Genet 122(1): 143-49.
144. Wheat	Stem rust	Ethiopia Germany	Ethiopian Inst Agricul Res, Plant Protect Res Ctr, Ethiopia JKI, Fed Res Inst Cultivated Plants JKI, Inst Resistance Res & Stress Tolerance, Germany Univ Giessen, Inst Crop Sci & Plant Breed 1, Germany	Admassu B, Perovic D, Friedt W et al. 2011. Genetic mapping of the stem rust (*Puccinia graminis* f. sp *tritici* Eriks. & E. Henn) resistance gene *Sr13* in wheat (*Triticum aestivum* L.). Theor Appl Genet 122(3): 643-48.
145. Wheat	Stem rust	USA	Univ Calif Davis, Dep Plant Sci Kansas State Univ, Dept Plant Pathol Univ Minnesota: Dep Plant Pathol; USDA-ARS, Cereal Dis Lab	Zhang WJ, Olson E, Saintenac C et al. 2010. Genetic maps of stem rust resistance gene *Sr35* in diploid and hexaploid wheat. Crop Sci 50(6): 2464-74.

			Washington State Univ, Dep. Crop & Soil Sci		
146.	Wheat	Stem rust	USA Mexico China	Cornell Univ, Dept Plant Breed & Genet, USA Univ Minnesota, Dept Agron & Plant Genet, USA CIMMYT, Mexico USDA-ARS, Cereal Dis Lab, USA Univ Calif Davis, Dept Plant Sci, USA USDA-ARS Plant Sci Res, USA CAAS, China Campo Experim Valle Mexico INIFAP, Mexico	Yu LX, Liu SX, Anderson JA et al. 2010. Haplotype diversity of stem rust resistance loci in uncharacterized wheat lines. Mol Breeding 26(4): 667-80.
147.	Wheat	Stem rust	USA	Univ Minnesota: Dep Agron & Plant Genet; USDA-ARS, Cereal Dis Lab	Tsilo TJ, Jin Y, Anderson JA. 2010. Identification of flanking markers for the stem rust resistance gene *Sr6* in wheat. Crop Sci 50(5): 1967-70.
148.	Wheat	Stem rust	USA	N Carolina State Univ: Dep Crop Sci; USDA-ARS Plant Sci Res, Dep Crop Sci; USDA-ARS Plant Sci Res, Dep Plant Pathol; Dep of Plant Sci USDA-ARS, Cereal Dis Lab N Dakota State Univ, Dep Plant Sci Univ Calif Davis, Dep Plant Sci	Olson EL, Brown-Guedira G, Marshall DS et al. 2010. Genotyping of U.S. wheat germplasm for presence of stem rust resistance genes *Sr24*, *Sr36* and *SR1RS^{amigo}*. Crop Sci 50(2): 668-75.
149.	Wheat	Stem rust	India	Indian Agricul Res Inst, Div Genet	Mallick N, Vinod, Sharma JB et al. 2010. Genetics of stem rust resistance in common wheat genotypes WR95 and selection T3336. Indian J Genet Pl Br 70 (2): 109-113.
150.	Wheat	Stem rust	USA Mexico	Univ Minnesota: Dept Agron & Plant Genet; USDA-ARS, Cereal Dis Lab, USA Cornell Univ, Dept Plant Breed & Genet, USA CIMMYT, Mexico	Liu SX, Yu LX, Singh RP et al. 2010. Diagnostic and co-dominant PCR markers for wheat stem rust resistance genes *Sr25* and *Sr26*. Theor Appl Genet 120(4): 691-97.
151.	Wheat	Stem rust	Canada	Agric & Agri-Food Canada, Cereal Res Ctr	Hiebert CW, Fetch TG, Zegeye T. 2010. Genetics and mapping of stem rust resistance to Ug99 in the wheat cultivar Webster. Theor Appl Genet 121(1): 65-69.
152.	Wheat	Stem rust	Ethiopia Germany	Plant Protect Res Ctr, Ethiopian Inst Agricul Res, Ethiopia JKI, Inst Resistance Res & Stress Tolerance, Fed Res Inst Cultivated Plants, Germany Justus Liebig Univ, Inst Crop Sci & Plant Breed 1, Germany	Admassu B, Friedt W, Ordon F. 2010. Genetic characterization of *Puccinia graminis* f.sp *tritici* populations from Ethiopia by SSRs. J Phytopathol 158(11-12): 806-12.
153.	Wheat	Stem rust	USA	Kansas State Univ, Dep Agron USDA-ARS, Plant Sci & Entomol Res Unit	Wu SY, Pumphrey M, Bai GH. 2009. Molecular mapping of stem-rust-resistance gene *Sr40* in wheat. Crop Sci 49(5): 1681-86.
154.	Wheat	Stem rust	USA	Univ Minnesota: Dept Agron & Plant Genet; USDA-ARS, Cereal Dis Lab USDA-ARS, Biosci Res Lab	Tsilo TJ, Chao S, Jin Y et al. 2009. Identification and validation of SSR markers linked to the stem rust resistance gene *Sr6* on the short arm of chromosome 2D in wheat. Theor Appl Genet 118(3): 515-24.

155. Wheat	Stem rust	Australia	CSIRO Plant Ind Univ Sydney, Plant Breed Inst Univ Adelaide, Sch Agric Food & Wine	Mago R, Zhang P, Bariana HS et al. 2009. Development of wheat lines carrying stem rust resistance gene *Sr39* with reduced *Aegilops speltoides* chromatin and simple PCR markers for marker-assisted selection. Theor Appl Genet 119(8): 1441-50.
156. Wheat	Stem rust	USA	S Dakota State Univ: Dept Plant Sci; Dept Biol & Microbiol Texas A&M Univ, Dept Soil & Crop Sci, Coll Stn	Babiker E, Ibrahim AMH, Yen Y, Stein J. 2009. Identification of a microsatellite marker associated with stem rust resistance gene *Sr35* in wheat. Aust J Crop Sci 3(4): 195-200.
157. Wheat	Stem rust	USA	Univ Minnesota: USDA-ARS, Cereal Dis Lab; Dept Plant Pathol; USDA-ARS, Plant Sci Res Unit	Vanegas CDG., Garvin DF, Kolmer JA. 2008. Genetics of stem rust resistance in the spring wheat cultivar Thatcher and the enhancement of stem rust resistance by *Lr34*. Euphytica 159(3): 391-401.
158. Wheat	Stem rust	USA	Univ Minnesota: Dept Agron & Plant Genet; USDA-ARS, Cereal Dis Lab	Tsilo TJ, Jin Y, Anderson JA. 2008. Diagnostic microsatellite markers for the detection of stem rust resistance gene *Sr36* in diverse genetic backgrounds of wheat. Crop Sci 48(1): 253-61.
159. Wheat	Stem rust	Australia France China	Murdoch Univ: WA State Agricul Biotechnol Ctr; Ctr Comparat Genom, Australia Univ Queensland, CSIRO Plant Ind, Australia Dept Agric & Food Western Australia, Australia INRA, Genet, Diversity & Ecophysiol of Cereals, France Mol Plant Breed CRC, Australia CAAS, Inst Crop Germplasm, China	McNeil MD, Kota R, Paux E et al. 2008. Bac-derived markers for assaying the stem rust resistance gene, *Sr2*, in wheat breeding programs. Mol Breeding 22(1): 15-24.
160. Wheat	Stem rust	USA South Africa Mexico Canada	Univ Minnesota, USDA-ARS, Cereal Dis Lab, USA Univ Orange Free State, Dept Plant Sci, South Africa CIMMYT, Mexico Agric & Agri-Food Canada, Cereal Res Ctr, Canada	Jin Y, Szabo LJ, Pretorius ZA et al. 2008. Detection of virulence to resistance gene *Sr24* within race TTKS of *Puccinia graminis* f. sp *tritici*. Plant Dis 92(6): 923-26.
161. Wheat	Stem rust	USA	USDA-ARS, Cereal Crops Res Unit, Red River Valley Agr Res Ctr USDA-ARS, No Crop Sci Lab N Dakota State Univ, Dept Plant Sci Univ Minnesota, USDA-ARS, Cereal Dis Lab	Faris JD, Xu SS, Cai XW et al. 2008. Molecular and cytogenetic characterization of a durum wheat-*Aegilops speltoides* chromosome translocation conferring resistance to stem rust. Chromosome Res 16(8): 1097-05.
162. Wheat	Stem rust	USA	Univ Minnesota: Dept Agron & Plant Genet; USDA-ARS, Cereal Dis Lab	Tsilo TJ, Jin Y, Anderson JA. 2007. Microsatellite markers linked to stem rust resistance allele *Sr9a* in wheat. Cr op Sci 47(5): 2013-20.
163. Wheat	Stem rust	Indonesia Australia Iran	Univ Mataram, Fac Agr, Indonesia Univ Adelaide, Sch Agr Food & Wine, Australia Mol Plant Breed Cooperat Res Ctr, Australia Univ Sydney, Plant Breed Inst, Australia Tarbiat Modares Univ, Dept Plant Breed, Fac Agr, Iran Murdoch Univ, State Agr Biotechnol Ctr, Australia Dept Agr & Food Western Australia, Australia Value Added Wheat Cooperat Res Ctr, Australia	Anugrahwati DR, Shepherd KW, Verlin DC et al. 2008. Isolation of wheat-rye 1RS recombinants that break the linkage between the stem rust resistance gene *SrR* and secalin. Genome 51(5): 341-49.

164. Wheat	Stem rust	USA	Kansas State Univ, Dept Plant Pathol Univ Minnesota, USDA-ARS, Cereal Dis Lab Washington State Univ, Dept Crop & Soil Sci USDA-ARS, Hard Winter Wheat Genet Res Unit Kansas State Univ, Dept Agron	Olson EL, Rouse MN, Pumphrey MO et al. 2013. Introgression of stem rust resistance genes *SrTA10187* and *SrTA10171* from *Aegilops tauschii* to wheat. Theor Appl Genet 126(10): 2477-84.
165. Wheat	Stem rust	Australia USA	CSIRO Plant Ind, Australia Univ Adelaide, Sch Agr Food & Wine, Australia Univ Sydney, Plant Breed Inst Cobbitty, Australia Univ Minnesota, USDA-ARS, Cereal Dis Lab, USA	Mago R, Verlin D, Zhang P et al. 2013. Development of wheat–*Aegilops speltoides* recombinants and simple PCR-based markers for *Sr32* and a new stem rust resistance gene on the 2S#1 chromosome. Theor Appl Genet 126(12): 2943-55.
166. Wheat	Stem rust	India	Indian Agricul Res Inst, Div Genet	Nagaraja NR, Singh A, Pallavi JK et al. 2013. Validation of molecular markers linked to the stem rust resistance genes effective in India. Indian J Genet Pl Br 73(3): 314-19.
167. Wheat	Stem rust	Canada Australia Kenya	Agric & Agri-Food Canada: Semiarid Prairie Agricul Res Ctr; Cereal Res Ctr, Canada Univ Sydney, Plant Breed Inst Cobbitty, Australia CIMMYT, Kenya	Singh A, Knox RE, DePauw RM et al. 2013. Identification and mapping in spring wheat of genetic factors controlling stem rust resistance and the study of their epistatic interactions across multiple environments. Theor Appl Genet 126(8): 1951-64.
168. Wheat	Stem rust	Mexico	CIMMYT	Lopez-Vera EE., Nelson S, Singh RP et al. 2013. Resistance to stem rust Ug99 in six bread wheat cultivars maps to chromosome 6DS. Theor Appl Genet, 127(1): 231-39.
169. Wheat	Stem rust	USA Kenya Australia	USDA-ARS: Small Grains & Potato Germplasm Res Unit; Eastern Reg Genotyping Lab; Cereal Dis Lab, USA N Dakota State Univ, Dept Plant Pathol, USA Univ Minnesota, USDA-ARS, Cereal Dis Lab, USA Kenya Agricul Res Inst, Kenya Univ Sydney, Plant Breed Inst, Australia	Newcomb M, Acevedo M, Bockelman HE et al. 2013. Field resistance to the Ug99 race group of the stem rust pathogen in spring wheat landraces. Plant Dis 97(7): 882-90.
170. Wheat	Stripe rust	Australia UK	CSIRO, Plant Ind, Australia JIC, Dept Crop Genet, UK Limagrain UK Ltd, UK Natl Inst Agricul Bot, Dept Genet & Breed, UK	Powell NM, Lewis CM, Berry ST et al. 2013. Stripe rust resistance genes in the UK winter wheat cultivar Claire. Theor Appl Genet 126(6): 1599-612.
171. Wheat	Stripe rust	India Switzerland	Punjab Agric Univ, Dept of Plant Breed Genet & Biotechnol, India Directorate of Wheat Res, Regional Stn, India Univ Zürich, Inst Plant Biol, Switzerland Indian Inst Technol	Chhuneja P, Kaur S, Garg T et al. 2008. Mapping of adult plant stripe rust resistance genes in diploid A genome wheat species and their transfer to bread wheat. Theor Appl Genet 116(3): 313-24.
172. Wheat	Stripe rust	China	Sichuan Agric Univ, State Key Lab of Plant Breed & Genet Shanxi Acad Agric Sci	Luo PG, Hu XY, Chang ZJ et al. 2009. A new stripe rust resistance gene transferred from *Thinopyrum intermedium* to hexaploid wheat (*Triticum aestivum*). Phytoprotection 90(2): 57-63.
173. Wheat	Stripe rust	China	Shandong Agric Univ, Coll Life Sci	Sui XX, He ZH, Lu YM et al. 2010. Molecular mapping of a non-host resistance gene *YrpstY1* in barley (*Hordeum vulgare* L.) for resistance to wheat stripe rust. Yi Chuan (=Hereditas) 147(5): 176-82.

174. Wheat	Stripe rust	Australia	Univ Sydney, Fac Agricul Food & Nat Resour Victorian AgriBioSci Ctr, La Trobe Res & Development Park, Primary Industries Res Victoria	Bansal UK, Hayden MJ, Gill MB, Bariana HS. 2010. Chromosomal location of an uncharacterised stripe rust resistance gene in wheat. Euphytica 171(1): 121-27.
175. Wheat	Stripe rust	China	Mianyang Acad Agric Sci, Mianyang Branch Natl Wheat Improv Ctr	Ren Y, Li SR, Li J et al. 2011. Genetic analysis and molecular mapping of stripe rust resistance gene in a restore line of thermo-photo sensitive hybrid wheat MR168. Yi Chuan (=Hereditas) 33(11): 1263-70.
176. Wheat	Stripe rust	China	Northwest A&F Univ, Coll Plant Protect	Chen HH, Yang WD, Wang MN, Jing JX. 2009. Inheritance analysis and molecular mapping of stripe rust resistance gene in wheat differential host Heines peko from Europe. Acta Phytopath Sinica 39(3): 278-84.
177. Wheat	Stripe rust	China	SAAS, Crop Res Inst	Li J, Wei HT, Hu XR et al. 2007. Molecular mapping of stripe rust resistance gene in synthetic derivative Chuanmai 47. Nong ye sheng wu ji shu xue bao = Journal of Agricultural Biotechnology 15(2): 318-22.
178. Wheat	Stripe rust	Iran	Univ Tehran, Coll Agric	Mandoulakani BA, Bihamta MR, Zali A et al. 2008. Fine mapping of stripe rust resistance gene *Yr15* in durum wheat. Seed Plant Improv J. 24(3): 371-88.
179. Wheat	Stripe rust	USA	Washington State Univ, Dept Plant Pathol	Cheng P, Chen XM. 2010. Molecular mapping of a gene for stripe rust resistance in spring wheat cultivar IDO377s. Theor Appl Genet 121(1): 195-204.
180. Wheat	Stripe rust	Turkey	Sci & Technol Res Council Turkey TUBITAK, Marmara Res Ctr MRC, Genet Engineer & Biotechnol Inst	Akfirat FS, Aydin Y, Ertugrul F et al. 2010. A Microsatellite marker for yellow rust resistance in wheat. Cereal Res Commun 38(2): 203-10.
181. Wheat	Stripe rust	USA Israel	Univ California, Dept Plant Sci, USA Univ Haifa, Dept Evolutionary & Environm Biol, Israel USDA-ARS, Western Regional Res Ctr, USA Univ California, Depr Plant Pathol, USA USDA-ARS & Washington State Univ, Dept Plant Pathol, USA	Fu D, Uauy C, Distelfeld A et al. 2009. A kinase-start gene confers temperature-dependent resistance to wheat stripe rust. Science 323(5919): 1357-60.
182. Wheat	Stripe rust	Turkey	Genetic Engineer & Biotechnol Inst , Marmara Res Ctr, Scientific & Technol Res Council Turkey Istanbul Univ, Dept Mol Biol & Genet Marmara Univ, Faculty Engineer, Dept Bioengineer	Karakas O, Gurel F, Uncuoglu AA. 2011. Assessment of genetic diversity of wheat genotypes by resistance gene analog-EST markers. Genet Mol Res 10(2): 1098-110.
183. Wheat	Stripe rust	Australia	Univ Sydney Plant Breed Inst-Cobbitty, Fac Agric, Food & Natural Resour La Trobe Res & Development Park, Victorian AgriBiosci Ctr, Dept Primary Industries Victoria	Bansal UK, Forrest KL, Hayden MJ et al. 2011. Characterisation of a new stripe rust resistance gene *Yr47* and its genetic association with the leaf rust resistance gene *Lr52*. Theor Appl Genet 122 (8): 1461-66.
184. Wheat	Stripe rust	USA	Virginia Tech, Dep Crop & Soil Environm Sci Texas AgriLife Res USDA-ARS, Plant Sci Res Unit Univ Georgia, Dep Crop & Soil Sci Univ Arkansas, Dep Plant Pathol Washington State Univ, USDA-ARS, Wheat Genet Qual Physiol & Dis Res Unit	Christopher MD, Liu SY, Hall, MD et al. 2013. Identification and mapping of adult plant stripe rust resistance in soft red winter wheat VA00W-38. Crop Sci 53(3): 871-79.

185. Wheat	Stripe rust	Mexico China	CIMMYT, Mexico Hebei Agricul Univ, Biologic Control Ctr Plant Dis & Plant Pests of Hebei, Dept Plant Pathol, China Dept Biotecnologia & Bioingenieria, Centro de Investigación & Estudios Avanzados Inst Politécnico Nacional,Mexico Campo Exper Valle de Mexico INIFAP, Mexico	Li, Z. F., Singh, S., Singh, R., Lopez-Vera, E. and Huerta-Espino, J. (2013). Genetics of resistance to yellow rust in PBW343 x Kenya Kudu recombinant inbred line population and mapping of a new resistance gene *YrKK*. Mol Breeding 32(4): 821-29.
186. Wheat	Stripe rust	China Pakistan	Northwest A&F Univ, Coll Agron, State Key Lab Crop Stress Biol Arid Areas, China Sindh Agricul Univ, Dept Biotechnol, Pakistan	Yang BJ, Ji WQ, Wang CY et al. 2013. Chromosome location and SSR markers of a stripe rust resistance gene from wheat (*Triticum aestivum*) line N9738. Pak J Botany 45(3): 719-24.
187. Wheat	Stripe rust	China Mexico	SAAC: Crop Res Inst, Key Lab Biol & Genet Breed Wheat Southwest; State Key Lab Plant Breed & Genet, China CIMMYT, Mexico Campo Experim Valle Mexico INIFAP, Mexico	Yang EN, Rosewarne GM, Herrera-Foessel SA et al. 2013. QTL analysis of the spring wheat "Chapio" identifies stable stripe rust resistance despite inter-continental genotype x environment interactions. Theor Appl Genet 126(7): 1721-32.
188. Wheat	Stripe rust	China Canada	Sichuan Agricul Univ, Triticeae Res Inst, China Agric & Agric-Food Canada, Canada, Eastern Cereal & Oilseed Res Ctr Sichuan Agricul Univ, Minis Educ, Key Lab Crop Genetic Resour & Improv, China	Kang H, Wang Y, Fedak G et al. 2011. Introgression of chromosome 3Ns from *Psathyrostachys huashanica* into wheat specifying resistance to stripe rust. PLoS One 6(7): e21802.
189. Wheat	Stripe rust	China	Shanxi Univ, Coll Life Sci Acad Agricul Sci, Inst Crop Sci, Shanxi Mini Agric, Key Lab Crop Gene Resour & Germplasm Enhancement Loess Plateau Univ Electronic Sci & Technol China, School Life Sci & Technol Shanxi Agricul Univ, Coll Agron	Liu J, Chang Z, Zhang X et al. 2013. Putative *Thinopyrum intermedium*-derived stripe rust resistance gene *Yr50* maps on wheat chromosome arm 4BL. Theor Appl Genet 126(1): 265-74.
190. Wheat	Stripe rust	France	CNRS-INRA-UPS-INAPG , UMR Génétique Végétale	Rhone B, Raquin AL, Goldringer I. 2007. Strong linkage disequilibrium near the selected *Yr17* resistance gene in a wheat experimental population. Theor Appl Genet 114(5): 787-802.
191. Wheat	Stripe rust	China USA	Northwest A&F University, Coll Plant Protect, Shaanxi Key Lab Molecular Biol Agricul, China USDA-ARS & Washington State Univ, Deprt Plant Pathol, USA	Wang X, Liu W, Chen X et al. 2010. Differential gene expression in incompatible interaction between wheat and stripe rust fungus revealed by cDNA-AFLP and comparison to compatible interaction. BMC Plant Biol 10: 9
192. Wheat	Stripe rust	USA	Washington State Univ: Dept Crop & Soil Sci; USDA-ARS Western Wheat Quality Lab; USDA-ARS, Wheat Genet, Quality, Physiol & Dis Res Unit; Dept Plant Pathol	Randhawa HS, Mutti JS, Kidwell K et al. 2009. Rapid and targeted introgression of genes into popular wheat cultivars using marker-assisted background selection. PLoS One 4(6): e5752.
193. Wheat	Stripe rust	South Africa UK	Univ Free State, Dep Plant Sci, South Africa JIC, Dept Dis & Stress Biol, UK CenGen (Pty) Ltd, South Africa	Agenbag GM, Pretorius ZA, Boyd LA et al. 2012. Identification of adult plant resistance to stripe rust in the wheat cultivar Cappelle-Desprez. Theor Appl Genet 125(1): 109-20.
194. Wheat	Stripe rust	China	CAAS, Inst Crop Sci, Natl Wheat Improv Ctr/The Natl Key Facility Crop Gene Resour & Genetic Improv Northwest Sci-Tech Univ A&F, Coll Agron CIMMYT China Off	Asad MA, Xia X, Wang C, He Z. 2012. Molecular mapping of stripe rust resistance gene *Yrsn104* in chinese wheat line shaannong 104. Hereditas 149(4): 146-52.

195. Wheat	Stripe rust	Turkey	Marmara Univ: Fac Sci & Letters, Dept Biol; Fac Engineer; Dept Bioengineer	Cabuk E, Aydin Y, Uncuoglu AA. 2011. Assessing wheat (*Triticum aestivum*) genotypes for "*Yr*" resistance genes using conserved regions and simple-sequence motifs. Genet Mol Res 10(4): 3463-71.
196. Wheat	Stripe rust	China	CAS, Key Lab Plant Mol Physiol, Inst Botany	Cao X, Zhou J, Gong X et al. 2012. Identification and validation of a major quantitative trait locus for slow-rusting resistance to stripe rust in wheat. J Integr Plant Biol 54(5): 330-44.
197. Wheat	Stripe rust	USA	USDA-ARS, Wheat Genet, Quality, Physiol & Dis Res Unit Washington State Univ: DeptPlant Pathol; Dept Mol Biosci	Coram TE, Settles M., Wang M, Chen X. 2008. Surveying expression level polymorphism and single-feature polymorphism in near-isogenic wheat lines differing for the *Yr5* stripe rust resistance locus. Theor Appl Genet 117(3): 401-11.
198. Wheat	Stripe rust	USA India Mexico	Oregon State Univ, Dept Crop & Soil Sci, USA Limagrain Cereals Seeds, USA Internatl Crops Res Inst Semi-Arid Tropics (ICRISAT), India Washington State Univ: USDA-ARS, Wheat Genet, Quality, Physiol & Dis Res Unit; Dept Plant Pathol, USA CIMMYT, Mexico Oregon State Univ, Dept Botany & Plant Pathol, USA	Dolores Vazquez M, James Peterson C, Riera-Lizarazu O et al. 2012. Genetic analysis of adult plant, quantitative resistance to stripe rust in wheat cultivar 'Stephens' in multi-environment trials. Theor Appl Genet 124(1): 1-11.
199. Wheat	Stripe rust	USA	Washington State Univ USDA-ARS	Feng J, Wang M, Hou L, Chen X. 2013. QTL mapping of resistance to stripe rust in spring wheat PI 182103. Phytopathology 103(6): 42-43.
200. Wheat	Stripe rust	China	CAAS, Inst Plant Protect, State Key Lab Biol Plant Dis & Insect Plant Protect Yunnan Agricul Univ	Feng J, Xu JJ, Lin RM et al. 2013. Genetic analysis and location of gene for resistance to stripe rust in wheat international differential host Strubes Dickkopf. Journal of Genetics 92(2): 267-72.
201. Wheat	Stripe rust	China	China Agricul Univ: Dept Plant Pathol; Coll Sci	Guo Q, Zhang ZJ, Xu YB et al. 2008. Quantitative trait loci for high-temperature adult-plant and slow-rusting resistance to *Puccinia striiformis* f. sp. *tritici* in wheat cultivars. Phytopathology 98(7): 803-09.
202. Wheat	Stripe rust	USA	Univ Georgia, Griffin Campus: Dept Crop & Soil Sci; Dept Plant Pathol North Carolina State Univ, USDA-ARS Plant Sci Res, Dept Crop Sci	Hao Y, Chen Z, Wang Y et al. 2011. Characterization of a major QTL for adult plant resistance to stripe rust in US soft red winter wheat. Theor Appl Genet 123(8): 1401-11.
203. Wheat	Stripe rust	China	Univ Electronic Sci & Technol China, School Life Sci & Technol Shanxi Acad Agricul Sci, Crop Genetic Inst Taiyuan, China	Hu, L. J., Li, G. R., Zeng, Z. X., Chang, Z. J., Liu, C. and Yang, Z. J. (2011). Molecular characterization of a wheat -*Thinopyrum ponticum* partial amphiploid and its derived substitution line for resistance to stripe rust. J Appl Genet 52(3): 279-85.
204. Wheat	Stripe rust	UK	JIC, Norwich Res Park, Dept Dis & Biol Limagrain UK Ltd	Jagger LJ, Newell C, Berry ST et al. 2011. The genetic characterisation of stripe rust resistance in the german wheat cultivar Alcedo. Theor Appl Genet 122(4): 723-33.
205. Wheat	Stripe rust	China Australia	CAAS, Inst Crop Sci, Natl Wheat Improv Ctr/The Natl Key Facility Crop Gene Resour & Genetic Improv, China Victorian AgriBiosci Ctr, Dept Primary Industries, Australia Gansu Acad Agricul Sci, Gansu Wheat Res Inst, China	Lan C, Liang S, Zhou X et al. 2010. Identification of genomic regions controlling adult-plant stripe rust resistance in Chinese landrace Pingyuan 50 through bulked segregant analysis. Phytopathology 100(4): 313-18.

			CIMMYT China Off, China	
206. Wheat	Stripe rust	China USA	Northwest A&F Univ, Coll Plant Protect & Shaanxi Key Lab Mol Biol Agric, China Washington State Univ, Dept Plant Pathol, USA USDA-ARS, Wheat Genet, Quality Physiol & Dis Res Unit, Dept Agric, USA	Li Q, Chen XM, Wang MN, Jing JX. 2011. *Yr45*, a new wheat gene for stripe rust resistance on the long arm of chromosome 3D. Theor Appl Genet 122(1): 189-97.
207. Wheat	Stripe rust	China USA	CAAS: Inst Plant Protect, State Key Lab Biol Plant Dis & Insect Pests; Inst Agricull Resour & Regional Planning, China Chinese Acad Medical Sci & Peking Union Medical Coll , Inst Medicinal Plant Development, China Washington State Univ, USDA-ARS & Dept Plant Pathol, USA	Li Y, Niu YC, Chen XM. 2009. Mapping a stripe rust resistance gene *YrC591* in wheat variety C591 with SSR and AFLP markers. Theor Appl Genet 118(2): 339-46.
208. Wheat	Stripe rust	USA China	Washington State Univ, Dept Plant Pathol, USA Shenyang Agricul Univ, Biosci & Technol Coll, China USDA-ARS, Wheat Genet, Quality, Physiol & Dis ResUnit, USA	Lin F, Chen XM. 2007. Genetics and molecular mapping of genes for race-specific all-stage resistance and non-race-specific high-temperature adult-plant resistance to stripe rust in spring wheat cultivar Alpowa. Theor Appl Genet 114(7): 1277-87.
209. Wheat	Stripe rust	USA China	Washington State Univ, Dept Plant Pathol, USA Shenyang Agricul Univ, Biosci & Technol Coll, China USDA-ARS, Wheat Genet, Quality, Physiol & Dis Res Unit, USA	Lin F, Chen XM. 2008. Molecular mapping of genes for race-specific overall resistance to stripe rust in wheat cultivar Express. Theor Appl Genet 116(6): 797-806.
210. Wheat	Stripe rust	USA China	Washington State Univ, Dept Plant Pathol, USA Shenyang Agricul Univ, Biosci & Technol Coll, China USDA-ARS, Wheat Genet, Quality, Physiol & Dis Res Unit, USA	Lin F, Chen XM. 2009. Quantitative trait loci for non-race-specific, high-temperature adult-plant resistance to stripe rust in wheat cultivar Express. Theor Appl Genet 118(4): 631-42.
211. Wheat	Stripe rust	China	CAAS: Inst Agricul Resour & Regional Planning; Inst Plant Protect Agricul Univ Anhui, Plant Protect Acad	Liu F, Niu Y, Deng H, Tan G. 2007. Mapping of a major stripe rust resistance gene in chinese native wheat variety Chike using microsatellite markers. J Genet Genomics 34(12): 1123-30.
212. Wheat	Stripe rust	USA Republic of Macedonia	Univ California, Depat Plant Sci, USA Fac Agricul Sci & Food, Dept Genet & Plant Breed, Republic of Macedonia USDA-ARS: Cereal Crops Res Unit; Wheat Genet, Quality Physiol & Dis Res Unit, USA	Lowe I, Jankuloski L, Chao S et al. 2011. Mapping and validation of QTL which confer partial resistance to broadly virulent post-2000 North American races of stripe rust in hexaploid wheat. Theor Appl Genet 123(1): 143-57.
213. Wheat	Stripe rust	China	CAAS, Inst Crop Sci, Natl Wheat Improv Ctr/Natl Key Facility Crop Gene Resour & Genetic Improv Northwest A&F Univ, Coll Plant Protect Gansu Acad Agricul Sci, Gansu Wheat Res Inst CIMMYT China Off	Lu Y, Lan C, Liang S et al. 2009. QTL mapping for adult-plant resistance to stripe rust in Italian common wheat cultivars Libellula and Strampelli. Theor Appl Genet 119(8): 1349-59.
214. Wheat	Stripe rust	China	SAAS, State Key Lab Plant Breed & Genet Univ Electronic Sci & Technol China, School Life Sci & Technol	Luo PG, Hu XY, Ren ZL et al. 2008. Allelic analysis of stripe rust resistance genes on wheat chromosome 2BS. Genome 51(11): 922-27.

215. Wheat	Stripe rust	China	Northwest A&F Univ , Coll Plant Protection, State Key Lab Crop Stress Biol Arid Areas	Ma DF, Zhou XL, Hou L et al. 2013. Genetic analysis and molecular mapping of a stripe rust resistance gene derived from *Psathynrostachys huashanica* Keng in wheat line H9014-121-5-5-9. Mol Breeding 32(2): 365-72.
216. Wheat	Stripe rust	UK	JIC, Dept Dis & Stress Biol Syngenta Seeds Ltd Nickerson-Advanta UK	Melichar JP, Berry S, Newell C et al. 2008. QTL identification and microphenotype characterisation of the developmentally regulated yellow rust resistance in the UK wheat cultivar Guardian. Theor Appl Genet 117(3): 391-99.
217. Wheat	Stripe rust	France	INRA UMR 118, Amélioration Plantes & Biotechnologies Végétales INRA UMR 1095 INRA BIOGER-CPP, UR 1290 INRA UMR 118 Biogenouest, Plateforme Genotypage	Paillard S, Trotoux-Verplancke G, Perretant MR et al. 2012. Durable resistance to stripe rust is due to three specific resistance genes in French bread wheat cultivar Apache. Theor Appl Genet 125 (5): 955-65.
218. Wheat	Stripe rust	Australia Czech Republic	Univ Sydney PBI-Cobbitty,Fac Agricul & Environ, Dept Plant & Food Sci, Australia Inst Exp Botany AS CR, Ctr Region Haná Biotechnological & Agricul Res, Czech Republic	Randhawa M, Bansal U, Valárik M et al. 2013. Molecular mapping of stripe rust resistance gene *Yr51* in chromosome 4AL of wheat. Theor Appl Genet 127(2): 317-24.
219. Wheat	Stripe rust	China USA	China Agricul Univ, Dept Plant Pathol, China Washington State Univ, Dept Plant Pathol, USA USDA-ARS, Wheat Genet, Quality, Physiol & Dis Res Unit, USA	Ren RS, Wang MN, Chen XM, Zhang ZJ. 2012. Characterization and molecular mapping of *Yr52* for high-temperature adult-plant resistance to stripe rust in spring wheat germplasm PI 183527. Theor Appl Genet 125(5): 847-57.
220. Wheat	Stripe rust	China Norway	CAAS, Inst Crop Sci, Natl Wheat Improv Ctr/The Natl Key Facility Crop Gene Resour & Genetic Improv, China CIMMYT China Off, China Norwegian Univ Life Sci, Dept Plant & Environm Sci, Norway SAAS, Crop Res Inst, China Gansu Acad Agricul Sci, Wheat Res Inst, China	Ren Y, He Z, Li J et al. 2012. QTL mapping of adult-plant resistance to stripe rust in a population derived from common wheat cultivars Naxos and Shanghai 3/Catbird. Theor Appl Genet 125(6): 1211-21.
221. Wheat	Stripe rust	USA	Washington State Univ: Dept Crop & Soil Sci; Dept Plant Pathol USDA-ARS, Wheat Genet, Quality, Physiol & Dis Res Unit	Santra DK, Chen XM, Santra M et al. 2008. Identification and mapping QTL for high-temperature adult-plant resistance to stripe rust in winter wheat (*Triticum aestivum* L.) cultivar 'Stephens'. Theor Appl Genet 117(5): 793-802.
222. Wheat	Stripe rust	UK	JIC: Dept Dis & Stress Biol; Dept Crop Genet	Smith PH, Hadfield J, Hart NJ et al. 2007. STS markers for the wheat yellow rust resistance gene *Yr5* suggest a NBX-LRR-type resistance gene cluster. Genome 50(3): 259-65.
223. Wheat	Stripe rust	Pakistan USA	Internatl Islamic Univ, Dept Biotechnol & Bioinformatics, Pakistan NUST Ctr Virology & Immunol, Natl Univ Sci & Technol(NUST), Pakistan Washington State Univ, USDA-ARS; Dept Plant Pathol, USA	Sobia T, Muhammad A, Chen X. 2010. Evaluation of Pakistan wheat germplasms for stripe rust resistance using molecular markers. Sci China Life Sci 53(9): 1123-34.
224. Wheat	Stripe rust	USA	Washington State Univ, Dept Plant Pathol USDA-ARS, Wheat Genet, Quality, Physiol & Dis Res Unit	Sui XX, Wang MN, Chen XM. 2009. Molecular mapping of a stripe rust resistance gene in spring wheat cultivar Zak. Phytopathology 99(10): 1209-15.

225. Wheat	Stripe rust	USA	Washington State Univ, USDA-ARS	Wang M, Chen X. 2013. Association mapping for stripe rust resistance genes in spring wheat germplasm lines. Phytopathology 103(6): 155-55.
226. Wheat	Stripe rust	China USA	Northwest A&F Univ, Coll Life Sci, Shaanxi Key Lab Mol Biol Agric, State Key Lab Crop Stress Biol Arid Areas, China Washington State Univ, Dept Plant Pathol, USA USDA-ARS, Wheat Genet, Quality, Physiol & Dis Res Unit, USA	Xu LS, Wang MN, Cheng P et al. 2013. Molecular mapping of *Yr53*, a new gene for stripe rust resistance in durum wheat accession PI 480148 and its transfer to common wheat. Theor Appl Genet 126(2): 523-33.
227. Wheat	Stripe rust	Australia	Univ Sydney, Plant Breed Inst	Zhang P, McIntosh RA., Hoxha S, Dong C. 2009. Wheat stripe rust resistance genes *Yr5* and *Yr7* are allelic. Theor Appl Genet 120(1): 25-9.
228. Wheat	Stripe rust	China	Northwest A&F Univ: State Key Lab Crop Stress Biol Arid Areas; Coll Plant Protect; Coll Agron; Coll Life Sci	Zhang X, Han D, Zeng Q et al. 2013. Fine mapping of wheat stripe rust resistance gene *Yr26* based on collinearity of wheat with *Brachypodium distachyon* and rice. PLoS One 8(3): e57885.
229. Wheat	Stripe rust	USA Mexico	Univ Minnesota, Dep Agron & Plant Genet, USA CIMMYT, Mexico USDA-ARS, Cereal Dis Lab, USA INIFAP, Mexico	Zhang JLX, Singh RP, Kolmer JA et al. 2008. Inheritance of leaf rust resistance in the CIMMYT wheat Weebill 1. Crop Sci 48(3): 1037-47.
230. Wheat	Stripe rust	China	Northwest Sci-Tech Univ A&F, Coll Plant Protect	Zhou XL, Wang WL, Wang LL et al. 2011. Genetics and molecular mapping of genes for high-temperature resistance to stripe rust in wheat cultivar Xiaoyan 54. Theor Appl Genet 123(3): 431-38.
231. Wheat	Leaf rust Stripe rust	USA	Kansas State Univ, Dept Plant Pathol, Wheat Genet & Genom Resour Ctr Washington State Univ, USDA-ARS, Western Regional Small Grains Genotyping Lab	Kuraparthy V, Sood S, See DR, Gill BS. 2009. Development of a PCR assay and marker-assisted transfer of leaf rust and stripe rust resistance genes *Lr57* and *Yr40* into hard red winter wheats. Crop Sci 49(1): 120-26.
232. Wheat	Leaf rust Stripe rust	USA India	Kansas State Univ, Wheat Genetic & Genomic Resour Ctr, Dept Plant Pathol, USA Punjab Agricul Univ, Dep Plant Breed, Genet & Biotechnol, India Indian Inst Technol, Dept Biotechnol, India Kansas State Univ, USDA-ARS, Plant Sci & Entomol Res Unit, USA	Kuraparthy V, Chhuneja P, Dhaliwal HS et al. 2007. Characterization and mapping of cryptic alien introgression from *Aegilops geniculata* with new leaf rust and stripe rust resistance genes *Lr57* and *Yr40* in wheat. Theor Appl Genet 114(8): 1379-89.
233. Wheat	Leaf rust Stripe rust	Australia Iran	Univ Sydney, Plant Breed Inst, Australia Shiraz Univ, Coll Agric, Dept Agron & Plant Breed, Iran	Dadkhodaie, N. A., Karaoglou, H., Wellings, C. R. and Park, R. F. (2011). Mapping genes *Lr53* and *Yr35* on the short arm of chromosome 6B of common wheat with microsatellite markers and studies of their association with *Lr36*. Theor Appl Genet 122(3): 479-87.
234. Wheat	Leaf rust Stripe rust	Australia Mexico	CSIRO Plant Ind, Australia CIMMYT,Mexico Campo Experim Valle Mexico INIFAP, Mexico	Rosewarne GM, Singh RP, Huerta-Espino J et al. 2008. Quantitative trait loci for slow-rusting resistance in wheat to leaf rust and stripe rust identified with multi-environment analysis. Theor Appl Genet 116(7): 1027-34.
235. Wheat	Leaf rust Stripe rust	Canada Australia	Agric & Agri-Food Canada, Cereal Res Ctr; Semiarid Prairie Agricul Res Ctr, Canada La Trobe Res & Develop Park, Victorian AgriBiosci Ctr, Dept Primary Industries, Australia	Hiebert CW, Thomas JB, McCallum BD et al. 2010. An introgression on wheat chromosome 4DL in RL6077 (Thatcher*6/PI 250413) confers adult plant resistance to stripe rust and leaf rust (*Lr67*). Theor Appl Genet 121(6): 1083-91.

			CSIRO Plant Ind, Australia	
236. Wheat	Leaf rust Stripe rust	Mexico Australia Kenya	CIMMYT, Mexico CSIRO Plant Ind,Australia Campo Experim Valle de México INIFAP, Mexico Victorian AgriBiosci Ctr, Dept Primary Industries, Australia Univ Sydney Plant Breed Inst-Cobbitty, Australia CIMMYT, ICRAF House, Kenya	Herrera-Foessel SA, Lagudah ES, Huerta-Espino J, 2011. New slow-rusting leaf rust and stripe rust resistance genes *Lr67* and *Yr46* in wheat are pleiotropic or closely linked. Theor Appl Genet 122(1): 239-49.
237. Wheat	Leaf rust Stripe rust	China	CAAS: Inst Crop Sci, Natl Wheat Improv Ctr/Natl Key Facility Crop Gene Resour & Genetic Improv Biologic Control Ctr Plant Dis & Plant Pests Hebei, Agricul Univ Hebei, Coll Plant Protect, Dept Plant Pathol CIMMYT China Off SAAS, Crop Res Inst Gansu Acad Agricul Sci, Wheat Res Inst	Ren Y, Li Z, He Z et al. 2012. Qtl mapping of adult-plant resistances to stripe rust and leaf rust in Chinese wheat cultivar Bainong 64. Theor Appl Genet 125(6): 1253-62.
238. Wheat	Leaf rust Stripe rust	China Mexico Australia	CIMMYT China Off, China CIMMYT, Mexico Campo Experim Valle Mexico INIFAP, Mexico Victorian AgriBiosci Ctr, Dept Primary Industries Victoria, Australia CSIRO Plant Ind, Australia	Rosewarne GM, Singh RP, Huerta-Espino J et al. 2012. Analysis of leaf and stripe rust severities reveals pathotype changes and multiple minor QTLs associated with resistance in an Avocet x Pastor wheat population. Theor Appl Genet 124(7): 1283-94.
239. Wheat	Leaf rust Stripe rust	India, Switzerland	Punjab Agric Univ, Dept Plant Breed Genet & Biotechnol, India Univ Zürich, Inst Plant Biol, Switzerland Indian Inst Technol	Singh K, Chhuneja P, Ghai M et al. 2007. Molecular mapping of leaf and stripe rust resistance genes in *T. monococcum* and their transfer to hexaploid wheat. Developments in Plant Breeding 12. 779-86.
240. Wheat	Leaf rust Stripe rust	India	Punjab Agric Univ, Dept Plant Breed Genet & Biotechnol Indian Inst Technol	Chhuneja P, Kaur S, Goel RK et al. 2007. Introgression of leaf rust and stripe rust resistance genes from *Aegilops umbellulata* to hexaploid wheat through induced homoeologous pairing. Wheat Production in Stressed Environments (eds. Buck HT et al.) Developments in Plant Breeding 12. 83-90.
241. Wheat	Leaf rust Stripe rust	USA	Kansas State Univ, Dept Plant Pathol, Wheat Genet & Genom Resour Ctr N Carolina State Univ, Dept Crop Sc	Kuraparthy V, Sood S, Gill BS. 2009. Molecular genetic description of the cryptic wheat-*Aegilops geniculata* introgression carrying rust resistance genes *Lr57* and *Yr40* using wheat ESTs and synteny with rice. Genome 52(12): 1025-36.
242. Wheat	Leaf rust Stripe rust	Mexico Australia	CIMMYT, Mexico Univ Adelaide, Australian Mol Plant Breed Cooperative Res Ctr (MPBCRC), Australia Campo Experim Valle Mexico INIFAP, Mexico	William, H. M., Singh, R. P., Huerta-Espino, J. and Rosewarne, G. (2007). Characterization of genes for durable resistance to leaf rust and yellow rust in CIMMYT spring wheats. In: Buck HT et al. (eds.): Wheat Production in Stressed Environments. Developments in Plant Breeding 12: 65-70.
243. Wheat	Leaf rust	Australia	CSIRO Plant Ind, Australia	Kolmer JA, Singh RP, Garvin DF et al. 2008. Analysis of the *Lr34/Yr18* rust

		Stripe rust	UK USA Mexico	DNRE, Australia NSW Dep Primary Ind, Australia JIC, UK Univ Sydney, Plant Breed Inst, Australia Univ Minnesota: USDA-ARS, Cereal Dis Lab; Dep Agron & Plant Genet USA CIMMYT, Mexico Campo Experim Valle Mexico INIFAP, Mexico	resistance region in wheat germplasm. Crop Sci 48(5): 1841-52.
244.	Wheat	Leaf rust Stripe rust	India	Indian Agr Res Inst, Div Genet Natl Res Ctr Plant Biotechnol	Revathi P, Tomar SMS, Vinod, Singh NK. 2010. Marker assisted gene pyramiding of leaf rust resistance genes Lr24, Lr28 along with stripe rust resistance gene Yr15 in wheat (Triticum aestivum L.). Indian J Genet Pl Br 70(4): 349-54.
245.	Wheat	Leaf rust Stripe rust	USA Czech Republic India Saudi Arabia	Kansas State Univ, Dept Plant Pathol, Wheat Genet Resour Ctr Inst Exp Botany AS CR, Ctr Region Haná Biotechnological & Agricul Res, Czech Republic Punjab Agricul Univ, School Agricul Biotechnol, India King Abdulaziz Univ, Fac Sci, Dept Biologic Sci, Saudi Arabia	Tiwari VK, Wang S, Sehgal S et al. 2014. SNP Discovery for mapping alien introgressions in wheat. BMC Genomics 15(1): 273.
246.	Wheat	Leaf rust Stripe rust Powdery mildew	Australia Switzerland Mexico USA	CSIRO Plant Ind, Australia Univ Zürich, Inst Plant Biol, Switzerland CIMMYT, Mexico Campo Experim Valle de Mexico INIFAP, Mexico N Carolina State Univ, USDA-ARS Plant Sci Res Unit, Dept Crop Sci, USA	Lagudah ES, Krattinger SG, Herrera-Foessel S et al. 2009. Gene-specific markers for the wheat gene *Lr34*/*Yr18*/*Pm38* which confers resistance to multiple fungal pathogens. Theor Appl Genet 119(5): 889-98.
247.	Wheat	Leaf rust Stripe rust Powdery mildew	Germany	Univ Hohenheim, State Plant Breed Inst Leibniz Inst Plant Genet & Crop Plant Res (IPK), Dept Cytogenet & Genome Analysis KWS LOCHOW GmbH Nordsaat Saatzuchtgesellschaft mbH Lantmännen SW Seed Hadmersleben GmbH Limagrain GmbH	Gowda M, Zhao Y, Wurschum T et al. 2014. Relatedness severely impacts accuracy of marker-assisted selection for disease resistance in hybrid wheat. Heredity (Edinb) 112: 552-61.
248.	Wheat	Leaf rust Stripe rust Powdery mildew	USA	Univ Minnesota, Dept Plant Pathol	Olivera PD, Steffenson BJ. 2009. *Aegilops sharonensis*: Origin, genetics, diversity, and potential for wheat improvement. Botany-Botanique 87(8): 740-56.
249.	Wheat	Leaf rust Powdery mildew	Russia	Russian Acad Sci, Inst Cytol & Genet	Gordeeva EI, Leonova IN, Kalinina NP et al. 2009. Comparative cytological and molecular analysis of common wheat introgression lines containing genetic material of *Triticum timopheevii* Zhuk. Russ J Genet 45(12): 1428-37.
250.	Wheat	Leaf rust Powdery mildew	USA	Virginia Polytech Inst & State Univ, Dept Crop & Soil Environm Sci Ohio State Univ, Dep Hort & Crop Sci Univ Kentucky, Dept Plant & Soil Sci Univ Maryland, Dep Plant Sci & Landscape Architecture, College Pk	Hall MD, Tucker D, Griffey CA et al. 2010. Registration of USG 3209/Jaypee wheat recombinant inbred line mapping population. J Plant Registr 4(2): 159-62.

			USDA-ARS, Plant Sci Res Unit	
251. Wheat	Leaf rust Powdery mildew	Armenia Italy Germany Syria	Yerevan State Univ, Fac Biol, Dept Ecol & Nat Protect, Armenia Biovers Int, Italy Leibniz Inst Plant Genet & Crop Plant Res IPK, Germany Int Ctr Agr Res Dry Areas ICARDA, Syria	Hovhannisyan NA, Dulloo ME, Yesayan AH et al. 2011. Tracking of powdery mildew and leaf rust resistance genes in *Triticum boeoticum* and *T. urartu*, wild relatives of common wheat. Czech J Genet Plant Breed 47(2): 45-57.
252. Wheat	Leaf rust Powdery mildew	Poland	Natl Res Inst Radzikow, Plant Breed & Acclimatizat Inst: Dept Plant Breed & Genet; Dept Plant Pathol	Pietrusinska A, Czembor JH, Czembor PC. 2011. Pyramiding two genes for leaf rust and powdery mildew resistance in common wheat. Cereal Res Commun 39(4): 577-88.
253. Wheat	Leaf rust Powdery mildew	Poland	Natl Res Inst Radzikow, Plant Breed & Acclimatizat Inst: Dept Plant Breed & Genet; Dept Plant Pathol	Pietrusinska A, Czembor PC, Czembor JH. 2013. *Lr39*+*Pm21*: a new effective combination of resistance genes for leaf rust and powdery mildew in wheat. Czech J Genet Plant Breeding 49(3): 109-15.
254. Wheat	Leaf rust Wheat curl mite	USA Canada	Montana State Univ, Dep Plant Sci & Plant Pathol, USA Agric & Agri-Food Canada, Lethbridge Res Ctr, Canada	Hofer P, Berg JE, Huang L et al. 2011. Registration of 'Yellowstone' winter wheat backcross–derived lines incorporating leaf rust and wheat curl mite resistance. J Plant Registr 5(3): 422-25.
255. Wheat	Leaf rust Cyst nematode	Tunisia	Univ Tunis El-Manar, Fac Sci Tunis, Unité Recherche Génomique Insectes Ravageurs des Cultures d'intérêt agronomique (GIRC, UR11ES10) Univ Jendouba, Inst Supérieur Biotechnol Béja (ISBB) Université Tunis, Inst Supérieur l'Animation Jeunesse & Culture (ISAJC)	Bouktila D, Habachi-Houimli Y, Khalfallah Y et al. 2014. Characterization of novel wheat NBS domain-containing sequences and their utilization, in silico, for genome-scale R-gene mining. Mol Genet Genomics. DOI 10.1007/s00438-014-0834-4.
256. Wheat	Leaf rust Eyespot	Poland	Polish Acad Sci, Inst Plant Genet: Lab Distant Crosses; Lab Metabol	Kwiatek M, Blaszczyk L, Wisniewska H, Apolinarska B. 2012. *Aegilops-Secale* amphiploids: chromosome categorisation, pollen viability and identification of fungal disease resistance genes. J Appl Genetics 53(1): 37-40.
257. Wheat	Stem rust Stripe rust	Mexico	CIFASIS CIMMYT Colegio Postgrad, Montecillo	Ornella L, Sukhwinder S., Perez P et al. 2012. Genomic prediction of genetic values for resistance to wheat rusts. Plant Genome 5(3): 136-48.
258. Wheat	Stem rust Stripe rust	Australia Switzerland	Univ Sydney, Plant Breed Inst Cobbitty, Fac Agric Food & Nat Resour, Australia Victorian AgriBiosci Ctr, Australia Univ Zürich, Inst Plant Biol, Switzerland	Bansal UK, Hayden MJ, Keller B et al. 2009. Relationship between wheat rust resistance genes *Yr1* and *Sr48* and a microsatellite marker. Plant Pathol 58(6): 1039-43.
259. Wheat	Leaf rust Stem rust	Bulgaria	AgroBioInst	Todorovska E, Christov N, Slavov S et al. 2009. Biotic stress resistance in wheat – breeding and genomic selection implications. Biotechnol Biotec Eq 23(4): 1417-26. (Review)
260. Wheat	Leaf rust Stem rust	India	Indian Agr Res Inst, Div Genet	Prabhu KV, Singh AK, Basavaraj SH et al. 2009. Marker assisted selection for biotic stress resistance in wheat and rice. Indian J Genet Pl Br 69(4): 305-14. (Review)
261. Wheat	Leaf rust Stem rust	Pakistan	Bahauddin Zakariya Univ: Inst Biotechnol; Inst Pure & Appl Biol, Multan BZ Univ Multan Pakistan, Univ Coll Agric	Babar M, Mashhadi AF, Mehvish A et al. 2010. Identification of rust resistance genes *Lr10* and *Sr9a* in Pakistani wheat germplasm using PCR based molecular markers. African J Biotechnol 9(8): 1144-50.

262.	Wheat	Leaf rust Stem rust	India	Indian Agr Res Inst, Reg Stn Directorate Wheat Res, Reg Stn	Brahma RN, Saikia A, Datta D et al. 2007. Development of new wheat (*Triticum aestivum*) lines with pyramided leaf rust (*Puccinia triticina*) resistance genes. Indian J Agr Sci 77(12): 834-39.
263.	Wheat Barley	Stem rust Leaf rust Stripe rust	USA	Univ Minnesota: Dept Plant Pathol; USDA-ARS, Cereal Dis Lab; Dept Agron	Steffenson BJ, Olivera P, Roy JK et al. 2007. A walk on the wild side: Mining wild wheat and barley collections for rust resistance genes. Aust J Agr Res 58(6): 532-44.
264.	Wheat	Stem rust Leaf rust Stripe rust	USA	Univ Calif Davis, Dept Plant Sci	Lowe, I., Cantu, D. and Dubcovsky, J. (2011). Durable resistance to the wheat rusts: integrating systems biology and traditional phenotype-based research methods to guide the deployment of resistance genes. Euphytica 179(1): 69-79.
265.	Wheat	Stem rust Leaf rust Stripe rust	USA	Iowa State Univ, USDA-ARS, Dept Plant Pathol & Microbiol, Ctr Plant Responses Environm Stresses	Ballini E, Lauter N, Wise R. 2013. Prospects for advancing defense to cereal rusts through genetical genomics. Front Plant Sci 4:117. (Review)
266.	Wheat	Stem rust Leaf rust Stripe rust	Pakistan	AAARI, Wheat Res Inst Univ Agr Faisalabad: Dept Plant Breeding & Genet; Ctr Agr Biochem & Biotechnol	Rehman AU, Sajjad M, Khan SH, Ahmad N. 2013. Prospects of wheat breeding for durable resistance against brown, yellow and black rust fungi. Int J Agric Biol 15(6): 1209-20. (Review)
267.	Wheat	Stem rust Leaf rust Stripe rust	South Africa Australia	CenGen Pty Ltd, South Africa Univ Free State, Dept Plant Sci, South Africa Univ So Queensland, Ctr Syst Biol, Fac Sci, Australia	Prins R, Pretorius ZA, Bender CM et al. 2011. QTL mapping of stripe, leaf and stem rust resistance genes in a Kariega x Avocet S doubled haploid wheat population. Mol Breeding 27(2): 259-70.
268.	Wheat	Stem rust Leaf rust Stripe rust	Pakistan	COMSATS Inst Informat Technol, Dept Biosci PMAS Arid Agric Univ, Dept Genet & Plant Breed Quaid-I-Azam Univ, Dept Microbiol	Zeb M, Shah MKN, Faryal R. 2013. Development of putative molecular markers to trace durable rust resistance genes in wheat breeding stocks. Pakist J Bot 45: 359-66.
269.	Wheat	Stem rust Leaf rust Stripe rust	Australia	CSIRO Plant Ind	Lagudah ES. 2011. Molecular genetics of race non-specific rust resistance in wheat. Euphytica 179(1): 81-91.
270.	Wheat	Stem rust Leaf rust Stripe rust	Canada	Agric & Agri-Food Canada: Semiarid Prairie Agric Res Ctr; Cereal Res Ctr; Lethbridge Res Ctr	Singh A, Pandey MP, Singh AK et al. 2013. Identification and mapping of leaf, stem and stripe rust resistance quantitative trait loci and their interactions in durum wheat. Mol Breed 31(2): 405-18.
271.	Wheat	Stem rust Leaf rust Stripe rust	Australia	Univ Sydney PBI-Cobbitty, Fac Agric & Environ Univ Queensland, School Agric & Food Sci	Bansal UK, Arief VN, DeLacy IH, Bariana HS. 2013. Exploring wheat landraces for rust resistance using a single marker scan. Euphytica 194(2): 219-33.
272.	Wheat	Stem rust Leaf rust Stripe rust Powdery mildew	Canada	Agric & Agri-Food Canada, Cereal Res Ctr Vineland Res & Innovat Ctr	McCallum BD, Humphreys DG, Somers DJ et al. 2012. Allelic variation for the rust resistance gene *Lr34*/*Yr18* in Canadian wheat cultivars. Euphytica 183(2): 261-74.
273.	Wheat	Stem rust Leaf rust Barley yellow dwarf virus	Australia Mexico	CSIRO Plant Ind, Australia Univ Sydney, Plant Breed Inst Cobbitty, Australia CIMMYT, Mexico	Ayala-Navarrete L, Bariana HS, Singh R et al. 2007. Trigenomic chromosomes by recombination of *Thinopyrum intermedium* and *Th. ponticum* translocations in wheat. Theor Appl Genet 116(1): 63-75.

274. Wheat	Stem rust Leaf rust BYDV	Australia	CSIRO Plant Ind	Ayala-Navarrete LI, Mechanicos AA., Gibson JM et al. 2013. The *Pontin* series of recombinant alien translocations in bread wheat: single translocations integrating combinations of *Bdv2*, *Lr19* and *Sr25* disease-resistance genes from *Thinopyrum intermedium* and *Th. ponticum*. Theor Appl Genet 126(10): 2467-75.
275. Wheat	Stem rust Leaf rust Stripe rust Fusarium head blight Common bunt Orange wheat blossom midge	Canada	Agric & Agri-Food Canada: Lethbridge Res Ctr; Cereal Res Ctr Univ Saskatchewan, Ctr Crop Dev; Dept Plant Sci Univ Alberta Semiarid Prairie Agricul Res Ctr	Randhawa HS, Asif M, Pozniak C et al. 2013. Application of molecular markers to wheat breeding in Canada. Plant Breeding 132(5): 458-71.
276. Wheat	Stem rust Leaf rust Stripe rust Powdery mildew Greenbug	Iran	Tarbiat Modares Univ, Fac Agric, Plant Breed & Biotechnol Dept Agron & Plant Breed Dept, Coll Agric	Tabibzadeh N, Karimzadeh G, Naghavi MR. 2013. Distribution of 1AL.1RS and 1BL.1RS wheat-rye translocations in iranian wheat, using PCR based markers and SDS-page. Cereal Res Commun 41(3): 458-67.
277. Wheat	Stem rust Leaf rust Stripe rust Powdery mildew Pest (cereal cyst nematode, root knot nematode, Hessian fly, greenbug)	Hungary	Hungarian Acad Sci, Agricul Res Inst	Schneider A, Molnar I, Molnar-Lang M. 2008. Utilisation of *Aegilops* (goatgrass) species to widen the genetic diversity of cultivated wheat. Euphytica 163(1): 1-19.
278. Wheat	Stem rust Leaf rust Stripe rust	Australia	USPBI Cobbitty, Fac Agric & Nat Resour USPBI Narrabri, Australian Grain Technol	Bariana HS, Brown GN, Bansal UK et al. 2007. Breeding triple rust resistant wheat cultivars for Australia using conventional and marker-assisted selection technologies. Aust J Agr Res 58(6): 576-87.
279. Wheat	Stem rust Leaf rust Powdery mildew	India	IARI: Reg Stn, Div Genet Devi Ahilya Vishwa	Sivasamy M, Vinod, Tiwari S et al. 2009. Introgression of useful linked genes for resistance to stem rust, leaf rust and powdery mildew and their molecular validation in wheat (*Triticum aestivum* L.). Indian J Genet Pl Br 69(1): 17-27.
280. Wheat	Stem rust Stripe rust Powdery mildew Wheat curl mite	China Canada	CAAS: Natl Key Facil Crop Gene Resour & Genet Improv, Inst Crop Sci; Inst Plant Protect, Key Lab Biol Plant Dis & Insect Pests, China Agric & Agri-Food Canada: Morden Res Stn; Lethbridge Res Ctr, Canada China Agricul Univ, Dept Plant Genet & Breed, China CAS, Inst Genet & Dev Biol, State Key Lab Plant Cell & Chromosome Engineer, China Lankao Nonghua Seed Co, China	Li H J, Conner RL, Liu ZY et al. 2007. Characterization of wheat-triticale lines resistant to powdery mildew, stem rust, stripe rust, wheat curl mite, and limitation on spread of WSMV. Plant Dis 91(4): 368-74.

281.	Wheat	Stem rust Leaf rust Stripe rust Powdery mildew	Mexico Norway Australia Uruguay	CIMMYT, Mexico Norwegian Univ Life Sci, Dept Plant & Environm Sci, Norway Univ Sydney, Australia Univ Republ Uruguay, Fac Agron, Uruguay	Crossa J, Burgueno J, Dreisigacker S et al. 2007. Association analysis of historical bread wheat germplasm using additive genetic covariance of relatives and population structure. Genetics 177(3): 1889-913.
282.	Wheat	Stem rust Leaf rust Powdery mildew Septoria leaf blotch	Russia Belarus Germany	Russian Acad Sci: Siberian Branch, Inst Cytol & Genet; VA Engelhardt Mol Biol Inst, Russia Natl Acad Sci Belarus, Inst Cytol & Genet, Belarus Leibniz Inst Plant Genet & Crop Plant Res, Germany	Leonova IN, Badaeva ED, Orlovskaya OA et al. 2013. Comparative characteristic of *Triticum aestivum*/*Triticum durum* and *Triticum aestivum*/*Triticum dicoccum* hybrid lines by genomic composition and resistance to fungal diseases under different environmental conditions. Russ J Genet 49(11): 1112-18.
283.	Wheat	Stem rust Powdery mildew	China	Univ Elect Sci & Technol China, Sch Life Sci & Technol Univ Hebei, Coll Plant Protect	Liu C, Li GR, Yan HF et al. 2011. Molecular and cytogenetic identification of new wheat-*Dasypyrum breviaristatum* additions conferring resistance to stem rust and powdery mildew. Breed Sci 61(4): 366-72.
284.	Wheat	Stripe rust Leaf rust Powdery mildew Leaf tip necrosis phenotype	Australia Mexico China	CSIRO Plant Ind, Australia CIMMYT, Mexico Univ Sydney, Plant Breed Inst, Australia Campo Experim Valle Mexico INIFAP, Mexico CAAS, China Murdoch Univ, Ctr Comparat Genom, Australia	Spielmeyer W, Singh RP, McFadden H et al. 2008. Fine scale genetic and physical mapping using interstitial deletion mutants of *Lr34*/*Yr18*: A disease resistance locus effective against multiple pathogens in wheat. Theor Appl Genet 116(4): 481-90.
285.	Wheat	Stem rust Leaf rust Powdery mildew Spot blotch Loose smut	Russia Germany	Inst Cytol & Genet SB RAS, Russia Leibniz Inst Plant Genet & Crop Plant Res, Germany	Leonova IN, Budashkina EB, Kalinina NP et al. 2011. *Triticum aestivum* – *Triticum timopheevii* introgression lines as a source of pathogen resistance genes. Czech J Genet Plant Breed 47: S49-S55.
286.	Wheat Barley	Wheat rusts Eyespot Fusarium head blight Barley yellow mosaic viruses Powdery mildew	Germany	Univ Hohenheim, State Plant Breed Inst KWS LOCHOW GmbH	Miedaner T, Korzun V. 2012. Marker-assisted selection for disease resistance in wheat and barley breeding. Phytopathology 102(6): 560-66.
287.	Wheat Barley	Leaf rust Barley yellow dwarf virus	Slovakia Germany	Slovak Agric Res Ctr, Res Inst Plant Product, Slovakia Inst Epidemiology & Resistance, Germany Hordeum s.r.o., Slovakia Slovak Univ, Technol Inst Biochem, Nutrition & Health Protect, Fac Chemical & Food Technol, Slovakia	Hudcovicova M, Sudyova V, Slikova S et al. 2008. Marker-assisted selection for the development of improved barley and wheat lines. Acta Agron Hung 56(4): 385-92.
288.	Wheat	Karnal bunt	India	CCS Haryana Agricul Univ, Dept Biotechnol & Mol Biologic, Dept Geneti, Dept Plant Physiol, Dept Biochem GB Pant Univ Agric & Technol, Dept Plant Breed	Kumar M, Luthra OP, Chawla V et al. 2006. Identification of RAPD markers linked to the karnal bunt resistance genes in wheat. Biol Plantarum 50(4): 755-58.
289.	Wheat	Karnal bunt	USA	USDA-ARS, Dale Bumpers Natl Rice Res Ctr Kansas State Univ, Dept Plant Pathol N Carolina State Univ, USDA-ARS, Plant Sci Res	Brooks SA, See DR, Brown-Guedira G. 2006. SNP-based improvement of a microsatellite marker associated with Karnal bunt resistance in wheat. Crop Sci 46(4): 1467-70.

290.	Wheat	Karnal bunt	India USA	Kansas State Univ, Dept Plant Pathol, USA Punjab Agricul Univ, Dept Plant Breed, Genet & Biotechnol, India USDA-ARS, Plant Sci & Entomol Res Unit, USA	Singh S, Sharma I, Sehgal SK et al. 2007. Molecular mapping of QTLs for Karnal bunt resistance in two recombinant inbred populations of bread wheat. Theor Appl Genet 116(1): 147-54.
291.	Wheat	Bunt	Romania	Natl Agr Res & Dev Inst Fundulea	Ciuca M. 2011. A Preliminary report on the identification of SSR markers for bunt (*Tilletia* sp.) resistance in wheat. Czech J Genet Plant Breed 47: S142-S45.
292.	Wheat	Common bunt	Canada	Agric & Agri-Food Canada	Knox RE, Campbell HL, Depauw RM et al. 2013. DNA markers for resistance to common bunt in 'McKenzie' wheat. Can J Plant Pathol 35(3): 328-37.
293.	Wheat	Common bunt	China Canada	Shenyang Agricul Univ, Coll Agron, China Agric & Agri-Food Canada: Semiarid Prairie Agricul Res Ctr; Cereal Res Ctr, Canada	Wang S, Knox RE, DePauw RM et al. 2009. Markers to a common bunt resistance gene derived from 'Blizzard' wheat (*Triticum aestivum* L.) and mapped to chromosome arm 1BS. Theor Appl Genet 119(3): 541-53.
294.	Wheat	Smut	Canada	Univ Saskatchewa, Crop Development Ctr Agric & Agri-Food Canada: Lethbridge Res Ctr; Cereal Res Ctr Semiarid Prairie Agricul Res Ctr, Swift Current	Randhawa HS, Popovic Z, Menzies J et al. 2009. Genetics and identification of molecular markers linked to resistance to loose smut (*Ustilago tritici*) race T33 in durum wheat. Euphytica 169(2): 151-57.
295.	Wheat	Flag smut	Australia	Univ Sydney, Plant Breed Inst, Australia	Toor A, Bansal U, Bariana H. 2013. Mapping of flag smut resistance in common wheat. Mol Breeding 32(3): 699-707.
296.	Wheat	Fusarium head blight	Austria Mexico USA	BOKU, Univ Nat Resour & Appl Life Sci, Dept IFA, Austria CIMMYT, Mexico Univ Minnesota, Dept Agron & Plant Genet, USA	Buerstmayr H, Ban T, Anderson JA. 2008. QTL mapping and marker-assisted selection for Fusarium head blight resistance in wheat. Cereal Res Commun 36(Supl. B): 1-3.
297.	Wheat	Fusarium head blight	Canada	Univ Manitoba, Dept Plant Sci Agric & Agri-Food Canada, Cereal Res Ctr	Cuthbert PA, Somers DJ, Brulé-Babel A. 2007. Mapping of *Fhb2* on chromosome 6BS: a gene controlling Fusarium head blight field resistance in bread wheat (*Triticum aestivum* L.). Theor Appl Genet 114(3): 429-37.
298.	Wheat	Fusarium head blight	Canada	Agric & Agri-Food Canada: Cereal Res Ctr, Eastern Cereals Oilseeds Res Ctr, Semiarid Prairie Agricul Res	McCartney CA, Somers DJ, Fedak G et al. 2007. The evaluation of FHB resistance QTLs introgressed into elite Canadian spring wheat germplasm. Mol Breeding 20(3): 209-21.
299.	Wheat	Fusarium head blight	China Australia	Jiangsu Acad Agricul Sci, Inst Biotechnol, China CAS, Inst Crop Sci, China PMB1, Mol Plant Breed CRC, Australia	Zhou MP, Hayden MJ, Zhang ZY et al. 2010. Saturation and mapping of a major Fusarium head blight resistance QTL on chromosome 3BS of Sumai 3 wheat. J Appl Genet 51(1): 19-25.
300.	Wheat	Fusarium head blight	China	Nanjing Agric Univ, Cytogenet Inst, Natl Key Lab Crop Genet & Germplasm Enhancement	Lang SP, Wang HY, Xu HY et al. 2008. Molecular marker-assisted selection of wheat germplasm with pyramided Fusarium head blight (*Gibberella zeae*) resistance and good HMW subunits for bread-making quality. J Tritic Crops 3: 415-18.
301.	Wheat	Fusarium head blight	China	Nanjing Agric Univ, Coll of Agron	Du JK, Yu GH, Wang Xiu E, Ma HX. 2010. Development and validation of a SSCP marker for Fusarium head blight resistance QTL region in wheat. J Tritic Crops 5: 829-834.

302. Wheat	Fusarium head blight	China	Jiangsu Acad Agricul Sci, Inst Biotechnol	M HX, Yao JB, Zhou MP et al. 2008. Molecular breeding for wheat Fusarium head blight resistance in China. Cereal Res Commun 36 (Suppl. B): 203-212.
303. Wheat	Fusarium head blight	China	Jiangsu Acad Agricul Sci, Inst Agrobiotechnol	Lu WZ, Ma HX, Zhang X et al. 2008. Application of molecular markers for marker-assisted selection on wheat Fusarium head blight resistance. Cereal Res Commun 36 (Suppl. B): 127-129.
304. Wheat	Fusarium head blight	Czech Republic	Crop Res Inst	Chrpova J, Sip V, Stockova L et al. 2010. Resistance sources against Fusarium head blight and their use in wheat breeding. Disease Resistance in Cereals (Proceedings): 21-29.
305. Wheat	Fusarium head blight	Czech Republic	SELGEN a.s. Res Ctr SELTON Ltd. Crop Res Inst	Horcicka P, Hanisova A, Rehorova K et al. 2010. Utilization of molecular markers in Czech wheat breeding programmes. 60. Jahrestagung der Vereinigung der Pflanzenzüchter und Saatgutkaufleute Österreichs 2009. 61-64.
306. Wheat	Fusarium head blight	Germany	JKI, Fed Res Ctr Cultivated Plants, Inst Resistance Res & Stress Tolerance	Perovic D, Forster J, Welz G et al. 2008. Marker-assisted wheat improvement: Creating semi-dwarf phenotypes with superior Fusarium head blight resistance. Cereal Res Commun 36(Suppl.B): 153-155.
307. Wheat	Fusarium head blight	Hungary	Cereal Res Non Profit Co Univ Szeged, Fac Sci & Informatics, Dept Plant Biol	Szabo-Hever A, Toth B, Lehoczki-Krsjak S, Mesterhazy A. 2008. Mapping of FHB resistance QTLs in the Mini Mano/Frontana and Frontana/Remus DH populations. Cereal Res Commun 36(Suppl. 6): 271-75.
308. Wheat	Fusarium head blight	Iran	Urmia Univ, Coll Agric	Hosseinzadeh AH, Bernousi I, Mardi M et al. 2009. Identification of SSR markers linked to QTL for Fusarium head blight resistance in wheat. Journal of Science and Technology of Agriculture and Natural Resources, Water and Soil Science 13(47): 669-76.
309. Wheat	Fusarium head blight	Austria Israel	BOKU, Univ Nat Resour & Appl Life Sci: Dept IFA Tulln, Inst Biotech in Plant Produc, Dep Appl Plant Sci and Plant Biotechnol, Austria Hebron Univ, Israël	Salameh A, Almaghrabi B, Buerstmayr H. 2008. Development and evaluation of winter wheat breeding lines carrying Fusarium head blight resistance QTL derived from spring wheat. 60. Jahrestagung der Vereinigung der Pflanzenzüchter und Saatgutkaufleute Österreichs 2009. 191.
310. Wheat	Fusarium head blight	USA	S Dakota State Univ, Dept Plant Sci	Rosyara UR, Gonzalez-Hernandez JL, Glover KD et al. 2009. Family-based mapping of quantitative trait loci in plant breeding populations with resistance to Fusarium head blight in wheat as an illustration. Theor Appl Genet 118(8): 1617-31.
311. Wheat	Fusarium head blight	USA Czech Republic France	Univ Minnesota, Dept Agron & Plant Genet, USA Kansas State Univ: USDA-ARS, Plant Pathol Dept, USA Inst. Experim Botany, Czech Republic URGV-INRA, France	Liu SX,. Pumphrey MO, Gill BS et al. 2008. Toward positional cloning of *Fhb1*, a major QTL for Fusarium head blight resistance in wheat. Cereal Res Commun 36(Suppl. 6): 195-201.
312. Wheat	Fusarium head blight	USA	Univ Minnesota, Dept Agron & Plant Genet	Anderson JA. 2007. Marker-assisted selection for Fusarium head blight resistance in wheat. Int J Food Microbiol 119(1-2): 51-53.

313. Wheat	Fusarium head blight	USA China	Kansas State Univ: Dept Plant Pathol; Dept Agron, USA JAAS, Plant Genet & Biotechnol, China USDA-ARS, Hard Winter Wheat Genet Res Unit, USA	Bernardo AN, Ma HX, Zhang DD, Bai GH. 2012. Single nucleotide polymorphism in wheat chromosome region harboring *Fhb1* for Fusarium head blight resistance. Mol Breeding 29(2): 477-88.
314. Wheat	Fusarium head blight	Mexico Norway China	CIMMYT, Global Wheat Program, Mexico Norwegian Univ Life Sci, Dept Plant & Environm Sci, Norway CIMMYT China Off, China	He XY, Singh PK, Schlang N et al. 2014. Characterization of Chinese wheat germplasm for resistance to Fusarium head blight at CIMMYT, Mexico. Euphytica 195(3): 383-95.
315. Wheat	Fusarium head blight	USA	North Dakota State Univ, Dept Plant Pathol, Heartland Plant Innovations Inc. USDA-ARS, Northern Crop Sci Lab North Dakota State Univ: Langdon Res Extension Ctr; Dept Plant Sci Univ Minnesota,Dept Plant Pathol	Chu C, Niu Z, Zhong S et al. 2011. Identification and molecular mapping of two QTLs with major effects for resistance to Fusarium head blight in wheat. Theor Appl Genet 123(7): 1107-119.
316. Wheat	Fusarium head blight	Canada Japan	Agric & Agri-Food Canada, Cereal Res Ctr, Canada Yokohama City Univ, Kihara Inst Biologic Res, T. Ban.Division Plant Genetic Resour Sci, Japan	Golkari S, Gilbert J, Ban T, Procunier JD. 2009. QTL-specific microarray gene expression analysis of wheat resistance to Fusarium head blight in Sumai-3 and two susceptible NILs. Genome 52(5): 409-18.
317. Wheat	Fusarium head blight	Germany Austria	Helmholtz Ctr Munich, Munich Information Ctr Protein Sequences, Inst Bioinformatics & Systems Biol, Germany Univ Natural Resour & Life Sci, Inst Biotechnol Plant Production, IFA-Tulln, Austria	Kugler KG, Siegwart G, Nussbaumer T et al. 2013. Quantitative trait loci-dependent analysis of a gene co-expression network associated with Fusarium head blight resistance in bread wheat (*Triticum aestivum* L.). BMC Genomics 14(1): 728.
318. Wheat	Fusarium head blight	USA China	Kansas State Univ, Wheat Genetic & Genomic Resour Ctr, Dept Plant Pathol, USA USDA-ARS, Plant Sci & Entomol Res Unit, USA Nanjing Agricul Univ, Natl Key Lab Crop Genet & Germplasm Enhancement, China	Qi LL, Pumphrey MO, Friebe B et al. 2008. Molecular cytogenetic characterization of alien introgressions with gene *Fhb3* for resistance to Fusarium head blight disease of wheat. Theor Appl Genet 117(7): 1155-66.
319. Wheat	Fusarium head blight	USA	Univ Kentucky. Dept Plant & Soil Sci USDA-ARS, Plant Sci Res Unit USDA-ARS, Soft Wheat Quality Lab	Balut AL, Clark AJ, Brown-Guedira G et al. 2013. Validation of *Fhb1* and *QFhs.nau-2DL* in several soft red winter wheat populations. Crop Sci 53(3): 934-45.
320. Wheat	Fusarium head blight	Austria Palestina	BOKU-Univ Natural Resour & Life Sci; Dept Agrobiotechnol, Austria Minist Agric, Natl Agricul Res Center (NARC) Jenin, Palestine	Buerstmayr M, Alimari A, Steiner B, Buerstmayr H. 2013. Genetic mapping of QTL for resistance to Fusarium head blight spread (type 2 resistance) in a *Triticum dicoccoides* x *Triticum durum* backcross-derived population. Theor Appl Genet 126(11): 2825-34.
321. Wheat	Fusarium head blight	Austria Netherlands USA	BOKU-Univ Natural Resour & Life Sci; Dept Agrobiotechnol, Austria Presse & Informationsdienst Agrarisches Informationszentrum (AIZ), Austria Rijk Zwaan Nederland B.V., Burgemeester Crezéelaan, Netherlands Kansas State Univ, Dept Plant Pathol, USA	Buerstmayr M, Huber K, Heckmann J et al. 2012. Mapping of QTL for Fusarium head blight resistance and morphological and developmental traits in three backcross populations derived from *Triticum dicoccum* x *Triticum durum*. Theor Appl Genet 125(8): 1751-65.

322. Wheat	Fusarium head blight	Argentina	CIRN, INTA, Inst Recursos Biológicos Univ. Nacional de Buenos Aires, Fac Agronomía, Cátedra de Genética	Cativelli M, Lewis S, Appendino ML. 2013. A Fusarium head blight resistance quantitative trait locus on chromosome 7D of the spring wheat cultivar Catbird. Crop Sci 53(4): 1464-71.
323. Wheat	Fusarium head blight	UK Germany Austria Hungary	JIC, Norwich Res Park, UK Natl Inst Agricul Botany (NIAB), UK Saaten-union Resistenzlabor GmbH, Germany Univ Natural Resour & Applied Life Sci, IFA-Tulln Biotechnol in Plant Production, Vienna Dept Agrobiotechnol,Austria Technical Univ Munich, Chair Plant Breed, Germany Cereal Res Non-profit Co.: Dept Biotechnol & Resistance Res; Wheat Breed Dept, Hungary	Draeger R, Gosman N, Steed A et al. 2007. Identification of QTLs for resistance to Fusarium head blight, DON accumulation and associated traits in the winter wheat variety Arina. Theor Appl Genet 115(5): 617-25.
324. Wheat	Fusarium head blight	USA Canada Australia	North Dakota State Univ: Dept Plant Sci; Dept Plant Pathol, USA Univ Guelph, Ctr Genetic Improv Livestock, Canada Grains Res & Develop Corporation (GRDC), Australia	Ghavami F, Elias EM, Mamidi S et al. 2011. Mixed model association mapping for Fusarium head blight resistance in Tunisian-derived durum wheat populations. G3: Genes, Genomes, Genetics 1(3): 209-18.
325. Wheat	Fusarium head blight	Germany	Bavarian State Res Ctr Agric, Inst Crop Sci & Plant Breed Saatzucht Josef Breun GdbR	Haberle J, Holzapfel J, Schweizer G, Hartl L. 2009. A major QTL for resistance against Fusarium head blight in European winter wheat. Theor Appl Genet 119(2): 325-32.
326. Wheat	Fusarium head blight	France	CAAS, Inst Crop Sci,: Key Lab Crop Gene Resour & Germplasm Enhancement, Minist Agric; Natl Key Facility Crop Gene Resour & Genetic Improv; China INRA UMR 1095, Genet Diversity & Ecophysiol Cereals, France	Hao C, Wang Y, Hou J et al. 2012. Association mapping and haplotype analysis of a 3.1-Mb genomic region involved in Fusarium head blight resistance on wheat chromosome 3BS. Plos One 7(10): e46444.
327. Wheat	Fusarium head blight	Germany	Bavarian State Res Ctr Agric, Inst Crop Sci & Plant Breed Univ Hohenheim (720), State Plant Breed Inst KWS LOCHOW GmbH	Holzapfel J, Voss HH, Miedaner T et al. 2008. Inheritance of resistance to Fusarium head blight in three European winter wheat populations. Theor Appl Genet 117(7): 1119-28.
328. Wheat	Fusarium head blight	USA	Kansas State Univ, Dept Agron, USDA-ARS Hard Winter Wheat Genetic Res Unit Univ Minnesota, Dept Plant Pathol	Jayatilake DV, Bai GH, Dong YH. 2011. A novel quantitative trait locus for Fusarium head blight resistance in chromosome 7A of wheat. Theor Appl Genet 122 (6): 1189-1198
329. Wheat	Fusarium head blight	USA China Mexico	Michigan State Univ, Dept Crop & Soil Sci, USA Nanjing Agricul Univ, State Key Lab Crop Genet & Germplasm Enhancement, China Jiangsu Acad Agricul Sci, China CIMMYT Wheat Program, Mexico	Jiang GL, Shi J, Ward RW. 2007. QTL analysis of resistance to Fusarium head blight in the novel wheat germplasm CJ 9306. I. Resistance to fungal spread. Theor Appl Genet 116(1): 3-13.
330. Wheat	Fusarium head blight	USA China Mexico	Michigan State Univ, Dept Crop & Soil Sci, USA Nanjing Agricul Univ, State Key Lab Crop Genet & Germplasm Enhancement, China Univ Minnesota, Dept Plant Pathol, USA Jiangsu Acad Agricul Sci, China CIMMYT Wheat Program, Mexico	Jiang GL, Dong Y, Shi J, Ward RW. 2007. QTL analysis of resistance to Fusarium head blight in the novel wheat germplasm CJ 9306. II. Resistance to deoxynivalenol accumulation and grain yield loss. Theor Appl Genet 115(8): 1043-52.
331. Wheat	Fusarium head	Germany France	Leibniz Inst Plant Genet & Crop Plant Res (IPK) , Germany	Kollers S, Rodemann B, Ling J et al. 2013. Whole genome association mapping of Fusarium head blight resistance in European winter wheat

	blight		JKI, Germany KWS LOCHOW GmbH, Germany Syngenta Seeds S.A.S.,France Syngenta Seeds GmbH, Germany TraitGenet GmbH, Germany	(*Triticum aestivum* L.). Plos One 8(2): e57500.
332. Wheat	Fusarium head blight	USA	North Dakota State Univ: Dept Plant Sci; Dept Plant Pathol USDA-ARS, Cereal Crops Res Unit, Northern Crop Sci Lab	Kumar S, Stack RW, Friesen TL, Faris JD. 2007. Identification of a novel Fusarium head blight resistance quantitative trait locus on chromosome 7A in tetraploid wheat. Phytopathology 97(5): 592-97.
333. Wheat	Fusarium head blight	China USA	Yangzhou Univ: Jiangsu Provincial Key Lab Crop Genet Physiology; Key Lab Plant Functional Genom Minist Educ, China Kansas State Univ: Dept Plant Pathol; Dept Agron, USA USDA-ARS, Hard Winter Wheat Genet Res Unit, USA	Li T, Bai G, Wu S, Gu S. 2011. Quantitative trait loci for resistance to Fusarium head blight in a Chinese wheat landrace Haiyanzhong. Theor Appl Genet 122(8): 1497-502.
334. Wheat	Fusarium head blight	USA Canada	Univ Missouri-Columbia, Division Plant Sci, USA Agric & Agri-Food Canada, Greenhouse Processing Crop Res Ctr, Canada North Dakota State Univ, Dept Plant Sci, USA	Liu S, Abate ZA, Lu H et al. 2007. QTL associated with Fusarium head blight resistance in the soft red winter wheat Ernie. Theor Appl Genet 115(3): 417-27.
335. Wheat	Fusarium head blight	USA	Virginia Tech: Dept Crop & Soil Environm Sci; Dept Plant Pathol, Physiol & Weed Sci Texas A&M Univ System, Texas A&M AgriLife Res & Extension Ctr Limagrain Cereal Seeds Univ Missouri, Dept Plant Sci Univ Idaho Aberdeen Res & Extension Ctr, Dept Agron USDA-ARS, Eastern Regional Small Grains Genotyping Lab Univ Kentucky, Dept Plant & Soil Sci	Liu S, Griffey CA, Hall MD et al. 2013. Molecular characterization of field resistance to Fusarium head blight in two US soft red winter wheat cultivars. Theor Appl Genet 126(10): 2485-98.
336. Wheat	Fusarium head blight	Belgium	Walloon Agricul Res Ctr, Life Sci Dept Catholic Univ Louvain, Inst Life Sci	Muhovski Y, Batoko H, Jacquemin JM. 2012. Identification, characterization and mapping of differentially expressed genes in a winter wheat cultivar (Centenaire) resistant to *Fusarium graminearum* infection. Mol Biol Rep 39(10): 9583-600.
337. Wheat	Fusarium head blight	Iran	Shahed Univ Tehran, Dep Agron & Crop Breed	Naji AM, Moghaddam M, Ghaffari MR et al. 2008. Validation of EST-derived STS markers localized on *Qfhs.ndsu-3Bs* for Fusarium head blight resistance in wheat using a 'Wangshuibai' derived population. J Genet Genomics 35(10): 625-29.
338. Wheat	Fusarium head blight	Canada	Univ Saskatchewan, Crop Development Ctr & Dept Plant Sci Agric & Agri-Food Canada, Soils & Crops Res & Development Ctr	Ruan Y, Comeau A, Langevin F et al. 2012. Identification of novel QTL for resistance to Fusarium head blight in a tetraploid wheat population. Genome 55(12): 853-64.
339. Wheat	Fusarium head blight	China Japan	Jiangsu Acad Agricul Sci, China Japan Internatl Res Ctr Agricul Sci (JIRCAS), Biologic Resour Division	Shi JR, Xu DH, Yang HY et al. 2008. DNA marker analysis for pyramided of Fusarium head blight (FHB) resistance QTLs from different germplasm. Genetica 133(1): 77-84.
340. Wheat	Fusarium head blight	Australia China Japan	CSIRO Plant Ind, Queensland Biosci Precinct, Australia Minis Educ, Jiangxi Agricul Univ, Key Lab Crop Physiol, Ecol & Genetic Breed, China	Li HB, Xie GQ, Ma J et al. 2010. Genetic relationships between resistances to Fusarium head blight and crown rot in bread wheat (*Triticum aestivum* L.). Theor Appl Genet 121(5): 941-50.

			Minist Agric, Key Lab Physiol, Eco & Cultivation Double Cropping Rice, China Univ Western Australia, Fac Natural & Agricul Sci, School of Plant Biol, Australia Hebei Agricul Univ, Fac Agric, China Yokohama City Univ, Kihara Inst Biologic Res, Japan	
341. Wheat	Fusarium head blight	UK	JKI, Norwich Res Park, Crop Genet Natl Inst Agricul Botany (NIAB)	Srinivasachary, Gosman N, Steed A et al. 2008. Susceptibility to Fusarium head blight is associated with the *Rht-D1b* semi-dwarfing allele in wheat. Theor Appl Genet 116(8): 1145-53.
342. Wheat	Fusarium head blight	Japan	Hokkaido Res Organization: Agricul Res Dept: Chuo Agricul Experim Stn; Kitami Agricul Experiment Stn Sato Professional Engineer's Off	Suzuki T, Sato M, Takeuchi T. 2012. Evaluation of the effects of five QTL regions on Fusarium head blight resistance and agronomic traits in spring wheat (*Triticum aestivum* L.). Breed Sci 62(1): 11-17.
343. Wheat	Fusarium head blight	USA	USDA-ARS, Northern Crop Sci Lab	Jauhar PP, Peterson TS, Xu SS. 2009. Cytogenetic and molecular characterization of a durum alien disomic addition line with enhanced tolerance to Fusarium head blight. Genome 52 (5): 467-83.
344. Wheat	Fusarium head blight	USA	USDA-ARS, Northern Crop Sci Lab	Jauhar PP, Peterson TS. 2013. Synthesis and characterization of advanced durum wheat hybrids and addition lines with *Thinopyrum* chromosomes. J Hered 104(3): 428-36.
345. Wheat	Fusarium head blight	China	Nanjing Agricul Univ, Natl Key Lab Crop Genet & Germplasm Enhancement, Cytogenet Inst Jiangsu Acad Agricul Sci Yangzhou Acad Agricul Sci	Wang L, Yuan J, Bie T et al. 2009. Cytogenetic and molecular identification of three *Triticum aestivum-Leymus racemosus* translocation addition lines. J Genet Genomics 36(6): 379-85.
346. Wheat	Fusarium head blight	China	Nanjing Agricul Univ: Appl Plant Genom Lab Crop Genom & Bioinformatics Centre; Natl Key Lab Crop Genet and Germplasm Enhancement; Coll Agricul Sci	Xue S, Li G, Jia H et al. 2010. Fine mapping *Fhb4*, a major QTL conditioning resistance to Fusarium infection in bread wheat (*Triticum aestivum* L.). Theor Appl Genet 121(1): 147-56.
347. Wheat	Fusarium head blight	Germany	Univ Hohenheim, State Plant Breed Inst Technical Univ Munich, Plant Breed KWS LOCHOW GmbH Bavarian State Res Ctr Agricul, Inst Crop Sci & Plant Breed	Wilde F, Schon CC, Korzun V et al. 2008. Marker-based introduction of three quantitative-trait loci conferring resistance to Fusarium head blight into an independent elite winter wheat breeding population. Theor Appl Genet 117(1): 29-35.
348. Wheat	Fusarium head blight	China	Nanjing Agricul Univ, Crop Genom & Bioinformatics Ctr & Natl Key Lab Crop Genet & Germplasm Enhancement	Xue S, Xu F, Tang M et al. 2011. Precise mapping *Fhb5*, a major QTL conditioning resistance to Fusarium infection in bread wheat (*Triticum aestivum* L.). Theor Appl Genet 123(6): 1055-63.
349. Wheat	Fusarium head blight	China USA	Shanghai Jiao Tong Univ: Plant Biotechnol Res Ctr; Fudan-SJTU-Nottingham Plant Biotechnol R&D Ctr; School Agric & Biol, China Jiangsu Acad Agricul Sci, Inst Agricul Biotechnol, China USDA-ARS, Plant Sci & Entomol Res Unit, USA	Yu GH, Ma HX, Bai GH, Tang KX. 2008. Single-strand conformational polymorphism markers associated with a major QTL for Fusarium head blight resistance in wheat. Mol Biol (Mosk) 42(4): 571-80.
350. Wheat	Fusarium head blight	USA	Kansas State Univ, Dept Agron USDA-ARS, Plant Sci & Entomol Res Unit Univ Alberta, Dept Biologic Sci Univ Minnesota, Dept Plant Pathol	Yu JB, Bai GH, Zhou WC et al. 2008. Quantitative trait loci for Fusarium head blight resistance in a recombinant inbred population of Wangshuibai/Wheaton. Phytopathology 98(1): 87-94.

			Univ Illinois,Dept Crop Sci	
351. Wheat	Fusarium head blight	USA	North Dakota State Univ, DeptPlant Sci	Zhang G, Mergoum M. 2007. Molecular mapping of kernel shattering and its association with Fusarium head blight resistance in a Sumai3 derived population. Theor Appl Genet 115(6): 757-66.
352. Wheat	Fusarium head blight	China	Sichuan Agricul Univ: Dept Plant Pathol; State Key Lab Plant Breed & Genetics	Zhang M, Zhang R, Yang J, Luo P. 2010. Identification of a new QTL for Fusarium head blight resistance in the wheat genotype "Wang shui-bai". Mol Biol Rep 37(2): 1031-35.
353. Wheat	Fusarium head blight	China USA	Jilin Univ, Coll Plant Sci Kansas State Univ, Dept Agron, USA USDA-ARS, Hard Winter Wheat Genet Res Unit, USA	Zhang X, Pan H, Bai G. 2012. Quantitative trait loci responsible for Fusarium head blight resistance in Chinese landrace Baishanyuehuang. Theor Appl Genet 125(3): 495-502.
354. Wheat	Fusarium head blight	USA	South Dakota State Univ, Dept Biol & Microbiol	Zhuang Y., Gala A, Yen Y. 2013. Identification of functional genic components of major Fusarium head blight resistance quantitative trait loci in wheat cultivar Sumai 3. Mol Plant Microbe Interact 26(4): 442-50.
355. Wheat	Fusarium head blight	Belgium India	Inst Agricul & Fisheries Res (ILVO) – Plant, Growth & Development, Belgium Natl Chemical Lab, India Ghent Univ, Fac Biosci Engineer, Dept Plant Production, Belgium	Zwart RS, Muylle H, van Bockstaele E, Roldan-Ruiz I. 2008. Evaluation of genetic diversity of Fusarium head blight resistance in European winter wheat. Theor Appl Genet 117(5): 813-28.
356. Wheat	Crown rot	Australia	Univ Southern Queensland, Fac Sci, Ctr Systems Bio Univ of Adelaide, Waite Campus, School Agric, Food & Wine Leslie Res Ctr, Dept Employment, Economic Develop & Innovation	Bovill WD, Horne M, Herde D et al. 2010. Pyramiding QTL increases seedling resistance to crown rot (*Fusarium pseudograminearum*) of wheat (*Triticum aestivum*). Theor Appl Genet 121(1): 127-36.
357. Wheat	Crown rot	Australia China	CSIRO Plant Ind, Australia Univ Western Australia, School Plant Biol, Australia Agricul Univ Hebei, Coll Life Sci, China Jiangsu Acad Agricul Sci, Inst Biotechnol, China Sichuan Agricul Univ, Minist Educ, Key Lab Crop Genetic Resour & Improv, China	Ma J, Li HB, Zhang CY et al. 2010. Identification and validation of a major QTL conferring crown rot resistance in hexaploid wheat. Theor Appl Genet 120(6): 1119-28.
358. Wheat	Crown rot	USA Australia	Washington State Univ, Dept Crop & Soil Sci, USA South Australian Res & Development Inst (SARDI), Australia Oregon State Univ, Columbia Basin Agricul Res Ctr, USA USDA-ARS: Dept Plant Pathol; Dept Crop & Soil Sci, USA	Poole GJ, Smiley RW, Paulitz TC et al. 2012. Identification of quantitative trait loci (QTL) for resistance to Fusarium crown rot (*Fusarium pseudograminearum*) in multiple assay environments in the Pacific Northwestern US. Theor Appl Genet 125(1): 91-107.
359. Wheat	Fusarium head blight Powdery mildew	Norway	Norwegian Univ of Life Sci, Dept. of Plant & Environm Sci	Lu QX. 2011. Partial resistance to Fusarium head blight and powdery mildew in wheat. PhD thesis. Norwegian University of Life Sciences. 127pp.
360. Wheat	Fusarium head blight Powdery mildew Rusts	Israel Canada	Univ of Haifa, Inst Evol, Israel Univ Guelph, Dept Environ Biol, Canada	Xie WL, Nevo E. 2008. Wild emmer: genetic resources, gene mapping and potential for wheat improvement. Euphytica 164(3): 603-14.
361. Wheat	Powdery mildew	Norway	Norwegian Univ Life Sci, Dept Plant & Environm Sci, Norway	Lillemo M, Asalf B, Singh RP et al. 2008. The adult plant rust resistance

			Mexico China	CIMMYT, Mexico Campo Experim Valle Mexico INIFAP, Mexico CAAS, Inst Crop Sci/Natl Wheat Improv Ctr, China CIMMYT China Off, China	loci *Lr34*/*Yr18* and *Lr46*/*Yr29* are important determinants of partial resistance to powdery mildew in bread wheat line saar Theor Appl Genet 116(8): 1155-66.
362.	Wheat	Powdery mildew	China	Northwest A&F Univ, Coll Agron, State Key Lab Crop Stress Biol Arid Areas	Xue F, Ji WQ, Wang CY et al. 2012. High-density mapping and marker development for the powdery mildew resistance gene *PmAS846* derived from wild emmer wheat (*Triticum turgidum* var. *dicoccoides*). Theor Appl Genet 124(8): 1549-60.
363.	Wheat	Powdery mildew	China	Nanjing Agric Univ, Coll Agric Sci, Crop Genom & Bioinformatics Ctr & Natl Key Lab of Crop Genet & Germplasm Enhancement, Applied Plant Genom Lab	Xu HX, Yao GQ, Xiong L et al. 2008. Identification and mapping of *pm2026*: a recessive powdery mildew resistance gene in an einkorn (*Triticum monococcum* L.) accession. Theor Appl Genet 117(4): 471-77.
364.	Wheat	Powdery mildew	China	Sichuan Agric Univ, State Key Lab Plant Breed & Genet Univ Electronic Sci & Technol of China, School of Life Sci & Technol Shanxi Acad Agric Sci, Inst Crop Genet	Luo PG, Luo HY, Chang ZJ et al. 2009. Characterization and chromosomal location of *Pm40* in common wheat: a new gene for resistance to powdery mildew derived from *Elytrigia intermedium*. Theor Appl Genet 118(6): 1059-64.
365.	Wheat	Powdery mildew	China	China Agric Univ, Dept Plant Genet & Breed Minist Agric: State Key Lab Agrobiotechnol; Key Lab Crop Genom & Genetic Improv Minist Educ: Beijing Key Lab Crop Genetic Improv; Key Lab Crop Heterosis Res & Utilization	Li GQ, Fang TL, Zhu J et al. 2009. Molecular identification of a powdery mildew resistance gene from common wheat cultivar Brock. Acta Agron Sin 35(9): 1613-19.
366.	Wheat	Powdery mildew	China	Shihezi Univ, Coll Agric Sci	Huang QH, Jing RL, Wu XY et al. 2008. QTL mapping for adult-plant resistance to powdery mildew in common wheat. Sci Agric Sin 8: 2528-36.
367.	Wheat	Powdery mildew	China	China Agric Univ, Min Agric, State Key Lab Agrobiotechnol, Key Lab Crop Genom & Genetic Improv	Hua W, Guo X, Zhu J et al. 2010. Identification and genetic mapping of powdery mildew resistance gene *MLW E27* in common wheat introgressed from *Triticum dicoccoides*. Nong ye sheng wu ji shu xue bao = Journal of Agricultural Biotechnology 18(1): 3-9.
368.	Wheat	Powdery mildew	China	China Agric Univ, Dept Plant Genet & Breed, State Key Lab Agrobiotechnol, Key Lab Crop Genom & Genetic Improv, Mnist Agric Beijing Univ Agric, Coll Plant Sci & Technol	Han J, Zhang LS, Li GQ et al. 2009. Molecular mapping of powdery mildew resistance gene *MlWE18* in wheat originated from wild emmer (*Triticum turgidum* van *dicoccoides*). Acta Agron Sin 35(10): 1791-97.
369.	Wheat	Powdery mildew	China	CAAS, State Key Lab Biol Plant Dis & Insect Pests, Inst Plant Protect, China Northwest A&F Univ, Coll Agron, China	Xue F, Zhai WW, Duan XY et al. 2009. Microsatellite mapping of powdery mildew resistance gene in wheat landrace Xiaobaidong. Acta Agron Sin 35(10): 1806-11.
370.	Wheat	Powdery mildew	China Canada	Lanzhou Univ, Key Lab Arid & Grassl& Ecol of Minist Educ, China Henan Acad Agr Sci, Inst Plant Protect, China Univ Manitob, Dept Plant Sci, Canada	Yi YJ, Li HY, Huang XQ et al. 2008. Development of molecular markers linked to the wheat powdery mildew resistance gene *Pm4b* and marker validation for molecular breeding. Plant breeding 127(2): 116-20.
371.	Wheat	Powdery mildew	China	Henan Acad Agricul Sci, Inst Plant Protect, China Northwest A&F Univ, Key Lab Plant Protect Resour & Pest Management Minist Educ Shaanxi Key Lab Mol Biol Agric	Wang JM, Liu HY, Wang F et al. 2007. Identification of a microsatellite marker linked with powdery mildew resistance gene *Pm6* in wheat. Acta Phytopath Sinica 3: 329-32.

372. Wheat	Powdery mildew	China	Henan Univ Sci & Technol , Coll Agric Shandong Agric Univ, Tai'an Subctr of Natl Wheat Improv Ctr, State Key Lab Crop Biol	Wang LM, Zhu YL, Li XF, Wang HG. 2011. Screening for SSR markers linked to wheat powdery mildew resistance gene *Pm2*. Journal of Plant Protection 3: 216-220.
373. Wheat	Powdery mildew	China	CAS: Ctr Agricul Resour Res, Inst Genet & Develop Biol (IGDB); State Key Lab Plant Cell & Chromosome Engineer, IGDB CAAS: State Key Lab Biol Plant Dis & Insect Pests, Inst Plant Protection; Inst Crop Sci, Natl Key Facility Crop Gene Resour & Genet Improv	An D, Zheng Q, Zhou Y et al. 2013. Molecular cytogenetic characterization of a new wheat-rye 4R chromosome translocation line resistant to powdery mildew. Chromosome Res 21(4): 419-32.
374. Wheat	Powdery mildew	Italy Spain	Consiglio Ricerca & Sperimentazione Agricoltura - Cereal Res Ctr, Italy Univ Bari, Dept Agro-Forestry & Environm Biol & Chem, Italy CSIC, Inst Sustainable Agric, Spain	Marone D, Russo MA, Laido G et al. 2013. Genetic basis of qualitative and quantitative resistance to powdery mildew in wheat: From consensus regions to candidate genes. BMC Genomics 14
375. Wheat	Powdery mildew	Germany	Bavarian State Res Ctr Agric, Inst Crop Sci & Plant Breed Secobra Saatzucht GmbH	Mohler V, Bauer C, Schweizer G et al. 2013. *Pm50*: a new powdery mildew resistance gene in common wheat derived from cultivated emmer. J Appl Genet 54(3): 259-63.
376. Wheat	Powdery mildew	China	Tianjin Normal Univ, Coll Chem & Life Sci, Tianjin Key Lab Cyto-genetical & Mol Regulation	Wang Y, Zhu J, Zhao HM et al. 2008. Screening and identification of the AFLP markers linked to a new powdery mildew resistance gene in wheat cultivar Brock. Fen Zi Xi Bao Sheng Wu Xue Bao (=Journal of Molecular cell Biology) 41(4): 294-300.
377. Wheat	Powdery mildew	China	CAAS, Natl Key Facility Crop Gene Resour & Genet Improv (NFCRI), Inst Crop Sci Henan Univ Sci & Technol, Forestry Coll CAS, Ctr Agricul Resour Res, Inst Genet & Developmen Biol	Xiao M, Song F, Jiao J et al. 2013. Identification of the gene *Pm47* on chromosome 7BS conferring resistance to powdery mildew in the Chinese wheat landrace Hongyanglazi. Theor Appl Genet 126(5): 1397-403.
378. Wheat	Powdery mildew	China	CAAS, Inst Crop Sci, Nat Key Facility Crop Gene Resour & Genetic Improv (NFCRI) Hebei Normal Univ Sci & Technol, Coll Life Sci & Technol Guilin Medical Univ, Coll Biotechnol	Zhao Z, Sun H, Song W et al. Genetic analysis and detection of the gene *MlLX99* on chromosome 2BL conferring resistance to powdery mildew in the wheat cultivar Liangxing 99. Theor Appl Genet 126(12): 3081-89.
379. Wheat	Powdery mildew Stripe rust	China	CAAS: Inst Crop Sci, Natl Wheat Improv Ctr; Natl Key Facility Crop Gene Resour & Genetic Improv; Inst Plant Protection CIMMYT China Off	Liu D, Xia X, He Z, Xu S. 2008. A novel homeobox-like gene associated with reaction to stripe rust and powdery mildew in common wheat. Phytopathology 98(12): 1291-96.
380. Wheat	Powdery mildew Fusarium head blight	China	Sichuan Agric Univ, Dept Plant Protect	Song W, Zhang M, Yang JZ et al. 2010. Pyramiding resistance to powdery mildew and Fusarium head blight (FHB) by molecular marker-assisted selection (MAS). Acta Phytopath Sinica 6: 655-658.
381. Wheat	Powdery mildew Barley yellow dwarf virus Rusts Common bunt Fusarium head blight Foliar diseases	Romania	NARDI Fundulea	Ittu M, Saulescu NN, Ittu G. 2007. Main objectives and results in breeding wheat for resistance to diseases at NARDI Fundulea. Analele Institutului Naţional de Cercetare-Dezvoltare Agricolă Fundulea 74: 23-27.
382. Wheat	Septoria leaf blotch	Romania	Univ Agric Sci & Veterinary Medicine	Curticiu DM, Botez C, Laura C, Meda L. 2007. Marker assisted selection for *Septoria tritici* resistance of common wheat. Buletin USAMV-CN

				63:311.
383. Wheat	Septoria leaf blotch	Romania	Univ Agric Sci & Veterinary Medicine	Botez C, Pamfil D, Curticiu D et al. 2009. Marker assisted selection for *Septoria tritici* resistance in wheat dihaploid lines. Not Bot Hort Agrobot Cluj 37(1): 253-55.
384. Wheat	Septoria leaf blotch	Netherlands France	Plant Res Internatl, Biointeractions & Plant Health, Netherlands Graduate School Experim Plant Sci, Netherlands Bioplante, France Florimond Desprez, France Serasem, France Wageningen Univ, Laboratory Plant Breed, Netherlands	Ghaffary SM, Robert O, Laurent V et al. 2011. Genetic analysis of resistance to *Septoria tritici* blotch in the French winter wheat cultivars Balance and Apache. Theor Appl Genet 123(5): 741-54.
385. Wheat	Take-all	China	Sichuan Agricul Univ: Triticeae Res Inst; Minist Educ, Key Lab Crop Genet Resour & Improv	Kang HY, Zhang HQ, Fan X, Zhou YH. 2008. Morphological and cytogenetic studies on the hybrid between bread wheat and *Psathyrostachys huashanica* Keng ex Kuo. Euphytica 162(3): 441-48.
386. Wheat	Take-all	Ukraine	Natl Acad Sci, Inst Plant Physiol & Genet	Bavol AV, Dubrovna OV. 2009. Molecular-genetic polymorphism of cellular lines of wheat resistant to cultural filtrate *Gaeumannomyces graminis* var. *tritici* and plant-regenerants from them. Tsitol Genet 43(5): 28-34.
387. Wheat	Eyespot	China France	CAS: NW Inst Plateau Biol; Grad Univ, China Qinghai Normal Univ, Coll Biol & Geog Sci, China INRA AgroCampus Ouest, UMR Ameliorat Plantes & Biotechnol Vegetales 118, France	Wei L, Muranty H, Zhang HG. 2011. Advances and prospects in wheat eyespot research: Contributions from genetics and molecular tools. J Phytopathol 159(7-8): 457-70.
388. Wheat	Eyespot	Germany	Fed Res Ctr Cultivated Plants, JKI, Inst Resistance Res & Stress Tolerance KWS LOCHOW GmbH JustusLiebig Univ Giessen, Dept Plant Breed, Res Ctr Bio Syst Land Resour & Nutr (IFZ)	Meyer N, Lind V, Heindorf M et al. 2011. Diagnostic value of molecular markers linked to the eyespot resistance gene *Pch1* in wheat. Euphytica 177(2): 267-75.
389. Wheat	Eyespot	USA	Washington State Univ, Dept Plant Pathol USDA-ARS, Wheat Genet Qual Physiol & Dis Res Unit	Sheng HY, See DR, Murray TD. 2012. Mapping QTL for resistance to eyespot of wheat in *Aegilops longissima*. Theor Appl Genet 125(2): 355-66.
390. Wheat	Eyespot	UK	John Innes Ctr	Burt C, Nicholson P. 2011. Exploiting co-linearity among grass species to map the *Aegilops ventricosa*-derived *Pch1* eyespot resistance in wheat and establish its relationship to *Pch2*. Theor Appl Genet 123(8): 1387-1400.
391. Wheat	Eyespot	UK	John Innes Ctr RAGT Seeds Ltd.	Burt C, Hollins TW, Nicholson P. 2011. Identification of a QTL conferring seedling and adult plant resistance to eyespot on chromosome 5A of Cappelle Desprez. Theor Appl Genet 122(1): 119-28.
392. Wheat	Eyespot	UK	John Innes Ctr RAGT Seeds Ltd.	Burt C, Hollins TW, Powell N, Nicholson P. 2010. Differential seedling resistance to the eyespot pathogens, *Oculimacula yallundae* and *Oculimacula acuformis*, conferred by *Pch2* in wheat and among accessions of *Triticum monococcum*. Plant Pathology 59 (5): 819-28.
393. Wheat	Eyespot	UK	John Innes Ctr	Chapman NH, Burt C, Nicholson P. 2009. The identification of candidate genes associated with *Pch2* eyespot resistance in wheat using cDNA-

				AFLP. Theor Appl Genet 118(6): 1045-57.
394. Wheat	Eyespot	UK	John Innes Ctr	Chapman NH, Burt C, Dong H, Nicholson P. 2008. The development of PCR-based markers for the selection of eyespot resistance genes *Pch1* and *Pch2*. Theor Appl Genet 117(3): 425-33.
395. Wheat	Eyespot	USA	Oregon State Univ, Dept Crop & Soil Sci Univ Idaho, Dept Plant Soil & Entomol Sci Washington State Univ: Dept Crop & Soil Sci; USDA-ARS	Leonard JM, Watson CJW, Carter AH et al. 2008. Identification of a candidate gene for the wheat endopeptidase *Ep-D1* locus and two other STS markers linked to the eyespot resistance gene *Pch1*. Theor Appl Genet 116(2): 261-70.
396. Wheat	Tan spot	USA	N Dakota State Univ: Dept Plant Pathol, NDSU Dept 7660 ; Dept Plant Sci, NDSU Dept 7670 Univ California, Dept Plant Pathol, Davis, c/o U.S. Agric Res Stn USDA-ARS, Small Grains & Potato Germplasm Res Unit	Gurung S, Mamidi S, Bonman JM et al. 2011. Identification of novel genomic regions associated with resistance to *Pyrenophora tritici-repentis* races 1 and 5 in spring wheat landraces using association analysis. Theor Appl Genet 123(6): 1029-41.
397. Wheat	Tan spot	China Australia	CSIRO Plant Ind, Queensland Biosci Precinct, Australia Jiangsu Acad Agricul Sci, Inst Food Crops, China Hebei Agricul Univ, Fac Agric, Baoding, China	Li HB, Yan W, Liu GR et al. 2011. Identification and validation of quantitative trait loci conferring tan spot resistance in the bread wheat variety Ernie. Theor Appl Genet 122(2): 395-403.
398. Wheat	Tan spot	USA	USDA-ARS, No Crop Sci Lab, NPA, NCSL N Dakota State Univ: Genom & Bioinformat Program; Dept Plant Sci	Faris JD, Abeysekara NS, McClean PE et al. 2012. Tan spot susceptibility governed by the *Tsn1* locus and race-nonspecific resistance quantitative trait loci in a population derived from the wheat lines Salamouni and Katepwa. Mol Breeding 30(4): 1669-78.
399. Wheat	Tan spot	Mexico Germany	CIMMYT, Mexico Tech Univ Munich, Inst Plant Breed, Germany	Tadesse W, Schmolke M., Hsam SLK et al. 2010. Chromosomal location and molecular mapping of a tan spot resistance gene in the winter wheat cultivar Red Chief. J Appl Genet 51(3): 235-42.
400. Wheat	Tan spot	USA	Kansas State Univ: USDA-ARS, Hard Winter Wheat Genet Res Unit; Dept Agron; Dept Plant Pathol	Sun XC, Bockus W, Bai GH. 2010. Quantitative trait loci for resistance to P*yrenophora tritici-repentis* race 1 in a Chinese wheat. Phytopathology 100(5): 468-73.
401. Wheat	Tan spot	Mexico USA	CIMMYT, Mexico N Dakota State Univ: Dept Plant Pathol, NDSU Dept 7660; Dept 7670, Dept Plant Sci, USA	Singh PK, Mergoum M, Adhikari TB et al. 2010. Genetic and molecular analysis of wheat tan spot resistance effective against *Pyrenophora tritici-repentis* races 2 and 5. Mol Breeding 25(3): 369-79.
402. Wheat	Tan spot	USA	N Dakota State Univ USDA-ARS, Small Grains & Potato Germplasm Res Unit	Gurung S, Bonman JM, Acevedo M, Adhikari TB. 2010. Genome wide association mapping of resistance to tan spot and spot blotch in spring wheat. Phytopathology 100 (6): S45-S45.
403. Wheat	Tan spot	USA	USDA-ARS, Cereal Crops Res Unit, No Crop Sci Lab N Dakota State Univ, Dept Plant Pathol	Chu CG, Chao S, Friesen TL et al. 2010. Identification of novel tan spot resistance QTLs using an SSR-based linkage map of tetraploid wheat. Mol Breeding 25(2): 327-38.
404. Wheat	Tan spot	USA India	Kansas State Univ: Dept Plant Pathol; USDA-ARS, USA Punjab Agrcul Univ, Dept Plant Breed Genet & Biotechnol, India	Singh S, Bockus WW, Sharma I et al. 2008. A novel source of resistance in wheat to *Pyrenophora tritici-repentis* race 1. Plant Dis 92(1): 91-95.
405. Wheat	Tan spot	USA Canada	N Dakota State Univ: Dept Plant Sci; Dept Plant Pathol, USA S Dakota State Univ, Dept Plant Sci, USA Univ Saskatchewan, Dept Plant Sci, Canada	Singh PK, Mergoum M, Gonzalez-Hernandez JL et al. 2008. Genetics and molecular mapping of resistance to necrosis inducing race 5 of *Pyrenophora tritici-repentis* in tetraploid wheat. Mol Breeding 21(3): 293-304.

406. Wheat	Tan spot	USA	USDA-ARS, No Crop Sci Lab N Dakota State Univ, Dept Plant Sci	Chu CG, Friesen TL, Xu SS, Faris JD. 2008. Identification of novel tan spot resistance loci beyond the known host-selective toxin insensitivity genes in wheat. Theor Appl Genet 117(6): 873-81.
407. Wheat	Tan spot	Germany	Tech Univ Munich, Inst Plant Breed	Tadesse W, Schmolke M, Hsam SLK et al. 2007. Molecular mapping of resistance genes to tan spot *Pyrenophora tritici-repentis* race 1 in synthetic wheat lines. Theor Appl Genet 114(5): 855-62.
408. Wheat	Tan spot	USA	USDA-ARS, Cereal Crops Res Unit, No Crop Sci Lab N Dakota State Univ, Dept Plant Pathol	Faris JD, Liu ZH, Xu SS. 2013. Genetics of tan spot resistance in wheat. Theor Appl Genet 126(9): 2197-17.
409. Wheat	Tan spot *Stagonospora nodorum* blotch	USA Canada Australia	USDA-ARS, Cereal Crops Res Unit, Northern Crop Sci Lab, USA N Dakota State Univ: Dept Plant Pathol; Dept Plant Sci, USA Agric & Agri-Food Canada, Cereal Res Ctr, Canada Throckmorton Plant Sci Ctr, USDA-ARS, Kansas State Univ, Plant Sci & Entomol Res Unit, Dept Plant Pathol, USA Murdoch Univ, Australian Ctr Necrotrophic Fungal Pathogens, Australia A6150, Australia	Faris JD, Zhang Z, Lu H et al. 2010. A unique wheat disease resistance-like gene governs effector-triggered susceptibility to necrotrophic pathogens. Proc Natl Acad Sci USA 107(30): 13544-49.
410. Wheat	Tan spot *Stagonospora nodorum* blotch	China USA	CAS: NW Plateau Inst Biol, Key Lab Adaptat & Evolut Plateau Biota; Inst Bot, State Key Lab Systemat & Evolutionary Bot, China Utah State Univ, USDA-ARS, Forage & Range Res Lab, USA	Dou QW, Lei YT, Li XM et al. 2012. Characterization of alien chromosomes in backcross derivatives of *Triticum aestivum* x *Elymus rectisetus* hybrids by using molecular markers and sequential multicolor fish/gish. Genome 55(5): 337-47.
411. Wheat	Tan spot *Stagonospora nodorum* blotch Septoria leaf blotch Fusarium head blight	USA Mexico	N Dakota State Univ: Dept Plant Sci, NDSU Dep 7670; Dept Plant Pathol, NDSU Dep 7660, USA CIMMYT, Mexico Mayville Univ, USA	Mergoum M, Singh PK, Frohberg RC et al. 2009. Registration of Steele-ND/ND 735 wheat recombinant inbred lines mapping population. J Plant Registr 3(3): 300-03.
412. Wheat	Tan spot Stripe rust Leaf rust Karnal bunt	Mexico India	CIMMYT, Mexico Univ Autonoma Chapingo, Mexico Punjab Agricul Univ, Dept Plant Breed Genet & Biotechnol, India	Sukhwinder S, Hernandez MV, Crossa J et al. 2012. Multi-trait and multi-environment QTL analyses for resistance to wheat diseases. PLoS One 7(6): e38008.
413. Wheat	Tan spot Septoria leaf blotch Stripe rust Leaf rust Stem rust 2 species of root-lesion nematode	Australia India	Queensland Primary Ind & Fisheries, Leslie Res Ctr, Dept Employment Econ Dev & Innovat, Australia Plant Mol Biol Unit, Biochemical Sci Division, Nat Chemical Lab, India Univ Sydney, Plant Breed Inst, Australia Wagga Wagga Agricul Inst, Primary Industries, Ind & Investment NSW, Australia	Zwart RS, Thompson JP, Milgate AW et al. 2010. QTL mapping of multiple foliar disease and root-lesion nematode resistances in wheat. Mol Breeding 26(1): 107-24.
414. Wheat	Hessian fly	USA	N Dakota State Univ: Dept Entomol; Dept Plant Sci USDA-ARS, No Crop Sci Lab	Yu GT, Wang T, Anderson KM et al. 2012. Evaluation and haplotype analysis of elite synthetic hexaploid wheat lines for resistance to hessian fly. Crop Sci 52(2): 752-63.
415. Wheat	Hessian fly	Spain	Ctr UdL IRTA	Sin E, Del Moral J, Hernandez P et al. 2011. Effects of the 4N(v) chromosome from *Aegilops ventricosa* on agronomic and quality traits in bread wheat. Czech J Genet Plant Breed 47: S63-S66.

416. Wheat	Hessian fly	USA	Purdue Univ: Dept Agron USDA-ARS, Crop Prod & Pest Control	Kong L, Ohm HW, Cambron SE, Williams CE. 2005. Molecular mapping determines that Hessian fly resistance gene *H9* is located on chromosome 1A of wheat. Plant Breeding 124(6): 525-31.
417. Wheat	Hessian fly	Republic of Korea USA	Korea Univ, Coll Life Sci & Biotechnol, Republic of Korea Univ Georgia, Dept Crop & Soil Sci, USA	Lee TG, Hong MJ, Johnson JW et al. 2009. Development and functional assessment of EST-derived 2RL-specific markers for 2BS.2RL translocations. Theor Appl Genet 119(4): 663-73.
418. Wheat	Hessian fly	USA	North Dakota State Univ: Dept Entomol, Dept Plant Sci, USDA-ARS, Western Regional Res Ctr Univ California, Dept Plant Sci USDA-ARS, Northern Crop Sci Lab, Univ Stn	Yu GT, Cai X, Harris MO et al. 2009. Saturation and comparative mapping of the genomic region harboring Hessian fly resistance gene *H26* in wheat. Theor Appl Genet 118 (8): 1589-99.
419. Wheat	Hessian fly	USA	USDA-ARS: Northern Crop Sci Lab; Crop Production & Pest Control Res Unit North Dakota State Univ: Dept Plant Sci; Dept Entomol	Xu SS, Chu CG, Harris MO, Williams CE. 2011. Comparative analysis of genetic background in eight near-isogenic wheat lines with different *H* genes conferring resistance to Hessian fly. Genome 54(1): 81-89.
420. Wheat	Hessian fly	USA	Univ Georgia: Dept Crop & Soil Sci; Dept Entomol Purdue Univ, USDA-ARS, Crop Production & Pest Control Res Unit, Dept Entomol	Hao YF, Cambron SE, Chen ZB et al. 2013. Characterization of new loci for Hessian fly resistance in common wheat. Theor Appl Genet 126(4): 1067-76.
421. Wheat	Hessian fly	China USA	Northwest A&F Univ, Coll Agron, China Kansas State Univ, Agron Dept, USA USDA-ARS: Hard Winter Wheat Genet Res Unit; Cereal Crops Res Unit, USA	Li CL, Chen MS, Chao SM et al. 2013. Identification of a novel gene, *H34*, in wheat using recombinant inbred lines and single nucleotide polymorphism markers. Theor Appl Genet 126 (8): 2065-71.
422. Wheat	Hessian fly	USA	Oklahoma State Univ, Dept Plant & Soil Sci Kansas State Univ,Dept Entomol USDA-ARS, Genom & Gene Discovery Res Unit	Tan CT, Carver BF, Chen MS et al. 2013. Genetic association of *OPR* genes with resistance to Hessian fly in hexaploid wheat. BMC Genomics 14: 369.
423. Wheat	Hessian fly Russian wheat aphid Sunn pest Wheat stem saw fly Cereal leaf beetle	Syria Australia	Univ Aleppo, Syria Int Ctr Agricul Res Dry Areas ICARDA, Syria Grains Res & Dev Corp, Australia	Joukhadar R, El-Bouhssini M, Jighly A, Ogbonnaya FC. 2013. Genome-wide association mapping for five major pest resistances in wheat. Mol Breeding 32(4): 943-60.
424. Wheat	Orange wheat blossom midge	USA	Montana State Univ: Dept Plant Sci & Plant Pathol; Dept Land Resour & Environm Sci NW Agricul Res Ctr	Blake NK, Stougaard RN, Weaver DK et al. 2011. Identification of a quantitative trait locus for resistance to *Sitodiplosis mosellana* (Gehin), the orange wheat blossom midge, in spring wheat. Plant Breeding 130(1): 25-30.
425. Wheat	Orange wheat blossom midge	Canada	Agric & Agri-Food Canada: Semiarid Prairie Agricul Res Ctr; Cereal Res Ctr; Lethbridge Res Ctr Univ Saskatchewan, Ctr Crop Dev	DePauw RM, Knox RE, Humphreys DG et al. 2011. New breeding tools impact Canadian commercial farmer fields. Czech J Genet Plant Breed 47: S28-S34 (Review)
426. Wheat	Hessian fly Orange wheat blossom midge	Canada	Agric & Agri-Food Canada, Semiarid Prairie Agricul Res Ctr	Clarke JM. 2007. Genetic enhancement of food safety attributes of durum wheat. Cereal Food World 52(4): 179-81 (Review)

427. Wheat	Barley yellow dwarf virus (BYDV)	Australia France	CSIRO Plant Ind, Australia Établissement national d'Enseignement supérieur agronomique Dijon (ENESAD), France	Ayala-Navarrete L, Tourton E, Mechanicos AA, Larkin PJ. 2009. Comparison of *Thinopyrum intermedium* derivatives carrying barley yellow dwarf virus resistance in wheat. Genome 52(6): 537-46.
428. Wheat	BYDV	China	CAAS, Natil Key Sci Facility Crop Gene Resour & Genetic Improv, Inst Crop Sci	Gao L, Ma Q, Liu Y et al. 2009. Molecular characterization of the genomic region harboring the BYDV-resistance gene *Bdv2* in wheat. J Appl Genet 50(2): 89-98.
429. Wheat	BYDV	China	CAAS, Natil Key Sci Facility Crop Gene Resour & Genetic Improv, Inst Crop Sci	Zhang Z, Lin Z, Xin Z. 2009. Research progress in BYDV resistance genes derived from wheat and its wild relatives. J Genet Genomics 36(9): 567-73 (Review)
430. Wheat	BYDV	Japan China	Tottori Univ, Fac Agric, Mol Genet Lab, Japan CAAS, Inst Crop Breed & Cultivation, China	Ma YZ, Tomita M. 2013. *Thinopyrum* 7Ai-1-derived small chromatin with Barley yellow dwarf virus (BYDV) resistance gene integrated into the wheat genome with retrotransposon. Cytology and Genetics 47(1): 1-7.
431. Wheat	Wheat dwarf virus BYDV	Czech Republic	Selgen a.s. SELTON Ltd. Crop Res Ins.	Veskrna O, Sedlacek T, Horcicka P et al. 2008. Reaction of selected BYDV-tolerant wheat genotypes to Czech PAV isolate. In: Molina-Cano J.L. et al. (eds.): Cereal science and technology for feeding ten billion people: genomics era and beyond. 173-74.
432. Barley	Barley leaf rust	USA	Virginia Polytech Inst & State Univ, Dept Crop & Soil Environm Sci	Mammadov JA, Brooks WS, Griffey CA. Saghai Maroof MA 2007. Validating molecular markers for barley leaf rust resistance genes *Rph5* and *Rph7*. Plant Breeding 126(5): 458-63.
433. Barley	Barley leaf rust	UK Netherlands	Scottish Crop Res Inst: Genet Programme; Biomathematics & Statistics Scotland (BioSS), UK Wageningen Univ, Graduate School Experim Plant Sci, Lab Plant Breed, Netherlands	Chen X, Hackett CA, Niks RE et al. 2010. An eQTL analysis of partial resistance to *Puccinia hordei* in barley. Plos One 5(1): e8598.
434. Barley	Barley leaf rust	New Zealand Netherlands	The New Zealand Inst Plant & Food Res Limited, New Zealand Wageningen Univ, Lab Plant Breed, Netherlands Formerly Plant & Food Res, New Zealand	Johnston PA, Niks RE, Meiyalaghan V et al. 2013. *Rph22*: Mapping of a novel leaf rust resistance gene introgressed from the non-host *Hordeum bulbosum* L. into cultivated barley (*Hordeum vulgare* L.). Theor Appl Genetics 126(6): 1613-25.
435. Barley	Barley leaf rust	Netherlands France Germany	Wageningen Univ, Graduate School Experim Plant Sci, Lab Plant Breed, Netherlands I.U.P.-P.V.I.A., Faculté des Sci,France Leibniz-Inst Plant Genet & Crop Plant Res (IPK), Germany	Marcel TC, Aghnoum R, Durand J et al. 2007. Dissection of the barley 2L1.0 region carrying the *'Laevigatum'* quantitative resistance gene to leaf rust using near-isogenic lines (NIL) and subNIL. Mol Plant Microbe Interact 20(12): 1604-15.
436. Barley	Barley leaf rust	Netherlands Germany France	Wageningen Univ, Lab Plant Breed, Graduate school Experim Plant Sci, Netherlands IPK, Germany Univ degli studi Modena & Reggio Emilia, Fac Agraria, Italy	Marcel TC, Varshney RK, Barbieri M et al. 2007. A high-density consensus map of barley to compare the distribution of QTLs for partial resistance to *Puccinia hordei* and of defence gene homologues. Theor Appl Genet 114(3): 487-500.
437. Barley	Barley leaf rust	Netherlands Czech Republic	Wageningen Univ, Lab Plant Breed, Graduate School Experim Plant Sci, Netherlands Czech Univ Agric, Dept Genet & Breed, Fac Agrobiol, Food & Nature Resour, Czech Republic	Marcel TC, Gorguet B, Ta MT et al. 2008. Isolate specificity of quantitative trait loci for partial resistance of barley to *Puccinia hordei* confirmed in mapping populations and near-isogenic lines. New Phytol 177(3): 743-55.
438. Barley	Barley leaf rust	Australia India	Univ Sydney, Plant Breed Inst Cobbitty, Australia	Golegaonkar PG, Karaoglu H, Park RF. 2009. Molecular mapping of leaf rust resistance gene *Rph14* in *Hordeum vulgare*. Theor Appl Genet

			Monsanto India Ltd, India	119(7): 1281-88.
439. Barley	Barley leaf rust	UK Netherlands	Genet Programme, Scottish Crop Res Inst, UK Wageningen Univ, Graduate School Experim Plant Sci, Lab Plant Breed, Netherlands INRA-AgroParisTech, UMR 1290 BIOGER-CPP, France	Chen X, Niks RE, Hedley PE et al. 2010. Differential gene expression in nearly isogenic lines with QTL for partial resistance to *Puccinia hordei* in barley. BMC Genomics 11: 629.
440. Barley	Barley leaf rust	Netherlands China France	CAAS: Inst Botany, Lab Photosynthesis & Environm Mol Physiol; Graduate Univ CAAS, China Wageningen Univ & Res Ctr, Lab Plant Breed, Netherlands NRA-AgroParisTech, UMR1290 BIOGER-CPP, France	Wang L, Wang Y, Wang Z et al. 2010. The phenotypic expression of QTLs for partial resistance to barley leaf rust during plant development. Theor Appl Genet 121(5): 857-64.
441. Barley	Barley leaf rust	Australia Uruguay	Univ Queensland, School Agric & Food Sci, Australia Hermitage Res Stn, Dept Employment, Economic Development & Innovation, Australia Inst Nacional de Investigación Agropecuaria, Uruguay Leslie Res Centre Toowoomba, Dept Employment, Economic Development & Innovation, Australia Univ Sydney, Plant Breed Inst-Cobbitty, Australia	Hickey LT, Lawson W, Platz GJ et al. 2011. Mapping *Rph20*: A gene conferring adult plant resistance to *Puccinia hordei* in barley. Theor Appl Genet 123(1): 55-68.
442. Barley	Barley leaf rust	Australia	Univ Queensland, School Agric & Food Sci Hermitage Res Facility, Dept Employment, Economic Development & Innovation	Hickey LT, Lawson W, Platz GJ et al. 2012. Origin of leaf rust adult plant resistance gene *Rph20* in barley. Genome 55(5): 396-99.
443. Barley	Barley leaf rust	Netherlands	Wageningen Univ & Res Ctr (WUR), Lab Plant Breed	Gonzalez AM, Marcel TC, Niks RE. 2012. Evidence for a minor gene-for-minor gene interaction explaining nonhypersensitive polygenic partial disease resistance. Phytopathology 102(11): 1086-93.
444. Barley	Barley leaf rust	Australia	Univ Sydney,Plant Breed Inst Leslie Res Ctr, Agri-Sci Queensland, Dept Agric, Fisheries & Forestry, Crop & Food Sci La Trobe Res & Development Park, Victorian AgriBiosci Ctr, Dept Primary Industries	Sandhu KS, Forrest KL, Kong S et al. 2012. Inheritance and molecular mapping of a gene conferring seedling resistance against *Puccinia hordei* in the barley cultivar Ricardo. Theor Appl Genet 125(7): 1403-11.
445. Barley	Barley leaf rust	Australia	Univ Sydney, Plant Breed Inst	Derevnina L, Singh D, Park RF. 2013. Identification and characterization of seedling and adult plant resistance to *Puccinia hordei* in chinese barley germplasm. Plant Breed 132(6): 571-79.
446. Barley	Barley leaf rust	China	Northwest A&F Univ , Coll of Agron	Liu FL, Wang H. 2010. Application of specific EST markers in the analysis of adult-plant leaf rust resistance gene on 5HS chromosome of barley. J Tritic Crops 30(5): 807-12.
447. Barley	Barley leaf rust Powdery mildew	Czech Republic	Res Ctr SELTON s.r.o.	Sedlacek T, Stemberkova L. 2010. Development of a molecular marker for simultaneous selection of *Rph7* gene and effective *Mla* alleles in barley. Cereal Res Commun 38(2): 175-83.
448. Barley	Barley leaf rust Powdery mildew Net blotch Spot blotch	USA	Crop & Soil Environm Sci, Virginia Tech Texas A&M Univ, Texas AgriLife Res Limagrain Cereal Seeds	Berger GL, Liu S, Hall MD et al. 2013. Marker-trait associations in virginia tech winter barley identified using genome-wide mapping. Theor Appl Genet 126(3): 693-710.

			USDA-ARS Biosci Res Lab Univ Minnesota, Dept Agron & Plant Genet Washington State Univ, Dept Soil & Crop Sci	
449. Barley	Stem rust	UK USA	Scottish Crop Res Inst, Genet Programme, UK Univ Birmingham, Sch Biosci, UK Univ Abertay, Sch Comp & Creat Technol, UK State Univ, Dept Crop & Soil Sci, UK Univ Minnesota, Dept Plant Pathol, USA Univ Calif Riverside, Dept Bot & Plant Sci, USA USDA-ARS, Corn Insects & Crop Genet Res, USA Iowa State Univ, Dept Plant Pathol, USA Univ Tennessee, Dept Anat & Neurobiol, USA	Druka A, Potokina E, Luo Z et al. 2008. Exploiting regulatory variation to identify genes underlying quantitative resistance to the wheat stem rust pathogen *Puccinia graminis* f. sp. *tritici* in barley. Theor Appl Genet 117(2): 261-72.
450. Barley	Stem rust	USA	Iowa State Univ: Bioinformatics & Computational Biol Graduate Program; Dept Plant Pathol & Microbiol; Ctr for Responses to Env Stresses; USDA-ARS, Corn Insects & Crop Genet Res Univ Minnesota, Dept Plant Pathol	Moscou MJ, Lauter N, Steffenson B, Wise RP. 2011. Quantitative and qualitative stem rust resistance factors in barley are associated with transcriptional suppression of defense regulons. PLoS Genet 7(7): e1002208.
451. Barley	Stem rust	Canada New Zealand	Agric & Agri-Food Canada, Cereal Res Ctr, Canada New Zealand Inst Crop & Food Res Limited, New Zealand	Fetch T, Johnston PA, Pickering R. 2009. Chromosomal location and inheritance of stem rust resistance transferred from *Hordeum bulbosum* into cultivated barley (*H. vulgare*). Phytopathology 99 (4): 339-43.
452. Barley	Stem rust	USA UK Latvia Iran Canada Ireland Australia	Washington State Univ, Dept Crop & Soil Sci, USA Scottish Crop Res Inst, UK Univ Idaho, Life Sci Building, Dept Biologic Sci, USA Washington State Univ, School Mol Biosci, USA Univ Latvia, Fac Biol, Latvia Isfahan Univ Technol, Coll Agric, Iran CFIA, Charlottetown Lab 93, Canada Univ Arizona, Arizona Genom Inst, Dept Plant Sci, USA Natl Univ Ireland, Off Res & Graduate Studies, Ireland Diversity Arrays Technol Pty. Ltd., Australia Pioneer Hi-Bred International, Inc., USA Monsanto Company, USA Univ Minnesota, Dept Plant Pathol,USA	Brueggeman R, Druka A, Nirmala J et al. 2008. The stem rust resistance gene *Rpg5* encodes a protein with nucleotide-binding-site, leucine-rich, and protein kinase domains. Proc Natl Acad Sci USA 105(39): 14970-975.
453. Barley	Stem rust	USA	Washington State Univ, Dept Crop & Soil Sci Univ Minnesota, Dept Plant Pathol	Brueggeman R, Steffenson, BJ, Kleinhofs A. 2009. The r*pg4*/*Rpg5* stem rust resistance locus in barley: Resistance genes and cytoskeleton dynamics. Cell Cycle 8(7): 977-81. (Review)
454. Barley	Stem rust	USA	Univ Minnesota, Dept Plant Pathol USDA-ARS, Cereal Dis Lab Washington State Univ, Dept Crop & Soil Sci Monsanto Company	Steffenson BJ, Jin Y, Brueggeman RS et al. 2009. Resistance to stem rust race TTKSK maps to the *rpg4*/*Rpg5* complex of chromosome 5H of barley. Phytopathology 99(10): 1135-41.

455.	Barley	Stem rust	USA	North Dakota State Univ, Dept Plant Pathol	Arora D, Gross T, Brueggeman R. 2013. Allele characterization of genes required for *rpg4*-mediated wheat stem rust resistance identifies *Rpg5* as the *R* gene. Phytopathology 103(11): 1153-61.
456.	Barley	Rusts	Netherlands	Wageningen Univ & Res Ctr (WUR), Lab Plant Breed	Jafary H, Albertazzi G, Marcel TC, Niks RE. 2008. High diversity of genes for nonhost resistance of barley to heterologous rust fungi. Genetics 178(4): 2327-39.
457.	Barley	Smuts	Australia	Univ Southern Queensland, Ctr Systems Biol Leslie Res Ctr, Dept Primary Industries & Fisheries	Lehmensiek A, Sutherland MW, McNamara RB. 2008. The use of high resolution melting (HRM) to map single nucleotide polymorphism markers linked to a covered smut resistance gene in barley. Theor Appl Genet 117(5): 721-28.
458.	Barley	Fusarium head blight	USA Japan	Univ Minnesota, Dept Agron & Plant Genet, USA Graduate Univ Advanced Studies, Japan	Fang Z, Eule-Nashoba A, Powers C et al. 2013. Comparative analyses identify the contributions of exotic donors to disease resistance in a barley experimental population. G3: Genes Genomes Genetics 3(11): 1945-53.
459.	Barley	Fusarium head blight	Germany	Technische Univ München: Phytopathol; Analytical Food Chem; BIOANALYTIK Weihenstephan, ZIEL Res Ctre Nutrition & Food Sci Saatzucht Josef Breun GmbH & Co. KG	Linkmeyer A, Goetz M, Hu L et al. 2013. Assessment and introduction of quantitative resistance to Fusarium head blight in elite spring barley. Phytopathology 103(12): 1252-59.
460.	Barley	Fusarium head blight	USA	Univ Minnesota: Dept Agron & Plant Genet; Dept Plant Pathol	Huang Y, Millett BP, Beaubien KA et al. 2013. Haplotype diversity and population structure in cultivated and wild barley evaluated for Fusarium head blight responses. Theor Appl Genet 126(3): 619-36.
461.	Barley	Fusarium head blight	USA	Univ Minnesota: Dept Agron & Plant Genet; Dept of Medicine; Supercomputing Inst Advanced Computational Res Monsanto Company BASF Plant Sci, Res Triangle Park	Jia H, Millett BP, Cho S et al. 2011. Quantitative trait loci conferring resistance to Fusarium head blight in barley respond differentially to *Fusarium graminearum* infection. Funct Integr Genomics 11(1): 95-102.
462.	Barley	Fusarium head blight	USA Australia China	North Dakota State Univ, NDS Dept 7670, Dept Plant Sci, USA Queensland Primary Industries & Fisheries:, Hermitage Res Stn; Leslie Res Ctr, Australia Zhejiang Univ, Dept Plant Protect	Yu GT, Franckowiak JD, Neate SM et al. 2010. A native QTL for Fusarium head blight resistance in North American barley (*Hordeum vulgare* L.) independent of height, maturity, and spike type loci. Genome 53(2): 111-118.
463.	Barley	Fusarium head blight	USA	Univ Minnesota, Dept Agron & Plant Genet	Nduulu LM, Mesfin A, Muehlbauer GJ, Smith KP. 2007. Analysis of the chromosome 2(2H) region of barley associated with the correlated traits Fusarium head blight resistance and heading date. Theor Appl Genet 115(4): 561-70.
464.	Barley	Fusarium crown rot	Australia	CSIRO Plant Ind, Queensland Biosci Precinct Univ Tasmania, Tasmanian Inst Agricul Res & School Agricul Sci Univ Western Australia, Fac Natural & Agricul Sci, School Plant Biol	Li HB, Zhou MX, Liu CJ. 2009. A major QTL conferring crown rot resistance in barley and its association with plant height. Theor Appl Genet 118(5): 903-10.
465.	Barley	Fusarium crown rot	Australia China	CSIRO Plant Ind, Australia Sichuan Agricul Univ, Triticeae Res Inst, China Univ Tasmania, Tasmanian Inst Agricul Res & School Agricul Sci, Australia	Chen GD, Liu YX et al. 2013. Major QTL for Fusarium crown rot resistance in a barley landrace. Theor Appl Genet 126(10): 2511-20.
466.	Barley	Powdery mildew	Czech Republic	Masaryk Univ, Fac Sci, Dept Expt Biol Agric Res Inst Kroměříž Ltd., Dept Integ Plant Prot	Repkova J, Dreiseitl A, Lizal P. 2009. New CAPS marker for selection of a barley powdery mildew resistance gene in the *Mla* locus. Cereal Res

				Commun 37(1): 93-99.
467. Barley	Powdery mildew	Germany	Leibniz Inst Pflanzengenet & Kulturpflanzenforsch	Schweizer P, Stein N. 2011. Large-scale data integration reveals colocalization of gene functional groups with meta-QTL for multiple disease resistance in barley. Mol Plant Microbe In 24(12): 1492-1501.
468. Barley	Powdery mildew	Germany	Max-Planck-Inst Plant Breed Res, Barley Genet Res Group Univ Halle-Wittenberg, Inst Agricul & Nutritional Sci, Chair Plant Breed	Schmalenbach I, Korber, N, Pillen K. 2008. Selecting a set of wild barley introgression lines and verification of QTL effects for resistance to powdery mildew and leaf rust. Theor Appl Genet 117(7): 1093-1106.
469. Barley	Powdery mildew	Australia	Univ So Queensland, Ctr Syst BiolDis Agri Sci Queensland, Dept Employment Econ Dev & Innovat, Hermitage Res Stn	Bovill J, Lehmensiek A, Sutherland MW et al. 2010. Mapping spot blotch resistance genes in four barley populations. Mol Breeding 26(4): 653-66.
470. Barley	Powdery mildew	Spain Germany	Univ Coruña, Dept Animal & Plant Physiol & Ecol, Spain JKI: Inst Resistance Res & Stress Tolerance; Inst Plant Protect Field Crops & Grassland, Germany CSIC, Aula Dei Experim Stn, Dept Genet & Plant Production, Spain	Silvar C, Kopahnke D, Flath K et al. 2013. Resistance to powdery mildew in one Spanish barley landrace hardly resembles other previously identified wild barley resistances. Euro J Plant Pathol 136(3): 459-68.
471. Barley	Powdery mildew	Spain Germany	Univ Coruña, Dept Eco, Plant & Animal Biol, Spain JKI: Inst Resistance Res & Stress Tolerance, Germany MIPS/IBIS, Helmholtz Zentrum München, Germany RWTH Aachen Univ, Inst Biol I, Germany, Dept Genet & Plant Production, Aula Dei Experime Stn, Spain	Silvar C, Perovic D, Nussbaumer T et al. 2013. Towards positional isolation of three quantitative trait loci conferring resistance to powdery mildew in two Spanish barley landraces. Plos One 8(6): e67336.
472. Barley	Spot blotch	USA	Univ Minnesota: Dept Plant Pathol, Dept Agron & Plant Genet USDA-ARS, Biosci Res Lab Univ California, Dept Botany Plant Sci	Roy JK, Smith KP, Muehlbauer GJ et al. 2010. Association mapping of spot blotch resistance in wild barley. Mol Breeding 26(2): 243-256.
473. Barley	Spot blotch	USA	Univ Minnesota, Dept Plant Pathol	Zhou H, Steffenson B. 2013. Genome-wide association mapping reveals genetic architecture of durable spot blotch resistance in U.S. barley breeding germplasm. Mol Breeding 32(1): 139-154.
474. Barley	Spot blotch	India	Banaras Hindu Univ, Inst Agricul Sci: Dept Genet & Plant Breed; Dept Mycol & Plant Pathol	Kuldeep T, Nandan R, Kumar U et al. 2008. Inheritance and identification of molecular markers associated with spot blotch (*Cochliobolus sativus* L.) resistance through microsatellites analysis in barley. Genet Mol Biol 31(3): 734-42.
475. Barley	Spot blotch Barley leaf rust	Uruguay USA	Univ Republ, Fac Agron: Dept Producc Vegetal; Dept Protec Vegetal, Uruguay INIA La Estanzuela, Uruguay Oregon State Univ, Dept Crop & Soil Sci, USA	Castro AJ, Gamba F, German S et al. 2012. Quantitative trait locus analysis of spot blotch and leaf rust resistance in the BCD47 Baronesse barley mapping population. Plant Breeding 131(2): 258-266.
476. Barley	Spot blotch Net blotch	Canada	Univ Saskatchewan, Ctr Crop Dev, Dept Plant Sci Saskatchewan Res Council, GenServe Labs ™	Grewal T S, Rossnagel B G, Scoles G J. 2012: Mapping quantitative trait loci associated with spot blotch and net blotch resistance in a doubled-haploid barley population. Mol Breeding 30(1): 267-279.
477. Barley	Net blotch	Australia	Murdoch Univ, Sch Biol Sci, State Agricul Biotechnol Ctr Hermitage Res Stn, Dept Primary Ind & Fisheries Dept Agric & Food	Gupta S, Li CD, Loughman R et al. 2010. Quantitative trait loci and epistatic interactions in barley conferring resistance to net type net blotch (*Pyrenophora teres* f. *teres*) isolates. Plant Breeding 129(4): 362-

			Hermitage Res Stn, Dept Primary Industries & Fisheries	68.
478. Barley	Net blotch	Germany	JKI, Fed Res Inst Cultivated Plants, Inst Resistance Res & Stress Tolerance Free Univ Berlin, Dept Physiol & Biochem Plants & Microbiol, Inst Biol	König J, Perovic D, Kopahnke D, Ordon F. 2013. Development of an efficient method for assessing resistance to the net type of net blotch (*Pyrenophora teres* f. *teres*) in winter barley and mapping of quantitative trait loci for resistance. Mol Breeding 32(3): 641-50.
479. Barley	Leaf blotch	Germany Spain Australia	Bavarian State Res Ctr Agric, Inst Crop Sci & Plant Breed, Germany Univ Coruña, Dept Animal & Plant Biol & Eco, Spain CSIC, Aula Dei Experim Stn, Dept Genet & Plant Product, Spain Fundación ARAID, Spain Plant Res Ctr, South Australian Res & Develop Inst, SARDI, Australia Univ Adelaide, School Agric, Food & Wine, Australia	Hofmann K, Silvar C, Casas AM et al. 2013. Fine mapping of the *Rrs1* resistance locus against scald in two large populations derived from Spanish barley landraces. Theor Appl Genetics 126(12): 3091-102.
480. Barley	Barley yellow dwarf virus (BYDV)	China	Ludong Univ, School of Life Sci Shanxi Agric Univ, Coll Agron Natl Engineer Res Ctr Wheat	Zhao YH, Wang YF, Li RZ et al. 2011. Identification of *Yd2* genotype in barley with molecular markers and their application in molecular marker-assisted selection. Acta Agron Sin 37(09): 1683-88.
481. Barley	BYDV	Germany	JKI, Bundesforschungsinstitut für Kulturpflanzen, Inst Resistenzforschung & Stresstoleranz	Riedel C, Habekuss A, Ordon F. 2010. Improvement of BYDV-tolerance in barley by pyramiding of tolerance alleles. JK-Archiv 424: 13-16.
482. Barley	BYDV	Germany	JKI, Federal Res Ctr Cultivated Plants: Inst Breed Res Agricul Crops; Inst Resistance Res & Stress Tolerance; Inst Breed Res Horticultural Crops & Fruit Crops, Germany Dept Biotechnol, N.I. Vavilov All-Russian Res Inst Plant Ind, Russia	Scholz M, Ruge-Wehling B, Habekuss A et al. 2009. *Ryd4*^{Hb}: A novel resistance gene introgressed from *Hordeum bulbosum* into barley and conferring complete and dominant resistance to the barley yellow dwarf virus. Theor Appl Genet 119(5): 837-49.
483. Barley	BYDV	Germany	JKI, Federal Res Inst Cultivated Plants, Inst Resistance Res & Stress Tolerance, Germany Wageningen Univ, Graduate School Experim Plant Sci, Dept Plant Breed, Netherlands Univ Rostock, Inst Land Use, Agrobiotechnol & Applied Res Bio- & Gene-Technol, Fac Agricul & Environm Sci, Germany	Riedel C, Habekuss A, Schliephake E et al. 2011. Pyramiding of *Ryd2* and *Ryd3* conferring tolerance to a german isolate of Barley yellow dwarf virus-PAV (BYDV-PAV-ASL-1) leads to quantitative resistance against this isolate. Theor Appl Genet 123(1): 69-76.
484. Barley	BSMV-based VIGS of plant gene (- effect on resistance)	USA UK	N Dakota State Univ, Dept Plant Pathol, USA James Hutton Inst, UK Washington State Univ, Dept Crop & Soil Sci, USA Univ Minnesota, Dept Plant Pathol, USA	Wang X, Richards J, Gross T et al. 2013. The rpg4-mediated resistance to wheat stem rust (*Puccinia graminis*) in barley (Hordeum vulgare) requires Rpg5, a second NBS-LRR gene, and an actin depolymerization factor. Mol Plant Microbe In 26(4): 407-18
485. Barley	BSMV-based VIGS of plant gene (+ effect on resistance)	USA	Washington State Univ: Dept Crop & Soil Sci; School Mol Biosci; Dept Plant Pathol; USDA-ARS; Dept Plant Pathol Univ Minnesota,Dept Plant Pathol	Zhang L, Lavery L, Gill U et al. 2009. A cation/proton-exchanging protein is a candidate for the barley *NecS1* gene controlling necrosis and enhanced defense response to stem rust. Theor Appl Genet 118(2): 385-97
486. Barley	Powdery mildew	Germany Netherlands	The Leibniz Inst Plant Genet & Crop Plant Res, Germany WUR, Lab Plant Breed, Netherlands	Douchkov D, Johrde A, Nowara D et al. 2011. Convergent evidence for a role of WIR1 proteins during the interaction of barley with the powdery mildew fungus *Blumeria graminis*. J Plant Physiol 168(1): 20-29.**(also in RNAI / silencing section)**
487. Maize	Common smut	USA	Univ Minnesota: Dept Plant Biologic Sci; Dept Agron & Plant Genet; Dept	Baumgarten AM, Suresh J, May G, Phillips RL. 2007. Mapping QTLs contributing to *Ustilago maydis* resistance in specific plant tissues of

			Eco, Evolution & Behavior Pioneer Hi-bred Internatl, Inc.	maize. Theor Appl Genet 114(7): 1229-38.
488. Maize	Common smut	China	China Agricul Univ, Natl Maize Improv Ctr China CAAS, Crop Res Inst	Ding JQ, Wang XM, Chander S, Li JS. 2008. Identification of QTL for maize resistance to common smut by using recombinant inbred lines developed from the Chinese hybrid Yuyu22. J Appl Genet 49(2): 147-54.
489. Maize	Fusarium rot	Ukraine	Ukrainian Acad Agricul Sci: S Plant Biotechnol Ctr; Natl Ctr Seed Growing & Seed Sci, Plant Breed & Genet Inst	Kozhukhova NE, Sivolap YuM, Varenyk BF, Sokollov VM. 2007. Marking loci responsible for resistance of maize to Fusarium rot. Cytol Genet 41(2): 98-102.
490. Maize	Fusarium rot	Ukraine	Ukrainian Acad Agricul Sci: S Plant Biotechnol Ctr; Natl Ctr Seed Growing & Seed Sci, Plant Breed & Genet Inst	Kozhukhova NE, Syvolap YuM, Varenyk BF, Sokolov VM. 2007. Marking of the loci encoding maize resistance to *Fusarium*. Tsitol Genet 41(2): 37-41.
491. Maize	Fusarium ear rot	China	Sichuan Agricul Univ, Minist Educ, Maize Res Inst, Key Lab Crop Genet Resour & Improv	Yuan GS, Xiang K, Zhang ZM et al. 2013. Analysis on the relationship between *Fusarium verticillioides* infection-induced genes and ear rot resistance in maize. J Food Agr Environ 11(2): 363-66.
492. Maize	Fusarium ear rot	USA Spain	N Carolina State Univ, Dept Crop Sci, Raleigh, USA CSIC, Mision Biol Galicia, Spain USDA-ARS, Plant Sci Res Unit, USA	Zila, C. T., Samayoa, L. F., Santiago, R., Butron, A. and Holland, J. B. (2013). A genome-wide association study reveals genes associated with Fusarium ear rot resistance in a maize core diversity panel. G3: Genes Genomes Genetics 3(11): 2095-104.
493. Maize	Gibberella ear rot	Canada USA	Univ Guelph , Dept Plant Agric , Canada Southern Illinois Univ, Dept Plant Biol, USA Univ Nebraska, Dept Agron & Horticul, USA	Yuan J, Liakat Ali M, Taylor J et al. 2008. A guanylyl cyclase-like gene is associated with Gibberella ear rot resistance in maize (*Zea mays* L.). Theor Appl Genet 116(4): 465-79.
494. Maize	Gibberella stalk rot	China	China Agric Univ, Natl Maize Improv Ctr China	Yang Q, Yin G, Guo Y et al. 2010. A major QTL for resistance to Gibberella stalk rot in maize. Theor Appl Genet 121(4): 673-87.
495. Maize	Northern leaf blight	USA Taiwan	Cornell Univ: Dept Plant Pathol & Plant-Microbe Biol; Dept Plant Breed & Genet, USA Natl Taiwan Univ, Dept Plant Pathol & Microbiol, Taiwan Kansas State Univ, USDA-ARS, Dept Agron, USA North Carolina State Univ, Dept Crop Sci, USA Ohio State Univ, Dept Plant Pathol, USA North Carolina State Univ, USDA-ARS, Dept Plant Pathol, USA	Chung CL, Poland J, Kump K et al. 2011. Targeted discovery of quantitative trait loci for resistance to northern leaf blight and other diseases of maize. Theor Appl Genet 123(2): 307-26.
496. Maize	European corn borer Mediterranean corn borer	Spain	CSIC, Spanish Natl Res Council	Ordas B, Malvar RA, Santiago R, Butron A. 2010. QTL mapping for Mediterranean corn borer resistance in European flint germplasm using recombinant inbred lines. BMC Genomics 11: 174.
497. Maize	European corn borer	Germany USA	Univ Hohenheim, Inst Plant Breed Seed Sci & Populat Genet, Germany AgReliant Genet, USA	Orsini E, Krchov LM, Uphaus J et al. 2012. Mapping of QTL for resistance to first and second generation of European corn borer using an integrated SNP and SSR linkage map. Euphytica 183(2): 197-206.
498. Maize	Mediterranean corn borer	Spain	Spanish Natl Res Council (CSIC), Misión Biológica Galicia	Ordas B, Malvar RA, Santiago R et al. 2009. Mapping of QTL for resistance to the Mediterranean corn borer attack using the intermated B73 x Mo17 (IBM) population of maize. Theor Appl Genet 119(8): 1451-

					59.
499.	OSR	Blackleg	Canada	Agric & Agri-Food Canada, Saskatoon Res Ctr Natl Res Council of Canada, Plant Biotechnol Inst	Yu F, Lydiate DJ, Gugel RK et al. 2012. Introgression of *Brassica rapa* subsp. *sylvestris* blackleg resistance into *B. napus*. Mol Breeding 30(3): 1495-1506.
500.	OSR	Blackleg	France	Univ Rennes 1, INRA, U Agrocampus Ouest, MR Ameliorat Plantes & Biotechnol Vegetales	Jestin C, Lode M, Vallee P et al. 2011. Association mapping of quantitative resistance for *Leptosphaeria maculans* in oilseed rape (*Brassica napus* L.). Mol Breeding 27(3): 271-87.
501.	OSR	Verticillium wilt	Germany	Justus Liebig Univ, Dept Plant Breed Georg August Univ, Div Plant Pathol & Crop Protect, Dept Crop Sci	Obermeier C, Hossain MA, Snowdon R et al. 2013. Genetic analysis of phenylpropanoid metabolites associated with resistance against *Verticillium longisporum* in *Brassica napus*. Mol Breeding 31(2): 347-61.
502.	OSR	Verticillium wilt	Germany Sweden Canada	Justus Liebig Univ, Res Ctr BioSyst Land Use & Nutr, Dept Plant Breed, Germany Svalöf Weibull AB, Sweden DNA Landmarks Inc, Canada	Rygulla W, Snowdon RJ, Friedt W et al. 2008. Identification of quantitative trait loci for resistance against *Verticillium longisporum* in oilseed rape (*Brassica napus*). Phytopathology 98(2): 215-21.
503.	OSR	Cabbage seed weevil	Canada	Univ Guelph, Dept Plant Agric, Crop Sci Building	Lee RW, Malchev IT, Rajcan I, Kott LS. 2013. Identification of putative quantitative trait loci associated with a flavonoid related to resistance to cabbage seedpod weevil (*Ceutorhynchus obstrictus*) in canola derived from an intergeneric cross, *Sinapis alba* x *Brassica napus*. Theor Appl Genet. DOI 10.1007/s00122-013-2228-0.
504.	Sunflower	Downy mildew	Bulgaria	AgroBioInst Univ Forestry General Toshevo, Dobroudja Agric Inst	Hvarleva T, Tarpomanova I, Hristova-Cherbadji M et al. 2009. Toward marker assisted selection for fungal disease resistance in sunflower. Utilization *of H. bolanderi* as a source of resistance to downy mildew. Biotechnol Biotec Eq, 23 (4), 2009: 1427-30.
505.	Sunflower	Downy mildew	Serbia	Inst of Field & Vegetable Crops, Oil Crops Dept	Jocić S, Cvejić S, Hladni N et al. 2010. Development of sunflower genotypes resistant to downy mildew. HELIA 33(53): 173-80.
506.	Sunflower	Downy mildew	USA	Univ Georgia, Ctr Appl Genetic Technol, USA Univ Zagazig, Efficient Productivity Inst, Plant Production Dept, Egypt Oregon State Univ,Dept Crop & Soil Sci, USA Univ Massachusetts, Dept Biol, USA Univ California, Dept Plant Sci & Genome Ctr, USA	Radwan O, Gandhi S, Heesacker A et al.2008. Genetic diversity and genomic distribution of homologs encoding NBS-LRR disease resistance proteins in sunflower. Mol Genet Genomics 280(2): 111-25.
507.	Sunflower	Phoma black stem	France	INP-ENSAT,Lab Biotechnol Ameliorat Plantes	Darvishzadeh R, Kiani SP, Dechamp-Guillaume G et al. 2007. Quantitative trait loci associated with isolate specific and isolate nonspecific partial resistance to *Phoma macdonaldii* in sunflower. Plant Pathol 56(5) : 855-61.
508.	Sunflower	Rust	Argentina	Nidera S.A., Dept Biotechnol	Bulos M, Ramos ML, Altieri E, Sala CA. 2013. Molecular mapping of a sunflower rust resistance gene from Har6. Breed Sci 63(1): 141-46.
509.	Sunflower	Rust	USA	North Dakota State Univ, Dept Plant Pathol USDA-ARS, Northern Crop Sci Lab	Gong L, Gulya TJ, Markell SG et al. 2013. Genetic mapping of rust resistance genes in confection sunflower line HA-R6 and oilseed line RHA 397. Theor Appl Genet 126(8): 2039-49.
510.	Sunflower	Rust	USA	North Dakota State Univ, Dept Plant Pathol	Gong L, Hulke BS, Gulya TJ et al. 2013. Molecular tagging of a novel rust

			USDA-ARS, Northern Crop Sci Lab	resistance gene R_{12} in sunflower (*Helianthus annuus* L.). Theor Appl Genet 126(1): 93-99.
511. Sunflower	Rust	USA	USDA-ARS, Northern Crop Sci Lab	Qi L, Gulya T, Seiler GJ et al. 2011. Identification of resistance to new virulent races of rust in sunflowers and validation of DNA markers in the gene pool. Phytopathology 101(2): 241-49.
512. Sunflower	Rust	USA	USDA-ARS, Northern Crop Sci Lab	Qi LL, Seiler GJ, Vick BA, Gulya TJ. 2012. Genetics and mapping of the R_{11} gene conferring resistance to recently emerged rust races, tightly linked to male fertility restoration, in sunflower (*Helianthus annuus* L.). Theor Appl Genet 125(5): 921-32.
513. Sunflower	Rust	USA	USDA-ARS, Northern Crop Sci Lab	Qi LL, Hulke BS, Vick BA, Gulya TJ. 2011. Molecular mapping of the rust resistance gene R_4 to a large NBS-LRR cluster on linkage group 13 of sunflower. Theor Appl Genet 123(2): 351-58.
514. Sunflower	Sclerotinia	Iran France	Tarbiat Moallem Univ, Dept Biol, Fac Sci, Iran Urmia Univ: Inst Biotechnol; Fac Agric, Dept Agron & Plant Breed; Dept Plant Protect, Iran INP ENSAT, IFR 40, Lab Biotechnol & Ameliorat Plantes BAP, France	Davar R, Darvishzadeh R, Majd A et al. 2010. QTL mapping of partial resistance to basal stem rot in sunflower using recombinant inbred lines. Phytopathol Mediter 49(3): 330-41.
515. Sunflower	Sclerotinia	USA	USDA-ARS, North Crop Sci Lab; Genom & Bioinf Res Unit N Dakota State Univ, Dept Plant Sci BioDiagnostics Inc.	Talukder ZI, Hulke BS, Qi L et al. 2013. Candidate gene association mapping of Sclerotinia stalk rot resistance in sunflower (*Helianthus annuus* L.) uncovers the importance of *COI1* homologs. Theor Appl Genet 127(1): 193-209.
516. Sunflower	Sclerotinia	Argentina	CICVyA INTA: Inst Biotecnol; Estn Expt Agr Balcarce; Estn Expt Agric Manfredi Univ Nacl Cordoba: Fac Ciencias Agric, Catedra Estadist & Biometria Univ Buenos Aires, Fac Ciencias Exactas & Nat	Fusari CM, Di Rienzo JA, Troglia C et al. 2012. Association mapping in sunflower for Sclerotinia head rot resistance. BMC Plant Biol 12: 93.
517. Sunflower	Sclerotinia	USA	N Dakota State Univ, Dept Plant Sci Dow AgroSci USDA-ARS, No Crop Sci Lab Univ Georgia, Ctr Appl Genet Technol	Yue B, Radi SA, Vick BA et al. 2008. Identifying quantitative trait loci for resistance to Sclerotinia head rot in two USDA sunflower germplasms. Phytopathology 98(8): 926-31.
518. Grapevine	Downy mildew	India	Natl Res Ctr for Grapes	Upadhyay A, Deokar KP, Reddy S et al. 2008. Identification of micro satellite markers associated with downy mildew resistance in grape - An example of association mapping in perennial crops. Acta Hort (ISHS) 785: 153-58.
519. Grapevine	Downy mildew	Italy France	Univ Udine, Dept Sci Agrarie & Ambientali, Italy Univ Verona, Dept Biotecnol, Italy Inst Natl Rescherche Agronomique, UMR1131 Santé Vigne & Qualité Vin, France Univ Strasbourg, UMR1131, France INRA-CNRS-UEVE, UMR Génomique Végétale, France Ist Genomica Applicata, Parco Scientifico & Tecnologico Luigi Danieli, Italy	Bellin D, Peressotti E., Merdinoglu D et al. 2009. Resistance to *Plasmopara viticola* in grapevine 'Bianca' is controlled by a major dominant gene causing localised necrosis at the infection site. Theor Appl Genet 120(1): 163-76.

520. Grapevine	Downy mildew	France	Univ Bordeaux, UMR 1287 Ecophysiologie & Génomique Fonctionelle Vigne (EGFV) Inst Sci Vigne & Vin (ISVV), UMR 1287 Ecophysiologie & Génomique Fonctionelle Vigne INRA: UMR 1287 Ecophysiologie & Génomique Fonctionelle Vigne (EGFV), Bât. ISVV, 210 Chemin de Leysotte; UMR 1131 Santé Vigne & Qualité Vin	Marguerit E, Boury C, Manicki A et al. 2009. Genetic dissection of sex determinism, inflorescence morphology and downy mildew resistance in grapevine. Theor Appl Genet 118(7): 1261-78.
521. Grapevine	Downy mildew	France Germany	Inst Natl Recherche Agronomique, UMR 1131 Santé Vigne & Qualité Vin, France Univ Strasbourg, UMR 1131 Santé Vigne & Qualité Vin, France Geisenheim Res Ctr Hochschule RheinMain, Germany	Blasi P, Blanc S, Wiedemann-Merdinoglu S et al. 2011. Construction of a reference linkage map of *Vitis amurensis* and genetic mapping of *Rpv8*, a locus conferring resistance to grapevine downy mildew. Theor Appl Genet 123(1): 43-53.
522. Grapevine	Downy mildew	Germany	JKI, Inst Grapevine Breed Geilweilerhof	Schwander F, Eibach R, Fechter I et al. 2012. *Rpv10*: A new locus from the asian vitis gene pool for pyramiding downy mildew resistance loci in grapevine. Theor Appl Genet 124(1): 163-76.
523. Grapevine	Downy mildew Anthracnose	Thailand	Suranaree Univ Technol Ctr Excellence Agricul Biotechnol (AG-BIO/PERDO-CHE)	Tantasawat PA, Poolsawat O, Prajongjai T et al. 2012. Association of RGA-SSCP markers with resistance to downy mildew and anthracnose in grapevines. Genet Mol Res 11(3): 1799-1809.
524. Grapevine	Downy mildew Powdery mildew	Bulgaria	AgroBioInst Inst Seed Knowledge	Hvarleva T, Bakalova A, Rusanov K et al. 2009. Toward marker assisted selection for fungal disease resistance in grapevine. Biotechnol Biotec Eq 23(4): 1431-35.
525. Grapevine	Downy mildew Powdery mildew	Germany	Federal Ctr Breed ResCultivated Plants, Inst Grapevine Breed	Eibach R, Zyprian E, Topfer R. 2009. The use of molecular markers for pyramiding resistance genes in grapevine breeding. Vitis 46 (2): 120-24.
526. Grapevine	Downy mildew Powdery mildew	Hungary	Szent Istvan Univ, Inst Genet & Biotechnol	Katula-Debreceni D, Kiss E, Lencses AK et al. 2009. Marker assisted selection for powdery and downy mildew resistance genes of different origin in grapevine (*Vitis vinifera* L.). Proceedings Bioexploit, EUCARPIA. Proceedings p. 57.
527. Grapevine	Downy mildew Powdery mildew	Australia France USA	CSIRO Plant Ind, Australia Montpellier SupAgro, UMR AGAP, France INRA: UMR1131 Sante Vigne & Qualite Vin; URGV; UMR AGAP, France Universite´ Strasbourg, Sante Vigne & Qualite Vin UMR1131, France USDA-ARS, Grape Genet Res Unit, USA Cornell Univ, Dept Horticul, NY Agricul Stn, USA	Feechan A, Anderson C, Torregrosa L et al. 2013. Genetic dissection of a TIR-NB-LRR locus from the wild North American grapevine species *Muscadinia rotundifolia* identifies paralogous genes conferring resistance to major fungal and oomycete pathogens in cultivated grapevine. Plant J 76(4): 661-74. **(also in transgenesis section)** [v]
528. Grapevine	Downy mildew Powdery mildew	Italy France	Univ Udine, Dept Sci Agrarie e Ambientali, Italy Ist Genomica Applicata, Italy INRA-CNRS-UEVE, UMR de Génomique Végétale, France	Di Gaspero G, Cipriani G, Adam-Blondon AF, Testolin R. 2007. Linkage maps of grapevine displaying the chromosomal locations of 420 microsatellite markers and 82 markers for *R*-gene candidates. Theor Appl Genet 114(7): 1249-63.
529. Grapevine	Downy mildew Powdery mildew	France	INRA: UMR1065 SAVE; UMR1131 SVQV Univ Bordeaux, ISVV, UMR1065 SAVE Univ Strasbourg, UMR1131 SVQV	Calonnec A, Wiedemann-Merdinoglu S, Deliere L et al. 2013. The reliability of leaf bioassays for predicting disease resistance on fruit: a case study on grapevine resistance to downy and powdery mildew Plant Pathol 62(3): 533-44.

530. Grapevine	Powdery mildew	USA	Cornell Univ: Dept Plant Breed; Inst Genomic Diversity; Computational Biol Service Unit, Dept Horticul, NY State Agricul Experiment Stn USDA-ARS Grape Genet Res Unit	Barba P, Cadle-Davidson L., Harriman J et al. 2014. Grapevine powdery mildew resistance and susceptibility loci identified on a high-resolution SNP map. Theor Appl Genet 127(1): 73-84.
531. Grapevine	Powdery mildew	USA France	Univ California, Dept Viticul & Enology, USA UMR AGAP, Equipe Diversité & Adaptation Vigne & Espèces Méditerranéennes: Montpellier SupAgro; INRA France Univ California, Foundation Plant Services, USA UMR AGAP, Equipe Diversité & Adaptation Vigne & Espèces	Riaz S, Boursiquot JM, Dangl GS et al. 2013. Identification of mildew resistance in wild and cultivated Central Asian grape germplasm. BMC Plant Biol 13 : 149.
532. Grapevine	Powdery mildew	USA Canada	USDA-ARS Grape Genet Res Unit, USA USDA-ARS San Joaquin Valley Agricul Sci Ctr, USA SRC Advanced Technol Initiative, USA NY State Agricul Experiment Stn, Dept Horticultur Sci, USA Stanford Univ, Dept Genet, USA Nova Scotia Agricul Coll, Dept Plant & Animal Sci, Canada	Mahanil S, Ramming D, Cadle-Davidson M et al. 2012. Development of marker sets useful in the early selection of *Ren4* powdery mildew resistance and seedlessness for table and raisin grape breeding. Theor Appl Genet 124(1): 23-33.
533. Grapevine	Powdery mildew	France	INRA-UDS, UMR 1131, Santé Vigne & Qualité Vin Université de Strasbourg, Santé Vigne & Qualité Vin	Blanc S, Wiedemann-Merdinoglu S, Dumas V et al. . 2012). A reference genetic map of *Muscadinia rotundifolia* and identification of *Ren5*, a new major locus for resistance to grapevine powdery mildew. Theor Appl Genet 125 (8): 1663-75.
534. Grapevine	Powdery mildew	USA	Univ California, Deprt Viticul & Enology USDA-ARS	Riaz S, Tenscher AC, Ramming DW, Walker MA. 2011. Using a limited mapping strategy to identify major QTLs for resistance to grapevine powdery mildew (*Erysiphe necator*) and their use in marker-assisted breeding. Theor Appl Genet 122(6): 1059-73.
535. Grapevine	Powdery mildew	Republic of Korea	Fruits Res Division, Natl Inst Horticultur & Herbal Sci, Rural Develop Adm Yeungnam Univ,Dept Horticultur Sci Genome Res Ctr, Korea Res Inst Biosci & Biotechnol Seoul Natl Univ: Dept Horticultur Sci; Res Inst Agric & Life Sci	Choi YJ, Yun HK, Park KS et al. 2010. Transcriptional profiling of ESTs responsive to *Rhizobium vitis* from 'Tamnara' grapevines (*Vitis* sp.). J Plant Physiol 167(13): 1084-92.
536. Grapevine	Powdery mildew	Hungary Italy USA	Res Inst Viticul & Enology, Hungary Univ Udine, Dept Sci Agrarie & Ambientali, Italy Parco Scientifico & Tecnologico Luigi Danieli, Inst Genomica Applicata, Italy Missouri State Univ, Dept Agric, USA Szent István Univ, Inst Genet & Biotechnol, Hungary	Hoffmann S, Di Gaspero G, Kovacs L et al. 2008. Resistance to *Erysiphe necator* in the grapevine 'Kishmish vatkana' is controlled by a single locus through restriction of hyphal growth. Theor Appl Genet 116(3): 427-38.
537. Grapevine	Powdery mildew	Italy Hungary	Univ Udine, Dept Scienze Agrarie & Ambientali, Italy Missouri State Univ, Dept Agric & Biol, USA Parco Scientifico & Tecnologico Luigi Danieli, Inst Genomica Applicata, Italy Univ Pécs, Res Inst Viticul & Enology, Hungary	Coleman C, Copetti D, Cipriani G et al. 2009. The powdery mildew resistance gene *REN1* co-segregates with an NBS-LRR gene cluster in two Central Asian grapevines. BMC Genet 10: 89.
538. Grapevine	Powdery mildew	Hungary	Szent Istvan Univ, Inst Genet & Biotechnol	Katula-Debreceni D, Lencses AK, Szoke A et al. 2009. Utilization of powdery mildew resistance gene originating from *Muscadinia rotundifolia* Mich. Small and *Vitis vinifera* L. in grape breeding based on

					marker assisted selection. Kertgazdaság - Horticulture 41(2): 82-91.
539.	Grapevine	Powdery mildew	Hungary USA	Szent Istvan Univ, Inst Genet & Biotechnol, Hungary Univ Pécs, Res Inst Viticul & Enology, Hungary Missouri State Univ, Dept Biol, USA	Katula-Debreceni D, Lencses AK, Szoke A et al. 2010. Marker-assisted selection for two dominant powdery mildew resistance genes introgressed into a hybrid grape population. Sci Hortic-Amsterdam 126(4): 448-53.
540.	Grapevine	Powdery mildew	Hungary	Szent Istvan Univ, Inst Genet & Biotechnol	Veres A, Katula-Debreceni D, Szoke A et al. 2012. Analysis of powdery mildew QTL linked SCAR marker in different grape varieties bred in Hungary. Kertgazdaság - Horticulture 44(1): 89-93.
541.	Grapevine	Fungus mainly mildews	Germany	JKI, Fed Res Ctr Cultivated Plants, Inst Grapevine Breed	Eibach R, Topfer R, Hausmann L. 2010. Use of genetic diversity for grapevine resistance breeding. Mitt Klosterneuburg 60: 332-37. (Review)
542.	Grapevine	Grapevine fanleaf virus	USA	Univ Calif Davis, Dept Viticulture & Enol	Hwang C F, Xu K N, Hu R et al. 2010. Cloning and characterization of xir1, a locus responsible for dagger nematode resistance in grape. Theor and Appl Genetics 121 (4): 789-799
543.	Grapevine	Grapevine fanleaf virus	South Africa USA	Univ Stellenbosch, Dept Viticulture & Enol, Matieland Univ Calif Davis, Dept Viticulture & Enol	van Zyl S, Vivier M A and Walker M A. 2012. Xiphinema index and its relationship to grapevines: A review. South African J of Enology and Viticulture 33 (1): 21-32 (Review)
544.	Potato	Late blight	Poland Germany	Res Ctr Młochów, Plant Breed & Acclimatization Inst, Poland JKI, Federal Res Ctr Cultivated Plants, Ins Breed Res Agricul Crops, Germany	Sliwka J, Jakuczun H, Lebecka R et al. 2007. Tagging QTLs for late blight resistance and plant maturity from diploid wild relatives in a cultivated potato (*Solanum tuberosum*) background. Theor Appl Genet 115(1): 101-12.
545.	Potato	Late blight	Poland Germany	Res Ctr Młochów, Plant Breed & Acclimatization Inst –Natl Res Inst, Poland Max Planck Inst Plant Breed Res, Germany	Smyda P, Jakuczun H, Debski K et al. 2013. Development of somatic hybrids *Solanum* x *michoacanum* Bitter. (Rydb.) (+) *S.tuberosum* L. and autofused 4x *S*. x *michoacanum* plants as potential sources of late blight resistance for potato breeding. Plant Cell Reports 32(8): 1231-41.
546.	Potato	Late blight	Netherlands	Wageningen Univ, Biosystematics Group, Res Ctr Wageningen UR Plant Breed Ctr BioSystems Genom	Jacobs MM, Vosman B, Vleeshouwers VG et al. 2010. A novel approach to locate *Phytophthora infestans* resistance genes on the potato genetic map. Theor Appl Genet 120(4): 785-96.
547.	Potato	Late blight	India	Central Potato Res Inst	Tiwari JK, Siddappa S, Singh BP et al. 2013. Molecular markers for late blight resistance breeding of potato: an update. Plant Breeding 132(3): 237-45.
548.	Potato	Late blight	Netherlands	Wageningen Univ, Dept Plant Sci, Lab Plant Breed Plant Res Internatl, Dept Biodiversity & Breed	Malosetti M, van der Linden CG, Vosman B, van Eeuwijk FA. 2007. A mixed-model approach to association mapping using pedigree information with an illustration of resistance to *Phytophthora infestans* in potato. Genetics 175(2): 879-89.
549.	Potato	Late blight	Netherlands	Wageningen Univ & Red Ctr, Lab Plant Breed	Tan MY, Hutten RC, Celis C et al. 2008. The $R_{pi\text{-}mcd1}$ locus from *Solanum microdontum* involved in resistance to *Phytophthora infestans*, causing a delay in infection, maps on potato chromosome 4 in a cluster of NBS-LRR genes. Mol Plant Microbe Interact 21(7): 909-18.

550. Potato	Late blight	France	INRA: UR 1052 GAFL Génétique & Amélioration Fruits & Légumes; UMR 118 APBV Amélioration Plantes & Biotechnolog Végétales Comité Nord, Stn Recherche de Bretteville	Danan S, Chauvin JE, Caromel B et al. 2009. Major-effect QTLs for stem and foliage resistance to late blight in the wild potato relatives *Solanum sparsipilum* and *S. spegazzinii* are mapped to chromosome X. Theor Appl Genet 119(4): 705-19.
551. Potato	Late blight	Germany	Max Planck Inst Plant Breed Res, Dept Plant Breed & Genet Univ Hohenheim, Inst Plant Breed, Seed Sci & Population Genet Saka Pflanzenzucht GbR, Zuchtstation Windeby, Bioplant GmbH Böhm-Nordkartoffel Agrarproduktion GbR Former RZPD German Resour Ctr Genome Res GmbH	Pajerowska-Mukhtar K, Stich B., Achenbach U et al. 2009. Single nucleotide polymorphisms in the allene oxide synthase 2 gene are associated with field resistance to late blight in populations of tetraploid potato cultivars. Genetics 181(3): 1115-27.
552. Potato	Late blight	Netherlands UK	Wageningen UR Plant Breed, Netherlands Sainsbury Lab Colney Lane, UK	Pel MA, Foster SJ, Park TH et al. 2009. Mapping and cloning of late blight resistance genes from *Solanum venturii* using an interspecific candidate gene approach. Mol Plant Microbe Interact 22(5): 601-15.
553. Potato	Late blight	Germany	Max-Planck Inst Plant Breed Res	Odeny DA, Stich B, Gebhardt C. 2010. Physical organization of mixed protease inhibitor gene clusters, coordinated expression and association with resistance to late blight at the *Stki* locus on potato chromosome III. Plant Cell Environ 33(12): 2149-61.
554. Potato	Late blight	Poland	Młochów Res Ctr, Plant Breed & Acclimatization Inst HZ Zamarte Ltd - IHAR Group	Sliwka J, Jakuczun H, Kaminski P, Zimnoch-Guzowska E. 2010. Marker-assisted selection of diploid and tetraploid potatoes carrying *Rpi-phu1*, a major gene for resistance to *Phytophthora infestans*. J Appl Genet 51(2): 133-40.
555. Potato	Late blight	Netherlands	Wageningen Univ and Red Ctr, Lab Plant Breed	Tan MY, Hutten RC, Visser RG et al. van Eck HJ. 2010. The effect of pyramiding *Phytophthora infestans* resistance genes $R_{pi\text{-}mcd1}$ and $R_{pi\text{-}ber}$ in potato. Theor Appl Genet 121(1): 117-25.
556. Potato	Late blight	France	INRA, UR 1052 Génétique & Amélioration Fruits & Légumes (GAFL) Inst Natl Recherche Agronomique (INRA-UPS-INA PG-CNRS), UMR 320 Génétique Végétale	Danan S, Veyrieras JB, Lefebvre V. 2011. Construction of a potato consensus map and QTL meta-analysis offer new insights into the genetic architecture of late blight resistance and plant maturity traits. BMC Plant Biol 11: 16.
557. Potato	Late blight	Netherlands DPR Korea	Wageningen Univ & Red Ctr: Lab Plant Breed; Plant Res Internatl, Netherlands Acad Agricul Sci, Res Inst Agrobiol, DPR Korea	Jo KR, Arens M, Kim TY et al. 2011. Mapping of the *S. demissum* late blight resistance gene *R8* to a new locus on chromosome IX. Theor Appl Genet 123(8): 1331-40.
558. Potato	Late blight	Poland Germany	Plant Breed & Acclimatization Inst, Poland Polish Acad Sci, Inst Biochem & Biophysics, Poland Max-Planck Inst Plant Breed Res, Germany	Szajko K, Chrzanowska M, Witek K et al. 2008. The novel gene *Ny-1* on potato chromosome IX confers hypersensitive resistance to potato virus Y and is an alternative to *Ry* genes in potato breeding for PVY resistance. Theor Appl Genet 116(2): 297-303.
559. Potato	Late blight	Netherlands Republic of Korea DPR Korea	Univ Wageningen & ResCtr, Wacheningen UR Plant Breed, Netherlands Nongwoo Bio. Co., Ltd, Biotechnol Inst, Republic of Korea Acad Agric Sci, Res Inst Agrobiol, DPR Korea	Kim HJ, Lee HR, Jo KR et al. 2012. Broad spectrum late blight resistance in potato differential set plants Ma*R8* and Ma*R9* is conferred by multiple stacked *R* genes. Theor Appl Genet 124(5): 923-35.
560. Potato	Late blight	China Peru	Huazhong Agric Univ: Minist Educ, Key Lab Horticultural Plant Biol; Natl Ctr Vegetable Improv (Central China), Potato Engineer & Technol Res Ctr	Li J, Lindqvist-Kreuze H, Tian Z et al. 2012. Conditional QTL underlying resistance to late blight in a diploid potato population. Theor Appl Genet

			Hubei Province, China Internatl Potato Ctr, Peru	124(7): 1339-50.
561. Potato	Late blight	Denmark Argentina	Aarhus Univ, Dept Mol Biol, Denmark Danish Potato Breed Stn (LKF-Vandel), Denmark Inst Investigaciones en Ingeniería Genética & Biología Mol (INGEBI-CONICET), Argentina	Orlowska E, Fiil A, Kirk HG et al. 2012. Differential gene induction in resistant and susceptible potato cultivars at early stages of infection by *Phytophthora infestans*. Plant Cell Rep 31(1): 187-203.
562. Potato	Late blight	Poland Australia	Młochów Res Ctr, Plant Breed & Acclimatization Inst, Poland Diversity Arrays Technol Pty Ltd, Australia	Sliwka J, Jakuczun H, Chmielarz M et al. 2012. Late blight resistance gene from *Solanum ruiz-ceballosii* is located on potato chromosome X and linked to violet flower colour. BMC Genet 13: 11.
563. Potato	Late blight	Poland Australia	Młochów Res Ctr, Plant Breed & Acclimatization Inst, Poland Diversity Arrays Technol Pty Ltd, Australia	Sliwka J, Jakuczun H, Chmielarz M et al. 2012. A resistance gene against potato late blight originating from *Solanum* x *michoacanum* maps to potato chromosome VII. Theor Appl Genet 124(2): 397-406.
564. Potato	Late blight	UK Poland	Sainsbury Lab; Genome Analysis Ctr, UK Res Ctr Młochów, Plant Breed & Acclimatization Inst, Poland James Hutton Inst: Information & Computational Sci; Cell Mol Sci, UK	Jupe F, Witek K, Verweij W et al. 2013. Resistance gene enrichment sequencing (RenSeq) enables reannotation of the NB-LRR gene family from sequenced plant genomes and rapid mapping of resistance loci in segregating populations. Plant J 76(3): 530-44.
565. Potato	Late blight	Poland UK	Młochów Res Ctr, Plant Breed & Acclimatization Inst, Poland Potato Breed Zamarte Ltd-IHAR Group, Poland JIC, Norwich Res Park, Sainsbury Lab, Norwich, UK James Hutton Inst, UK	Tomczynska I, Stefanczyk E, Chmielarz M et al. 2014. A locus conferring effective late blight resistance in potato cultivar Sárpo Mira maps to chromosome XI. Theor Appl Genet 127(3): 647-57.
566. Potato	Late blight	China	Huazhong Agric Univ, Potato Engineer & Technol Res Ctr of Hubei Provinee, Natl Ctr Vegetable, Minist Educ, Improv Central China, Key Lab Hort Plant Biol Enshi Acad Agric Sci, Southern Potato Res Ctr of China	Yao CG, Song BT, Liu J et al. 2011. Population improvement of resistance to late blight in tetraploid potato: a case study in combination with AFLP marker assisted background selection. Agr Sci China 10(8): 1177-87.
567. Potato	Late blight	China	CAAS, Inst Vegetables & Flowers Northeast Agricul Univ, Coll Agric	Xu JF, Wang JJ, Pang WF et al. 2013. The potato *R10* resistance specificity to late blight is conferred by both a single dominant *R* gene and quantitative trait loci. Plant Breeding 132(4): 407-12.
568. Potato	Late blight	Argentina Canada	Internat Potato Ctr, Genetics & Crop Improv, Argentina Agric & Agri-Food Canada, Canada	Lindqvist-Kreuze H, Gastelo M, Perez W et al. 2014. Phenotypic stability and genome wide association study of late blight resistance in potato genotypes adapted to the tropical highlands. Phytopathology 104(6):624-33.
569. Potato	Late blight	Netherlands	Univ Wageningen & Res Ctr, Wageningen UR Plant Breed Averis Seeds B.V.	Verzaux E, Budding D, de Vetten N et al. 2011. High resolution mapping of a novel late blight resistance gene *Rpi-avl1*, from the wild bolivian species *Solanum avilesii*. Am J Pot Res 88(6): 511-19.
570. Potato	Late blight	USA	Penn State Univ, Univ Park, Dept Plant Pathol USDA-ARS-PSI, Gen Improv Fruits & Vegetables Lab	Wickramasinghe WK, Qu XSS, Costanzo S et al. 2009. Development of PCR-based markers linked to quantitative resistance to late blight in a diploid hybrid potato population of *Solanum phureja* x *S. stenotomum*. Am J Pot Res 86(3): 188-95.
571. Potato	Late blight	USA	Penn State Univ, Univ Park, Dept Plant Pathol	Wickramasinghe WK, Qu XSS, Costanzo S et al. 2007. PCR-based markers for marker assisted selection for quantitative resistance to late blight in

				a diploid potato family. Phytopathology 97(7): s123.
572. Potato	Late blight	Romania	Fac Agric, Univ Agric Sci & Veterinary Medicine Natl High School of Agron, Dept Botany	Botez C, Pamfil D, Taoutaou A et al. 2009. Preliminary results concerning marker assisted selection for potato resistance to *Phytophthora infestans*. Bulletin UASMV Agr 66 (1): 10-16.
573. Potato	Late blight Potato Virus Y	Germany Romania Russia	JKI, Federal Res Ctr Cultivated Plants: Inst Breed Res Agricul Crops; Inst Biosafety Genetically Modified Plants; Ins Plant Protect Field Crops & Grassland, Germany Babeş-Bolyai Univ, Romania N.I. Vavilov Inst Plant Ind, Russia BTL Bio-Test Lab GmbH Sagerheide, Germany	Thieme R, Rakosy-Tican E, Gavrilenko T et al. 2008. Novel somatic hybrids (*Solanum tuberosum* L. + *Solanum tarnii*) and their fertile BC1 progenies express extreme resistance to potato virus Y and late blight. Theor Appl Genet 116(5): 691-700.
574. Potato	Colorado potato beetle	Chile USA Uganda	Inst Invest Agropecuarias INIA, CRI Rayentue, Chile N Dakota State Univ : Dept Plant Pathol; Dept Vet & Microbiol Sci, USA USDA-ARS, No Crop Sci Lab, USA Int Inst Trop Agric, Uganda	Sagredo B, Balbyshev N, Lafta A et al. 2009. A QTL that confers resistance to Colorado potato beetle (*Leptinotarsa decemlineata* Say) in tetraploid potato populations segregating for leptine. Theord Appl Genet 119(7): 1171-81.
575. Potato	Golden nematode	Poland	Res Ctr Młochów, Plant Breed & Acclimatizat Inst, Natl Res Inst	Milczarek D. 2012. A Multiplex PCR method of detecting markers linked to genes conferring resistance to *Globodera rostochiensis*. Am J Pot Res 89(2): 169-71.
576. Potato	Golden nematode	Poland USA	Wroclaw Univ Environm & Life Sci, Fac Life Sci & Technol, Dept Genet, Plant Breed & Seed Product, Poland Adam Mickiewicz Univ, Fac Biol, Dept Mol & Cellular Biol, Inst Mol Biol & Biotechnol, Poland Cornell Univ, Dept Plant Breed & Genet, USA	Galek R, Rurek M, De Jong et al. 2011. Application of DNA markers linked to the potato *H1* gene conferring resistance to pathotype Ro1 of *Globodera rostochiensis*. J Appl Genet 52(4): 407-11.
577. Potato	Golden nematode	Ukraine	Nat Acad Sci Ukraine : Inst Plant Protect; State Inst Food Biotechnol & Genom Ustimivka Experim Stn Plant Growing	Karelov AV, Pilipenko LA, Kozub NA et al. 2013. Allelic state of the molecular marker for the golden nematode (*Globodera rostochiensis*) resistance gene *H1* among Ukrainian and world cultivars of potato (*Solanum tuberosum* ssp. *tuberosum*). Tsitol Genet 47(5): 41-46.
578. Potato	Potato cyst nematodes	Poland	Res Ctr Młochów, Plant Breed & Acclimatizat Inst Res Ctr Radzików, Plant Breed & Acclimatizat Inst	Milczarek D, Flis B, Przetakiewicz A. 2001. Suitability of molecular markers for selection of potatoes resistant to *Globodera* spp. Am J Pot Res 88(3): 245-55.
579. Potato	Potato cyst nematode	France	INRA: Génétique & Amélioration Fruits & Légumes; Agrocampus Rennes, BiO3P (Biologie Organismes & Populations Appliquée Protection Plantes); Agrocampus Rennes,Amélioration Plantes & Biotechnolog Végétales	Jolivet K, Grenier E, Bouchet JP et al. 2007. Identification of plant genes regulated in resistant potato *Solanum sparsipilum* during the early stages of infection by *Globodera pallida*. Genome 50(4): 422-27.
580. Potato	Pale cyst nematode	Germany Netherlands Canada	Dept Plant Breed & Genetics, Max Planck Inst Plant Breed Res, Germany Rheinische Friedrich-Wilhelms-Univ Bonn, Inst Mol Physiol & Biotechnol Plants (IMBIO),Germany Biometris, Wageningen Univ, Netherlands DNA LandMarks Inc., Canada Saka-Pflanzenzucht GbR, Zuchtstation Windeby, Germany Bioplant GmbH, Germany	Achenbach U, Paulo J, Ilarionova E et al. 2009. Using SNP markers to dissect linkage disequilibrium at a major quantitative trait locus for resistance to the potato cyst nematode *Globodera pallida* on potato chromosome V. Theor Appl Genet 118(3): 619-29.

				Böhm-Nordkartoffel Agrarproduktion GbR, Germany	
581.	Potato	Potato cyst nematodes	Netherlands	Wageningen Univ, Plant Sci Group: Lab Nematol; Lab Plant Breed	Finkers-Tomczak A, Danan S, van Dijk T et al. 2009. A high-resolution map of the *Grp1* locus on chromosome v of potato harbouring broad-spectrum resistance to the cyst nematode species *Globodera pallida* and *Globodera rostochiensis*. Theor Appl Genet 119(1): 165-73.
582.	Potato	Pale cyst nematode	Ireland UK	Crops Res Ctr, Ireland Univ Coll Cork, Dept Zoology, Ecol & Plant Sci, Ireland Genet Programme, Scottish Crop Res Inst, UK	Moloney C, Griffin D, Jones PW et al.2010. Development of diagnostic markers for use in breeding potatoes resistant to *Globodera pallida* pathotype Pa2/3 using germplasm derived from *Solanum tuberosum* ssp. *andigena* CPC 2802. Theor Appl Genet 120(3): 679-89.
583.	Potato	Potato cyst nematodes	Japan	NARO Hokkaido Agricul Res Ctr, Upland Farm Res Division	Asano K., Kobayashi A, Tsuda S et al. 2012. DNA marker-assisted evaluation of potato genotypes for potential resistance to potato cyst nematode pathotypes not yet invading into Japan. Breed Sci 62(2): 142-50.
584.	Potato	Potato Virus Y (PVY)	India	Cent Potato Res Inst Campus Cent Tuber Crop Res Inst	Kaushik SK, Sharma R, Garg ID et al. 2013. Development of a triplex (YYYy) parental potato line with extreme resistance to potato virus Y using marker assisted selection. J Hortic Sci Biotech 88(5): 580-84.
585.	Potato	PVY	Poland UK	MłochówRes Ctr, Plant Breed & Acclimatization Inst - Natl Res Inst, Poland JIC, Norwich ResPark, Sainsbury Lab, UK James Hutton Inst, Cell & Mol Sci, UK	Tomczyńska I, Jupe F, Hein I et al. 2014. Hypersensitive response to Potato virus Y in potato cultivar Sárpo Mira is conferred by the *Ny-Smira* gene located on the long arm of chromosome IX. Mol Breeding: DOI 10.1007/s11032-014-0050-2.
586.	Potato	PVY	Chile	Ctr Reg Invest Rayentue, Carillanca & Remehue, Inst Investigaciones Agropecuarias INIA	Sagredo B, Mathias M, Barrientos C et al. 2009. Evaluation of a SCAR RYSC3 marker of the Ry_{adg} gene to select resistant genotypes to potato virus Y (PVY) in the INIA potato breeding program. Chilean J Agric Res 69(3): 305-15.
587.	Potato	PVY	Germany	JKI, Federal Res Ctr for Cultivated Plants	Lindner K, Behn A, Schwarzfischer A, Song YS. 2011. Extreme resistance to Potato virus Y in potatoes of the German variety list. Journal für Kulturpflanzen 63(4): 97-103.
588.	Potato	PVY Golden nematode	Spain	Appacale SA	Ortega F, Lopez-Vizcon C. 2012. Application of molecular marker-assisted selection (MAS) for disease resistance in a practical potato breeding programme. Potato Res 55(1): 1-13.
589.	Potato	Potato leafroll virus (PLRV)	USA	USDA-ARS, Crop Genet & Prod Res Unit Univ Idaho R&E Ctr, Small Grains & Potato Res Unit, USDA-ARS	Gillen AM, Novy RG. 2007. Molecular characterization of the progeny of *Solanum etuberosum* identifies a genomic region associated with resistance to potato leafroll virus. Euphytica 155 (3): 403-15.
590.	Potato	PLRV	Peru	Int Potato Ctr	Velasquez AC, Mihovilovich E, Bonierbale M. 2007. Genetic characterization and mapping of major gene resistance to potato leafroll virus in *Solanum tuberosum* ssp. *andigena*. Theor Appl Genet 114(6): 1051-58.
591.	Beet	Cercospora leaf spot	Japan	Natl Agric & Food Res Org, Hokkaido Agric Res Ctr, Memuro Upland Farming Res Div Hokkaido Univ, Res Fac Agric, Lab Genet Engineer	Taguchi K, Kubo T, Takahashi H, Abe H. 2011. Identification and precise mapping of resistant QTLs of Cercospora leaf spot resistance in sugar beet (*Beta vulgaris* L.). G3: Genes, Genomes, Genetics 1 (4): 283-91.

592. Beet	Powdery mildew	UK	Brooms Barn Res Stn	Grimmer MK, Bean KMR, Asher MJC. 2007. Mapping of five resistance genes to sugar-beet powdery mildew using AFLP and anchored SNP markers. Theor Appl Genet 115(1): 67-75.
593. Beet	Rhizoctonia root rot	Germany	Univ Kiel, Plant Breed Inst Inst Sugar Beet Res, Associated Inst at the Univ Göttingen Martin-Luther-Univ Halle-Wittenberg, Inst Agric & Nutritional Sci Strube-Dieckmann KWS SAAT AG	Lein JC, Sagstetter CM, Schulte D et al. 2008. Mapping of Rhizoctonia root rot resistance genes in sugar beet using pathogen response-related sequences as molecular markers. Plant Breeding 127(6): 602-11.
594. Beet	Beet mild yellowing virus Powdery mildew Rust	UK Belgium Sweden	Brooms Barn Res Stn, UK ADAS UK Ltd, UK SESVanderHave, Belgium Syngenta Seeds, Sweden	James LC, Bean KMR, Grimmer MK et al. 2012. Varieties of the future: Identification of 'broad spectrum' genetic resistance in sugar beet. Int Sugar J 114 (1359): 164-68.
595. Beet	Rhizomania disease (BNYVV)	Italy Iran	Univ Padua, Dipart Agron Anim Alimenti Risorse Nat & Am, Italy Sugar Beet Seed Inst, Iran	Stevanato P, Trebbi D, Norouzi P et al. 2012. Identification of SNP markers linked to the *Rz1* gene in sugar beet. Int Sugar J 114(1366): 715-18.
596. Beet	Rhizomania disease (BNYVV)	Iran	Univ Tehran, Dept Agron & Plant Breed Sugar Beet Seed Inst Univ Tabriz, Dept Crop Prod & Breed, Fac Agric Univ Tehran, Dept Crop Prod & Breed	Amiri R, Mesbah M, Moghaddam M et al. 2009. A new RAPD marker for beet necrotic yellow vein virus resistance gene in *Beta vulgaris*. Biol Plantarum 53(1): 112-19.
597. Beet	Rhizomania disease (BNYVV)	UK	Brooms Barn Res Ctr	Asher MJC, Grimmer MK, Mutasa-Goettgens ES. 2009. Selection and characterization of resistance to *Polymyxa betae*, vector of beet necrotic yellow vein virus, derived from wild sea beet. Plant Pathol 58(2): 250-60.
598. Beet	Rhizomania disease (BNYVV)	UK Sweden	Brooms Barn Res Ctr, UK Syngenta Seeds AB, Sweden	Grimmer MK, Kraft T, Francis SA, Asher MJC. 2008. QTL mapping of BNYVV resistance from the WB258 source in sugar beet. Plant Breeding 127(6): 650-52.
599. Beet	Rhizomania disease (BNYVV)	UK	Brooms Barn Res Stn Rothamsted Res	Grimmer M K, Trybush S., Hanley S et al. 2007. An anchored linkage map for sugar beet based on AFLP, SNP and RAPD markers and QTL mapping of a new source of resistance to beet necrotic yellow vein virus. Theor Appl Genet 114(7): 1151-60.
600. Beet	Rhizomania disease (BNYVV)	Germany China	Univ Kiel, Plant Breed Inst, Dept Mol Phytopathol, Germany Strube Dieckmann, Germany Harbin Inst Technol, Dept Life Sci & Engineer, China Yangzhou Univ, Dept Agron, China	Lein JC, Asbach K., Tian YY et al. 2007. Resistance gene analogues are clustered on chromosome 3 of sugar beet and cosegregate with QTL for Rhizomania resistance. Genome 50(1): 61-71.
601. Beet	Rhizomania disease (BNYVV)	Iran	Zanjan Univ Univ Tehran, Coll Aboureihan Sugar Beet Seed Inst	Nouhi A, Amiri R., Haghnazari A et al. 2008. Tagging of resistance gene(s) to Rhiozmania disease in sugar beet (*Beta vulgaris* L.). Afr J Biotechnol 7(4): 430-33.

Supplementary Material 5.

Analysis of scientific articles about biotic stress (BS) challenges, reporting the use of transgenesis, cisgenesis, RNAi (stable and transient assays), mutagenesis, cloning, conventional breeding, and molecular markers to tag resistance genes and/or for marker assisted selection

When authors are in Europe, their country code is given in brackets with the number of articles.
(see http://www.iso.org/iso/fr/home/standards/country_codes/country_names_and_code_elements.htm)
(Some papers deal with several challenges and are listed as individual 'studies' in this compilation).

Abbreviations: BS, biotic stress; MAS, marker-assisted selection; RNAi, RNA interference

*BS challenges not addressed in any article (71)

**RNAi /silencing (stable and transient assays)

***Molecular markers used to tag resistance genes and for MAS

Crop (Total studies = 937)	**BS challenge** (128)	**Latin names**	**Transgenesis** (Total = 80)	**Cisgenesis** (Total = 3)	**RNAi**** (Total = 52)	**Other transient assays** (Total = 14)	**Cloning of resistance gene** (Total = 8)	**Mutagenesis** (Total = 6)	**Conventional breeding** (Total = 35)	**MAS***** (Total = 739)
Wheat	**Fungal diseases**									
	Leaf (brown) rust	*Puccinia triticina* (*Puccinia recondita* f. sp. *tritici*)	4 (1 CH, 1 CH/FR)	0	2	2 (1 CH)	1 (1 CH/FR)	1	7 (1 SE)	158 (1 RO, 1 BG, 6 HU, 13 DE, 3 IT, 5 CH, 1 SK/DE, 2 TR, 1 SE, 2 CZ, 2

										UK, 1 FR, 3 PL, 1FR/CH, 1 DE/HU/PL, 1 IT/ES, 1 HU/UK, 1 IT/PL, 1 IT/DE)
	Stem rust	*Puccina graminis*	0	0	1	0	0	1	4	100 (8 DE, 2 HU, 2 IT, 1 BG, 1 RO, 1 FR, 3 CH, 1 TR)
	Stripe (yellow) rust	*Puccinia striiformis*	3 (1 CH)	0	11 (1 DE)	0	0	1	4	104 (6 UK, 1 HU, 2 DE, 1 RO, 3TR, 2 FR, 4 CH, 2 CZ)
	Bunts and smuts	*Ustilago tritici,Tilletia* spp., *Urocystis agropyri*	0	0	0	0	0	0	1	12 (2 RO, 1 DE)
	Fusarioses (incl. Fusarium head blight) Crown rot	*Fusarium graminearum* (Fusarium head blight), *Fusarium* spp., *Microdochium* spp.	13 (1 CH, 3 IT, 1 DE, 1 IT/FR)	0	0	0	1 (1 NL/CZ)	0	3	70 (2 CZ, 5 DE, 1 HU, 1 RO, 3 AT, 1 UK, 1 FR, 2 BE, 1 NL/AT, 1 CZ/FR, 1 DE/AT, 1 UK/DE/AT/HU, 1 DE/FR)
	Powdery mildew	*Blumeria (Erysiphe) graminis*	6 (1 CH, 1 CH/FR)	0	4 (1 DE, 1 UK/DE, 1HU)	0	0	1	3	42 (1 HU, 1 RO, 5 DE, 1 CH, 2 PL, 1 IT/ES, 1 IT/DE)

	Septoria leaf blotch	*Mycosphaerella graminicola* (anamorph: *Septoria tritici*)	0	0	0	0	0	0	0	6 (2 RO, 1 NL/FR, 1 DE)
	Take-all	*Gaeumannomyces graminis* var. *tritici* (*Ophiobolus graminis*)	2	0	0	0	0	0	0	2
	Eyespot	*Pseudocercosporella herpotrichoides*	0	0	0	0	0	0	0	11 (2 DE, 1 FR, 5 UK, 1 PL)
	Tan spot (yellow leaf spot)	*Drechslera* (*Pyrenophora*) *tritici-repentis*	0	0	0	0	0	0	2	18 (2 DE)
	Insect pests									
	Hessian fly	*Mayetiola destructor*	0	0	1	0	0	0	2	12 (1 ES, 1 HU)
	Sunn pest	*Eurygaster integriceps*	0	0	0	0	0	0	1	1
	Corn ground beetle*	*Zabrus tenebrioides*	0	0	0	0	0	0	0	0
	Grain aphid Rose-grain aphid	*Sitobion avenae* *Metopolophium dirhodum*	0	0	2	0	0	0	0	0
	Frit fly*	*Oscinella frit*	0	0	0	0	0	0	0	0
	Chloropid gout fly*	*Chlorops pumilionis*	0	0	0	0	0	0	0	0
	Wheat blossom midge: orange wheat blossom midge, yellow wheat blossom midge*	*Sitodiplosis mosellana* *Contarinia tritici*	0	0	0	0	0	0	0	4

	Cereal leaf beetle	*Oulema melanopus* (*Lema melanopa*)	0	0	0	0	0	0	0	1
	Viral diseases	Vector								
	Wheat dwarf virus (WDV)	Leafhoppers	0	0	0	1 (1 HU)	0	0	0	1 (1CZ)
	Barley yellow dwarf virus (BYDV)	Aphids	0	0	1	0	0	0	1	10 (1 CZ, 1 SK /DE, 1 RO, 1 FR)
Subtotal 639			*28*	*0*	*22*	*3*	*2*	*4*	*28*	*552*
Barley	**Fungal diseases**	**Latin names**	**Transgenesis**	**Cisgenesis**	**RNAi****	**Other transient assays**	**Cloning of resistance gene**	**Mutagenesis**	**Conventional breeding**	**MAS*****
	Barley leaf (brown) rust	*Puccinia hordei*	2 (1 DE/CH, 1 NL)	0	0	0	0	0	0	18 (1 CZ, 2 UK/NL, 2 NL, 2 NL/FR/DE, 1 NL/CZ, 1FR/NL)
	Stem rust	*Puccinia graminis*	1 (1 NL)		3 (1 UK)					8 (1 NL, 1 UK, 1 IE/LV/UK
	Bunts and smuts	*Ustilago tritici, Tilletia caries, T. laevis, T. controversa*	0	0	0	0	0	0	0	1
	Fusarioses (incl. Fusarium head blight)	*Fusarium graminearum* (Fusarium head blight)*, Fusarium* spp.*,*	1 (1 DE)	0	2 (1 DE, 1 FR/DE)	0	0	0	1	8 (1 DE)

		Microdochium spp.							
	Powdery mildew	*Blumeria* (*Erisyphe*) *graminis*	3 (1 DE, 1 DE/CH)	0	3 (1 DE/NL, 2 UK/DE)	1 (1DE)	0	1 (1 DE)	0	9 (2 CZ, 3 DE, 2 DE/ES)
	Spot blotch	*Bipolaris sorokiniana* (teleomorph: *Helminthosporium sativum, Cochliobolus sativus*)	0	0	0	0	0	0	0	6
	Net blotch	*Pyrenophora* (*Helminthosporium*) *teres*	0	0	0	0	0	0	0	4 (1 DE)
	Leaf blotch	*Rhynchosporium secalis*	0	0	0	0	0	0	0	1 (1 DE/ES)
	Insect pests									
	Sunn pest*	*Eurygaster integriceps*	0	0	0	0	0	0	0	0
	Corn ground beetle*	*Zabrus tenebrioides*	0	0	0	0	0	0	0	0
	Grain aphid* Rose-grain aphid* Bird cherry-out aphid (wheat aphid)*	*Sitobion avenae* *Metopolophium dirhodum* *Rhopalosiphum padi*	0	0	0	0	0	0	0	0
	Cereal leaf beetle*	*Oulema melanopus* (*Lema melanopa*)	0	0	0	0	0	0	0	0
	Frit fly*	*Oscinella frit*	0	0	0	0	0	0	0	0

	Chloropid gout fly*	*Chlorops pumilionis*	0	0	0	0	0	0	0	0
	Viral diseases	Vector								
	Barley yellow dwarf virus (BYDV)	Aphids	0	0	0	0	0	0	0	5 (3 DE, 1 SK /DE)
	Wheat dwarf virus (WDV)*	Leafhoppers	0	0	0	0	0	0	0	0
Subtotal 78			*7*	*0*	*8*	*1*	*0*	*1*	*1*	*60*
Maize	**Fungal diseases**	**Latin names**	**Transgenesis**	**Cisgenesis**	**RNAi****	**Other transient assays**	**Cloning of resistance gene**	**Mutagenesis**	**Conventional breeding**	**MAS*****
	Common smut	*Ustilago zeae* (*U. maydis*)	1	0	0	0	0	0	0	2
	Fusarioses	*Fusarium* spp. (conidial form of *F. graminearum*: *Gibberella zeae*)	1	0	0	0	0	0	0	6 (1 ES)
	Northern leaf blight	*Setosphaeria turcica* (anamorph: *Exserohilum* (*Helminthosporium*) *turcicum*)	0	0	0	0	0	0	0	1
	Insect (arthropod) pests									
	European corn borer	*Ostrinia nubilalis*	0	0	0	0	0	0	0	2 (1 DE, 1 ES)
	Corn rootworm	*Diabrotica* spp.	0	0	1 (1 BE)	0	0	0	0	0
	Wireworm (click	*Agriotes* spp.	0	0	0	0	0	0	0	0

	beetle)*									
	Corn earworm (cotton bollworm)	*Helicoverpa* (*Heliothis*) *armigera*	1	0	0	0	0	0	0	0
	Maize leaf (gray corn) weevil *	*Tanymecus dilaticollis*	0	0	0	0	0	0	0	0
	Mediterranean corn borer	*Sesamia nonagrioides*	0	0	0	0	0	0	0	2 (2 ES)
	Symphylan*	*Scutigerella immaculata*	0	0	0	0	0	0	0	0
	Spider mite*	*Tetranychus* spp.	0	0	0	0	0	0	0	0
	Cereal fly* Frit fly*	*Geomyza* spp. *Oscinella* spp.	0	0	0	0	0	0	0	0
	Leafhopper* Maize orange leafhopper*	*Zyginidia scutellaris* *Cicadulina bipunctata*	0	0	0	0	0	0	0	0
	Rose-grain aphid* Grain aphid*	*Metopolophium dirhodum* *Sitobion avenae*	0	0	0	0	0	0	0	0
	Corn seed maggot*	*Delia platura*	0	0	0	0	0	0	0	0
	Cutworm*	*Agrotis* spp.	0	0	0	0	0	0	0	0
Subtotal 17			*3*	*0*	*1*	*0*	*0*	*0*	*0*	*13*
Oilseed rape **OSR**	**Fungal diseases**	**Latin names**	**Transgenesis**	**Cisgenesis**	**RNAi****	**Other transient assays**	**Cloning of resistance gene**	**Mutagenesis**	**Conventional breeding**	**MAS*****
	Light leaf spot*	*Pyrenopeziza brassicae*	0	0	0	0	0	0	0	0
	Gray leaf spot*	*Alternaria*	0	0	0	0	0	0	0	0

		brassicae							
	Sclerotinia (white mold)	*Sclerotinia sclerotiorum*	7	0	0	0	1	0	0	0
	Blackleg (Phoma stem canker)	*Leptosphaeria maculans* (anamorph: *Phoma lingam*)	1	0	0	0	1	0	0	2 (1 FR)
	Clubroot	Rhizaria*: Plasmodiophora brassicae*	1 (1 DE)	0	0	0	0	0	0	0
	White leaf spot*	*Pseudocercosporella capsellae*	0	0	0	0	0	0	0	0
	Ring spot*	*Mycosphaerella brassicicola*	0	0	0	0	0	0	0	0
	Verticillium wilt	*Verticillium longisporum* (*V. dahliae var. longisporum*)	0	0	0	0	0	0	0	2 (1 DE, 1 SE/DE)
	Powdery mildew*	*Erysiphe cruciferarum*	0	0	0	0	0	0	0	0
	Downy mildew*	*Hyaloperonospora brassicae*	0	0	0	0	0	0	0	0
	Insect pests									
	Rape stem weevil*	*Ceutorhynchus napi*	0	0	0	0	0	0	0	0
	Cabbage seed weevil	*Ceutorhynchus assimilis*	0	0	0	0	0	0	0	1
	Stem weevil (terminal bud weevil)*	*Ceutorhyncus picitarsis*	0	0	0	0	0	0	0	0
	Brassica pod midge*	*Dasineura brassicae*	0	0	0	0	0	0	0	0
	Turnip sawfly*	*Athalia rosae*	0	0	0	0	0	0	0	0

	Cabbage stem flea beetle*	*Psylliodes chrysocephala*	0	0	0	0	0	0	0	0
	Pollen beetle*	*Meligethes aeneus*	0	0	0	0	0	0	0	0
	Cabbage aphid* Green peach aphid (green fly)*	*Brevicoryne brassicae* *Myzus persicae*	0	0	0	0	0	0	0	0
	Flea beetle*	*Phyllotreta* spp.	0	0	0	0	0	0	0	0
	Cabbage root fly (maggot)*	*Delia radicum*	0	0	0	0	0	0	0	0
Subtotal 16			*9*	*0*	*0*	*0*	*2*	*0*	*0*	*5*
Sunflower	**Fungal diseases**	**Latin names**	**Transgenesis**	**Cisgenesis**	**RNAi****	**Other transient assays**	**Cloning of resistance gene**	**Mutagenesis**	**Conventional breeding**	**MAS*****
	Downy mildew	*Plasmopara halstedii* *P. helianthi*	0	0	0	0	0	0	0	3 (1 BG)
	Phoma black stem	*Phoma macdonaldii*	0	0	0	0	0	0	0	1 (1 FR)
	Rust	*Puccinia helianthi*	0	0	0	0	0	0	1	6
	Sclerotinia (white mold, basal stem rot, Sclerotinia head rot)	*Sclerotinia sclerotiorum*	1	0	0	0	1	0	0	4 (1 FR)
	Botrytis bunch rot*	*Botrytis cinerea*	0	0	0	0	0	0	0	0
	Phomopsis stem canker*	*Diaporthe helianthi*	0	0	0	0	0	0	0	0
	Verticillium wilt	*Verticillium*	0	0	0	0	0	0	1	0

		dahliae								
	Charcoal rot*	*Macrophomina phaseolina*	0	0	0	0	0	0	0	0
	White blister rust*	*Pustula helianthicola*	0	0	0	0	0	0	0	0
	Insect pests									
	Wireworm (click beetle)*	*Agriotes* spp.	0	0	0	0	0	0	0	0
	Black bean aphid (blackfly)* Leaf curl plum aphid *	*Aphis fabae Brachycaudus helichrysi*	0	0	0	0	0	0	0	0
	Parasitic plant									
	Sunflower broomrape	*Orobanche cumana*	0	0	0	0	0	0	1 (1 ES)	0
	Weed									
	Common ragweed*	*Ambrosia artemisiifolia*	0	0	0	0	0	0	0	0
Subtotal 19			*1*	*0*	*0*	*0*	*1*	*0*	*3*	*14*
Grapevine	**Fungal diseases**	**Latin names**	**Transgenesis**	**Cisgenesis**	**RNAi****	**Other transient assays**	**Cloning of resistance gene**	**Mutagenesis**	**Conventional breeding**	**MAS*****
	Downy mildew	*Plasmopara viticola*	1 (1 FR)	0	0	3 (3 FR)	0	0	0	13 (1 BG, 3 DE, 1 HU, 3 FR, 2 IT/FR, 1 FR/DE)
	Powdery mildew	*Erysiphe* (*Uncinula*) *necator*	2 (1 FR)	0	0	1	0	0	0	18 (1 BG, 2 DE, 4 HU, 1 IT, 4 FR, 1 IT/FR, 1 IT/HU)

	Gray mold (grey mould, Botrytis bunch rot)*	*Botryotinia fuckeliana* (anamorph: *Botrytis cinerea*)	0	0	0	0	0	0	0	0
	Insect (arthropod) pests									
	Grape leafroller*	*Sparganothis pilleriana*	0	0	0	0	0	0	0	0
	Grape leaf blister mite (grape bud mite, grape erineum mite)*	*Eriophyes* (*Colomerus*, *Phytoptus*) *vitis*	0	0	0	0	0	0	0	0
	Yellow spider mite*	*Eotetranychus* (*Tetranychus*) *carpini*	0	0	0	0	0	0	0	0
	European grapevine moth* Grapevine moth*	*Lobesia* (*Polychrosis*) *botrana* *Eupoecilia ambiguella*	0	0	0	0	0	0	0	0
	Grape tortrix*	*Argyrotaenia ljungiana*	0	0	0	0	0	0	0	0
	Viruslike diseases	Vector								
	Flavescence dorée* Bois noir (black wood)*	*Scaphoideus titanus* *Hyalesthes obsoletus* and other planthoppes	0	0	0	0	0	0	0	0
	Viral diseases	Vector								

	Grapevine fanleaf virus (GFLV)	*Xiphinema index*	2 (1IT)	0	2 (1 FR)	0	0	0	1 (1FR)	2
	Grapevine leafroll-associated virus (GLRaV)	Pseudococcidae Coccidae	0	0	1	1 (1 ES)	0	0	0	0
Subtotal 47			*5*	*0*	*3*	*5*	*0*	*0*	*1*	*33*
Potato	**Fungal diseases**	**Latin names**	**Transgenesis**	**Cisgenesis**	**RNAi****	**Other transient assays**	**Cloning of resistance gene**	**Mutagenesis**	**Conventional breeding**	**MAS*****
	Late blight	*Phytophthora infestans*	13 (1 IE/DK/IT, 1 UK/PL/NL, 2 NL, 1 CZ)	3 (3 NL)	4 (1 DE)	4 (3 NL, 1 UK/NL)	3 (1 NL, 1 NL/UK)	0	0	30 (7 NL, 1 RO, 4 PL, 3 DE, 2 FR, 1 DK, 2 PL/DE, 1 UK/NL, 2 PL/UK, 1 DE/RO)
	Deforming rust*	*Aecidium cantense*	0	0	0	0	0	0	0	0
	Early blight	*Alternaria solani*	2	0	0	0	0	0	0	0
	Insect pests									
	Potato aphid* Green peach aphid (green fly)	*Macrosiphum euphorbiae* (*Siphonophora solanifolii*) *Myzus persicae*	2	0	0	0	0	0	0	0
	Colorado potato beetle (ten-striped spearman, ten-	*Leptinotarsa* (*Chrysomela*, *Doryphora*, *Polygramma*)	4 (1 BG/PL)	0	0	0	0	0	0	1

	lined potato beetle, potato bug)	*decemlineata*								
	Nematode pests									
	Potato cyst nematodes: golden nematode, pale cyst nematode	Potato cyst nematodes: golden nematode, pale cyst nematode	2 (2 UK)	0	0	0	0	0	0	10 (1 ES, 1 IE/UK, 1 NL, 1 DE/NL, 1 FR, 3 PL)
	Viral diseases	Vector								
	Potato Virus Y (PVY)	Aphids	3	0	7 (1 HU, 1 UK)	0	0	1	1	6 (1 DE, 1 ES, 1 PL/UK, 1 DE/RO)
	Potato leafroll virus (PLRV)	Aphids	0	0	5 (1 UK)	0	0	0	1	2
Subtotal 104			*26*	*3*	*16*	*4*	*3*	*1*	*2*	*49*
Beet	**Fungal diseases**	**Latin names**	**Transgenesis**	**Cisgenesis**	**RNAi****	**Other transient assays**	**Cloning of resistance gene**	**Mutagenesis**	**Conventional breeding**	**MAS*****
	Cercospora leaf spot	*Cercospora beticola*	0	0	0	0	0	0	0	1
	Ramularia leaf spot*	*Ramularia beticola*	0	0	0	0	0	0	0	0
	Powdery mildew	*Erysiphe betae* (*E. polygoni*)	0	0	0	0	0	0	0	2 (1 UK, 1 BE/UK/SE)
	Rust	*Uromyces betae,* (*U. beticola, Nigredo betae, Uredo betae, U.*	0	0	0	0	0	0	0	1 (1 BE/UK/SE)

		betaecola, U. beticola)								
	Rhizopus root rot*	*Rhizopus stolonifer R. arrhizus*	0	0	0	0	0	0	0	0
	Rhizoctonia foliar blight Crown rot Root rot	*Rhizoctonia* (*Moniliopsis*) *solani*	0	0	0	0	0	0	0	1 (1 DE)
	Insect pests									
	Beet leaf miner* Beet fly*	*Pegomya hyoscyami P. betae* (*Anthomyia betae*)	0	0	0	0	0	0	0	0
	Flea beetle*	*Chaetocnema tibialis*	0	0	0	0	0	0	0	0
	Wireworm (click beetle)*	*Agriotes* spp.	0	0	0	0	0	0	0	0
	Crane fly (daddy longlegs)*	*Tipula* spp.	0	0	0	0	0	0	0	0
	Sugar beet moth*	*Scrobipalpa* (*Phthorimaea*, *Gnorimoschema* , *Lita*) *ocellatella*	0	0	0	0	0	0	0	0
	Black bean aphid (black fly)* Green peach aphid (green fly)*	*Aphis fabae Myzus persicae*	0	0	0	0	0	0	0	0
	Nematode pests									
	Beet cyst eelworm (beet	*Heterodera* (*Tylenchus*,	0	0	0	0	0	0	0	0

	cyst nematode)*	*Heterobolbus*) *schachtii*								
	Stem nematode (stem and bulb eelworm)*	*Ditylenchus dipsaci*	0	0	0	0	0	0	0	0
	Viral diseases	Vector								
	Beet western yellows virus (BWYV)* Beet mild yellowing virus (BMYW)	*Aphis fabae* *Myzus persicae*	0	0	0	0	0	0	0	1 (1 BE/UK/SE)
	Beet necrotic yellow vein virus (BNYVV) causing Rhizomania disease	*Polymyxa betae*	1 (1 GR)	0	2 (1 FI/SE, 1 NL/GR)	1 (1 IT/FR)	0	0	0	7 (1 DE, 1 IT, 2 UK, 1 SE/UK)
	Beet mosaic virus (BtMV)*	*Aphis fabae* *Myzus persicae*	0	0	0	0	0	0	0	0
Subtotal 17			*1*	*0*	*2*	*1*	*0*	*0*	*0*	*13*
Olive	**Fungal diseases**	**Latin names**	**Transgenesis**	**Cisgenesis**	**RNAi****	**Other transient assays**	**Cloning of resistance gene**	**Mutagenesis**	**Conventional breeding**	**MAS*****
	Olive leaf spot (peacock spot)*	*Spilocaea oleaginea* (*Cycloconium* (*Fusicladium*) *oleaginum*)	0	0	0	0	0	0	0	0
	Verticillium wilt*	*Vertilicium dahliae*	0	0	0	0	0	0	0	0

	Anthracnose*	*Colletrotichum acutatum* (*C. cingulata*)	0	0	0	0	0	0	0	0
	Bacterial diseases									
	Olive-knot disease*	*Pseudomonas syringae pv. savastanoi*	0	0	0	0	0	0	0	0
	Insect pests									
	Olive fruit fly*	*Bactrocera oleae* (*Dacus* (*Musca*) *oleae*)	0	0	0	0	0	0	0	0
	Olive leaf moth (jasmine moth, olive leaf worm)*	*Palpita (Margaronia) unionalis*	0	0	0	0	0	0	0	0
	Leopard moth* Olive pyralid moth*	*Zeuzera* (*Phalaena*) *pyrina* (*P.esculi*) *Euzophera pinguis*	0	0	0	0	0	0	0	0
	Olive moth (olive kernel borer)*	*Prays oleae* (*P. oleellus*)	0	0	0	0	0	0	0	0
Subtotal 0			*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*

Supplementary Material 6.
List of recent European public research programs on nine crops and fruit trees using transgenesis and new techniques in the 13 countries studied

(Only research programs directly relevant to addressing the biotic stress challenges identified in this study are included. Some research programs included may comprise of a number of individual research components. The data presented is influenced by the level of response to questionnaires in the individual countries and therefore cannot be considered as an exhaustive summary.)

Abbreviations:

Belgium (BE), Bulgaria (BG), the Czech Republic (CZ), France (FR), Germany (DE), Hungary (HU), Italy (IT), Portugal (PT), Romania (RO), Spain (ES), Sweden (SE), Turkey (TR), and the United Kingdom (UK).

New techniques include RNAi, TALEN, CRISPR.

Note:

Some programs using micropropagation are not taken into account (they concern two programs to fight potato virus Y and virus S carried out in CZ).

Country	Crop	Novel traits through genetic engineering	Current stage
BE	Potato	No current activities about resistance genes being introduced using genetic engineering. However, field research ongoing with genetically engineered potatoes that were made in The Netherlands.	On-going field trial (2011-2012). T in the Netherlands
BE	Wheat	GM fungal resistant in wheat is in development (Syngenta).	Field trials have been performed in different countries (not Belgium).
BG	Grapevine	Grapevine fanleaf virus (GFLV) resistance through coat protein transformation.	Research terminated. Plants destroyed in T0.
BG	Grapevine	*R. radiobacter* (*A. vitis*) resistance through expression of sarcotoxin gene. Expression of the gene is driven by a wound inducible promoter, thus produced only at the sites of possible pathogen attack.	Research terminated. Plants destroyed in T0.
CZ	OSR	Phoma stem canker (blackleg, *Leptosphaeria maculans*): experiments with signaling pathways in defense response against pathogen.	Laboratory experiments: preparation of the defense response elicitors derived from pathogen and their use for increase resistance.
CZ	Plum tree	Plum pox virus.	Field trials. T (RNAi)
CZ	Potato	Biotic stress: SPI gene (serine type inhibitor of proteases) to enhance resistance to pests and late blight.	Effect on target organisms in laboratory and glasshouse experiments.
CZ	Potato	Potato leafroll virus (PLRV). The inserted gene for PLRV replicase to potato by transgenesis.	On-going research: potato with PLRV's coat proteins, potato with PLRV's replicase. T.
CZ	Sugar Beet	No current activities about resistance genes being introduced using genetic engineering.	Three field trials (2011, 2012).

		However, field research ongoing with transgenic sugar beet tolerant to glyphosate and Rhizomania (caused by beet necrotic yellow vein virus, BNYVV) that were made by private international companies.	T by private international companies.
CZ	wheat	Grass powdery mildew (*Blumeria graminis*) characterization of interaction between pathogen and host (wheat), positional cloning of gene for resistance to grass powdery mildew.	Laboratory experiments.
CZ	wheat	Powdery mildew (*Mycosphaerella graminicola*, sexual stage *Septoria tritic*i): identification of wheat gene of resistance, study of plant defense.	Laboratory experiments: experiments have shown that most of the tested varieties of wheat, both commercial and with specific resistance genes (not Czech origin), had not susceptible response to mildew's isolates, so the GM variety will be useful.
CZ	Wheat	Wheat dwarf virus (WDV).	On-going research (project started in 2012 till the end of 2015): to assess the level of resistance in wheat and to identify sources of resistance, which will enable the development of effective strategies and methods of grain protection. New techniques (RNAi).
DE	Barley	BARLEY-fortress is an international research consortium of public and private partners (with Australia) for the targeted exploitation of basal defence genes in barley with the aim to introgress and engineer broad and durable pathogen resistance into this major crop. In a combined marker-assisted backcrossing and transgenic approach in two German elite varieties of spring barley, valuable haplotypes of functionally validated genes of PTI are introgressed from landraces or wild barley, and selected combinations of genes are being used for stacked over-expression or RNAi.	On-going.
DE	Barley	dsRNAguard program to explore powdery mildew resistance.	On-going.
DE	Barley	GMO strategies (using antimicrobial peptides).	Research level.
DE	Wheat	dsRNAguard program to explore *Fusarium* resistance.	On-going.
DE	Wheat	Basic analysis concerning fungal resistance.	Public research, field trials from 2009-2011.
ES	Grapevine	Transformation aiming to give resistance to Downy mildew of grape (*Plasmopara vitícola*)	On-going research IRTA-CRAG.
ES	Grapevine	Transformation aiming to give resistance to Grey mould (*Botrytis cindered*)	On-going research IMIDA.
ES	Grapevine	Transformation aiming to give resistance to Springworm (*Sparganothis pilleriana*)	On-going research, Universidad Santiago de Compostela.
ES	Maize	Genes from Bt. European corn borer (*Ostrinia nubilalis, Sesamina nonagroides*)	Bt Maize commercial varieties cultivated on the field. 100.000 ha cultivated in 2012 in Spain.
ES	Olive	Engineering resistance to Olive leaf spot (*Cycloconium oleaginum*)	On-going research Universidad Malaga.
ES	Plum tree	Plum pox virus.	Ended. T (RNAi)
FR	Apple, maize, OSR, potato, Wheat	"Genius" project (2012-2019). Proof of concept. Various stresses including biotic stress and Nitrogen Use Efficiency.	On-going basic research. T and new techniques of genome editing.

FR	Barley	Powdery mildew (*Erisyphe graminis*) genome sequenced by international consortium in order to understand why this fungal is biotrophe.	On-going basic research. Possible development of barley resistant varieties using T.
FR	Grapevine	Transgenic grapevine rootstocks expressing the grapevine fanleaf virus (GFLV) resistance GFLV coat protein (CP) gene. Grafted stock is non-transgenic.	Stopped: trial in Colmar (started in 2005) destroyed by an individual in September, 2009. Trial re-implemented but on August, 2010, 62 persons tore away the 70 vines.
FR	Grapevine	Development of resistance strategies to challenge grapevine fanleaf virus (GFLV) resistance by genetic engineering.	In progress.
FR	Plum tree	Plum pox virus. A bilateral project France-Romania called "BRANCUSI" (2013-2014 with extension for a new project). INRA Bordeaux and SCDP Bistrita (Research Station for Orchard Development)	Trials in greenhouses. T (RNAi)
HU	Grapevine	Ferritin as an iron scavenger to reduce iron-catalysed oxidative stress (in biotic and abiotic stress).	Plants for testing at Corvinus University (since 2009). T.
HU	Maize	Transfer of GM *Bt* resistance trait into local lines and hybrids via crossing.	NA (program stopped in 2012). T.
HU	Potato	Coat protein-mediated potato virus Y (PVY) resistance.	GM plants for testing at Potato Research Center, Pannon University (since 2011). T, MAS, and new techniques.
IT	Apple	Resistant to *Venturia inaequalis*; paper published in 2004 (Sansavini's group - Bologna University).	Never allowed to be field tested. T and MAS.
IT	Olive tree	Resistance to fungi and tree shape (Rugini's group)	Trial terminated in 2012 by government order.
IT	Wheat	Expression of polygalacturonase-inhibiting for resistance to *Fusarium*	Laboratory research published. Never field tested.
RO	Plum tree	Plum pox virus. A bilateral project France-Romania called "BRANCUSI" (2013-2014 with extension for a new project). INRA Bordeaux and SCDP Bistrita (Research Station for Orchard Development)	Trials in greenhouses in 2013. T (RNAi)
SE	Potato	Resistance gene introduction (late blight disease).	Application filed for commercial release (BASF).
TR	Maize	Attempts to introduce *Bt* maize varieties (resistant to European Corn Borer).	Field trials have been terminated.
UK	To be evaluated in both *Brassica* and barley	Transgenic cereals and *Brassicas* with modified responses to pathogen-associated molecular patterns. This research will test how these responses contribute to quantitative disease resistance against foliar and root pathogens such as yellow rust and take-all diseases of wheat and stem canker of oilseed rape (*Leptosphaeria maculans*).	Collaborative EU-wide research program (PRR-CROP) funded under ERA-PG program, including industry. 'Proof of concept' in glasshouse trials.
UK	*Brassica* and barley	Expression of a cyanobacterial flavodoxin in plants results in enhanced resistance to a wide range of biotic, abiotic and xenobiotic stresses (increases yield).	Technology developed at public research institutes and technology Licensed by PBL (www.pbltechnology.com) to multinational agribusiness company.
UK	OSR	Enhanced resistance to insects and slugs mediated through genes induced by UV-B in transgenic oilseed rape. The work will also test UV-B responsive gene function that could be used in traditional breeding approaches.	On-going collaborative research to glasshouse trials.
UK	Potato	Blight resistance genes.	Field trials.

UK	Potato	Cysteine proteinase inhibitors (cystatins) that impair digestion of protein by feeding nematodes have been expressed in potato under the control of either a constitutive or tissue-specific promoter to deliver partial nematode resistance. This transgenic approach has been stacked with partial natural resistance to achieve full control of PCN. In a different transgenic approach, a non-lethal peptide is secreted from potato roots that interferes with nematode host-seeking behavior. A third approach utilises RNAi technology to deliver dsRNA from the potato plant to silence nematode genes.	Tested in both glasshouse and field trials. A number of field trials for cystatin-expressing plants were carried out at the University of Leeds Field Station running for 5 years from 1998. The peptide technology was tested in a field trial in 2008 (trial destroyed by protestors) and successfully in 2009. The RNAi technology was tested in a field trial in 2010. T and new techniques. Ended.
UK	Wheat	'Take All' resistance. Introduction of genes involved in avenacin biosynthesis from oats into wheat.	On-going.
UK	Wheat	Aphid resistance. Resistance gene isolated from peppermint plants and cloned into cereals.	Field trials planted in 2012.
UK	Wheat	Introduction of cloned resistance genes against wheat rusts from wild relatives of wheat with a view to mobilising these in bread wheat as a transgene cassette containing multiple resistance genes.	On-going research, evaluation under glass.
UK	Wheat and barley	Yellow rust resistance.	Testing under glass. The group would consider evaluation of this and/or future traits of interest if funding and public attitudes were more favorable to do so.

Supplementary Material 7.

Recent field trial notifications in Europe concerned with biotic stress (BS) challenges (2003-2013)

Source: http://gmoinfo.jrc.ec.europa.eu/gmp_browse.aspx

Number	Notification Number	Member State	Publication	Name of the Institutes or Companies	Title of the Project
1.	B/ES/13/19	Spain	07/05/2013	Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria (INIA)	Field trial of maize Bt11 x MIR604 x GA21 under AMIGA Project: Assessing and Monitoring Impacts of Genetically modified plants on Agro-ecosystems (AMIGA 289706 SPI cooperation).
2.	B/ES/13/15	Spain	20/03/2013	LIMAGRAIN IBERICA	Field trial of maize genetically modified to resist lepidopters larvae and tolerate glyphosate.
3.	B/ES/13/09	Spain	20/03/2013	Monsanto Europe, S.A., represented by Monsanto Agricultura España, S.L.	Continuation of multiannual field trials, under official supervision, for registration of maize varieties containing NK603 x MON 810, genetically modified for tolerance to glyphosate and protected against corn borers.
4.	B/RO/13/01	Romania	06/02/2013	Monsanto Europe, S.A	Notification according to Directive 2001/18/EC, Part B, for the deliberate release of NK603 x MON 810 maize for the use in field trials in Romania.
5.	B/NL/12/L02	Netherlands	10/01/2013	Wageningen University	Selection of genetic modified potato plants for late blight resistance III.
6.	B/IE/12/01	Ireland	13/03/2012	Teagasc	Assessing and monitoring the impact on the agri-environment of genetically modified potatoes with resistance to *Phytophthora infestans*, causative organism of late blight disease (2012 – 2016).
7.	B/NL/11/05	Netherlands	14/11/2011	BASF Plant Science GmbH	Application for the release into the environment of potato lines with improved resistance to *Phytophthora infestans* according to the Genetically Modified Organisms Decree, 2012 – 2018.
8.	B/SE/11/652	Sweden	03/02/2011	BASF Plant Science GmbH	Application for the release into the environment of potato lines with an improved resistance to *Phytophthora infestans.*
9.	B/NL/10/06	Netherlands	23/12/2010	Stichting Dienst Landbouwkundig	Potato late blight control strategies and monitoring of *Phytophthora infestans* virulence.

				Onderzoek (DLO)	
10.	B/BE/10/V1	Belgium	13/12/2010	University of Ghent	Two year field trial with genetically modified potatoes that are less susceptible to late blight (*Phytophtora infestans*).
11.	B/BE/10/V2	Belgium	13/12/2010	BASF Plant Science GmbH	Application for the release into the environment of potato lines with improved resistance to *Phytophthora infestans*, 2011 and 2012.
12.	B/ES/10/22-CON	Spain	01/03/2010	Syngenta Seeds SAS	Field trials of genetically modified Rhizomania resistant SBVR111 sugar beet to be carried out in 2010. Rhizomania disease is caused by the beet necrotic yellow vein virus (BNYVV).
13.	B/FR/09/11/01	France	25/02/2010	INRA - Institut National de la Recherche Agronomique	Expérimentation en milieu non-confiné de porte-greffes transgéniques de vigne exprimant le gène de la protéine de capside du Grapevine fanleaf virus (GFLV) (In French in text) *****
14.	B/NL/09/02	Netherlands	10/02/2010	Wageningen University	Selection of genetic modified potato plants for late blight resistance II.
15.	B/GB/10/R29/01	United Kingdom	09/02/2010	The Sainsbury Laboratory	Improving late blight (*Phytophthora infestans*) resistance in potato using resistance genes from South American potato relatives.
16.	B/GB/09/R31/01	United Kingdom	01/02/2010	University of Leeds	Control of potato cyst-nematodes with minimised environmental impact.
17.	B/SE/09/12598	Sweden	27/01/2010	Syngenta Seeds AB	SBVR111. Rhizomania resistant sugar beets, Sweden, 2010 – 2014.
18.	B/ES/09/46	Spain	06/04/2009	Syngenta Seeds SA	Sugar beet tolerant to glyphosate and resistant to Rhizomania, Spain, 2009 – 2012.
19.	B/ES/09/27	Spain	03/04/2009	Dow AgroSciences	Efficacy trials on *Agrotis ypsilon*/*segetum* with 1507 maize varieties.
20.	B/CZ/09/02	Czech Republic	18/02/2009	Vesa Velhartice	Release into the environment of genetically modified potatoes with the change of late blight resistance.
21.	B/DE/07/195	Germany	23/06/2008	University of Rostock	In-field evaluation of loose smut resistance in genetically modified spring wheat expressing KP4 protein with special focus on effects of resistance against other fungal pathogens.
22.	B/SE/07/12880	Sweden	09/01/2008	Syngenta Seeds AB	Sugar beet tolerant to glyphosate and resistant to virus disease Rhizomania, Sweden, 2008 – 2012.
23.	B/NL/07/07	Netherlands	05/12/2007	BASF Plant Science GmbH	Potato with improved resistance to *Phytophthora infestans.*
24.	B/NL/07/01	Netherlands	05/12/2007	Wageningen University	Testing of genetic modified potato plants for late blight resistance.

25.	B/DE/07/191	Germany	05/12/2007	BASF Plant Science GmbH	Application for the release into environment of genetically modified potatoes with altered starch metabolism or with improved resistance to *Phytophthora infestans* under simplified procedure (2008 – 2012).
26.	B/GB/07/R42/01	United Kingdom	23/03/2007	BASF Plant Science GmbH	Notification for the release into the environment of genetically modified potatoes with improved resistance to *Phytophthora infestans* (2007 – 2011).
27.	B/DE/06/183	Germany	16/02/2007	BASF Plant Science GmbH	Application for the release into environment of genetically modified potatoes with altered starch metabolism or with improved resistance to *Phytophthora infestans* (2007 – 2011).
28.	B/CZ/07/01	Czech Republic	29/01/2007	BASF CZ	Release into the environment of genetically modified potatoes with improved resistance to *Phytophthora infestans.*
29.	B/DE/05/174	Germany	07/03/2006	BASF Plant Science GmbH	Application for the release into the environment of genetically modified potatoes with improved resistance to *Phytophthora infestans* (2006 – 2010).
30.	B/IE/06/01	Ireland	14/02/2006	BASF Plant Science GmbH	Notification for the release into the environment of genetically modified potatoes with improved resistance to *Phytophthora infestans* (2006 – 2010).
31.	B/SE/05/8615	Sweden	16/11/2005	Plant Science Sweden AB	Potato with improved resistance to *Phytophthora infestans.*
32.	B/NL/05/03	Netherlands	17/10/2005	BASF Plant Science GmbH	Potato with improved resistance to *Phytophthora infestans.*
33.	B/SE/05/450	Sweden	20/01/2005	Plant Science Sweden AB	Potato with improved resistance to *Phytophthora.*
34.	B/SE/03/6371-CON	Sweden	13/01/2004	Syngenta Seeds AB	Rhizomania resistant sugar beet. Sweden 2004 – 2008.
35.	B/DE/02/143	Germany	19/05/2003	Syngenta Seeds GmbH	Fungal resistant wheat. Germany 2003, Fusarium pathogens.
36.	B/FR/03/01/02	France	03/03/2003	ADVANTA France	Validation of a concept of long-term resistance to the rhizomania virus (BNYVV): Field evaluation of sugar beet hybrids genetically modified to be resistant to BNYVV (experimental programme: 2003 – 2006).
37.	B/FR/03/01/03	France	03/03/2003	Syngenta Seeds SA	Rhizomania resistant sugar beet. France 2003-2007.
38.	B/FR/03/01/05	France	03/03/2003	Pioneer Genetique	Testing of Coleopteran insect resistant as well as herbicide tolerant maize hybrids
39.	B/FR/03/02/02	France	03/03/2003	Pioneer Genetique Sarl	Testing of insect resistant and herbicides tolerant maize hybrids.

40.	B/FR/03/02/03	France	03/03/2003	Biogemma	Field experimentation of a genetically modified corn tolerant to corn root worm
41.	B/GB/02/R34/4	United Kingdom	16/01/2003	Syngenta Seeds Ltd	To compare the pathogen infestation level and mycotoxin level of wheat modified to express an enhanced resistance to *Fusarium* pathogens with existing non-modified varieties, grown under standard agronomic conditions.

* A participative experiment (using an obsolete virus resistance technology) designed by sociologists, involving stakeholders, which was nevertheless vandalized twice (see Kuntz et al. 2012).