

## Supplementary Material 8.

### Analysis of patents dealing with Biotic Stress (BS) challenges according to pests/diseases and crop

- The country codes in bold case correspond to the country of the applicants.
- Extensions of non-European patents to Europe are highlighted in blue in the European patent column. These extensions are not counted individually in the total patent number (350).
- Patents concerning several pests or crops are counted several times.

CROP	BS CHALLENGE	LATIN NAMES	PATENT NUMBER	EUROPEAN PATENTS	NON EUROPEAN PATENTS
				<i>Inventions (methods or genes)</i>	<i>Patented varieties</i>
WHEAT	Fungal diseases				
	Septoria leaf blotch	<i>Mycosphaerella graminicola</i> (anamorph: <i>Septoria tritici</i> )	1		RO 1999 (Before its entry in EU)
	Rusts	<i>Puccinia triticina</i> (Wheat leaf rust = brown rust) <i>Puccinia graminis</i> (Stem rust) <i>Puccinia striiformis</i> (Stripe rust = yellow rust)	44	CN 2000, 2002, 2004, 2008(2), 2009(2), 2010(8), 2011(4), 2012(4), 2013(3), 2014(4) RU 1995(2), 1998, 2010 US 2013, 2014 IN 2005	CN 2008, 2013, 2014(2) RO 1999(2) (Before its entry in EU)
	Powdery mildew	<i>Blumeria (Erysiphe) graminis</i>	68	CN 2003, 2004(2), 2005, 2006(5), 2008, 2009(4), 2010(19), 2011(7), 2012(10), 2013(7), 2014(6) BG 1995 (Before its entry in EU)	RU 2000 RO 1999(2) (Before its entry in EU) SK 1994 (Before its entry in EU)
	Bunts and smuts	<i>Ustilago tritici</i> , <i>Tilletia caries</i> , <i>T. leavis</i> , <i>T. controversa</i>	1		CN 2012

Fusarioses (incl. Head blight)	<i>Fusarium graminearum</i> , <i>F. culmorum</i> , <i>F. avenaceum</i> , <i>Microdochium</i> spp.	19	FR 2003 EP 2012	CN 2003, 2009, 2010(2), 2011, 2012, 2013(2) US 2001, 2002, 2005, 2011, 2013, 2014 MD 2001, 2007 (Moldavia)	RO 1999(2) (Before its entry in EU)
Take-all	<i>Gaeumannomyces graminis</i>	1		CN 2013	
Tan spot, yellow leaf spot	<i>Drechslera tritici</i> , <i>Pyrenophora tritici</i> <i>repentis</i> , <i>Stagonospora nodorum</i>	1		MD 2007	
Insect pests					
Sunn pest	<i>Eurygaster integriceps</i>	1		RU 2005	
Grain aphid, Rose-grain aphid	<i>Sitobion avenae</i> , <i>Metopolophium dirhodum</i>	4		CN 2003, 2006, 2009, 2011	
Viral disease		6	EP 2012	CN 2002, 2004, 2008, 2011, 2013 US 2011	
Subtotal 146		3 European patents			
BARLEY	Fungal diseases				
Barley rust, stem rust	<i>Puccinia hordei</i> , <i>P. graminis</i>	1	EP 2000	AU+US 1999	
Bunts and smuts	<i>Ustilago tritici</i> , <i>Tilletia caries</i> , <i>T. leavis</i> , <i>T. controversa</i>	1			RO 1999 (Before its entry in EU)
Fusarioses (incl. Head blight)	<i>Fusarium graminearum</i> , <i>F. culmorum</i>	3	EP 2008	US 2002 JP 2004, 2007	
Powdery mildew	<i>Blumeria (Erysiphe) graminis</i>	4		CN 2012(2), 2014 UA 2006	
Viral diseases		2	EP 2008	JP 2005 AU 2002	
Subtotal 11		3 European patents			

MAIZE		Fungal diseases				
Common smut	<i>Ustilago zeae</i> = <i>U. maydis</i>	12	EP 2011	CN 1995(2), 2009, 2010(4), 2011, 2012 CN+US 2010	RO 1998(2) (Before its entry in EU)	
Fusarioses	<i>Fusarium</i> spp., <i>F. graminearum</i> , <i>F. verticilloides</i>	16	FR 2008, 2009 CH 2008, 2013 EP 2000, EP 2012(2)	CA 1999, 2002, US 2010 (2), 2011 UA 2010	RO 1998(6) (Before its entry in EU)	
Northern leaf blight	<i>Exserohilum</i> (= <i>Helminthosporium</i> ) <i>turcicum</i>	11	EP 2000, EP 2008, EP 2010, EP 2011, EP 2013	US 1999, 2006, 2008, 2010, 2011 CN 2010	US 1999, 2003 RO 1997, 1998(2) (Before its entry in EU)	
Insect pests						
General patents		4	EP 2008	US 1998, 2008 CN 2011, 2014		
European corn borer	<i>Ostrinia nubilalis</i>	17	NL 1998 EP 2010, EP 2013, EP 2014	US 2004, 2009, 2011(2), 2013 CN 2006(2), 2008, 2011, 2012(2)	RO 1997, 1998(4) (Before its entry in EU)	
Corn rootworm	<i>Diabrotica</i> spp.	23	DE 2008(2), 2010 CH 2003 EP 1996, EP 1998, EP 2000, EP 2001, EP 2002, EP 2007, EP 2008, EP 2010(2), EP 2013	US 1994, 1996, 1998, 2000(4), 2004, 2007, 2009(2), 2011(2), 2014(3) CN 2009	US 1996 CH 2003	
Wireworms	<i>Agriotes</i> spp., <i>A. lineatus</i>	1	NL 1998			
Cotton bollworm	<i>Helicoverpa armigera</i> = <i>Heliothis armigera</i>	2	EP 2013	US 2012 CN 2010		
Subtotal 86		34 European patents				

OILSEED RAPE/ BRASSICA	<b>Fungal diseases</b>				
	Sclerotinia (White mold)	<i>Sclerotinia sclerotiorum</i>	3	EP 2008	US 2006, 2012 CN 2014
	Black leg	<i>Leptosphaeria maculans</i> (anamorph: <i>Phoma lingam</i> )	4	BE 2005	US 2000(2), 2008
	Clubroot	<i>Plasmodiophora brassicae</i>	6	NL 2012 EP 2014	JP 2009 US 2013 KR 2010
	Ring spot	<i>Mycosphaerella brassicicola</i>	2	NL 2002, 2007	
	Verticillium wilt	<i>Verticillium longisporum</i>	2	EP 2002	CA 2000 CN 2011
	Mildew	Powdery mildew ( <i>Erysiphe cruciferarum</i> ) ; Downy mildew ( <i>Hyaloperonospora parasitica</i> , <i>H. brassicae</i> )	2	GB 2000	KR 2012
	<b>Insect pests</b>				
	Flea beetle	<i>Phyllotreta</i> spp.	1		CN 2014
<b>Subtotal 20</b>			<b>8 European patents</b>		

SUNFLOWER	General patent		1	EP 2000	US 1999	
	Fungal diseases					
	Downy mildew	<i>Plasmopara halstedii</i> , <i>P. helianthi</i>	2			HU 1995(2) (Before its entry in EU)
	Sclerotinia	<i>Sclerotinia sclerotiorum</i>	6	FR 1998, 2005		HU 1995(2) (Before its entry in EU) RO 1998(2) (Before its entry in EU)
	Botrytis bunch rot	<i>Botrytis cinerea</i>	1			HU 1995 (Before its entry in EU)
	Phomopsis	<i>Diaporthe helianthi</i>	4		UA 2011	HU 1995(2) (Before its entry in EU) RO 1998 (Before its entry in EU)
	Parasitic plant					
	Sunflower broomrape	<i>Orobanche cumana</i>	4	EP 2005, EP 2009	UA 2011 US 2003, 2008	RO 1998 (Before its entry in EU)
Subtotal 18			5 European patents			

<b>GRAPEVINE</b>	<b>Fungal diseases</b>				
	Mildew	Downy mildew ( <i>Plasmopara viticola</i> ) Powdery mildew ( <i>Erysiphe necator</i> = <i>Uncinula necator</i> )	7		CN 2005(2), 2008, 2009, 2011 JP 2000 US 2012
	Gray mold = grey mould, Botrytis bunch rot	<i>Botryotinia fuckeliana</i> (anamorph: <i>Botryotinia cinerea</i> )	2	EP 1999	US 1997, 2003
	Grape tortrix, Argyrotaenia = Eulia	<i>Argyrotaenia ljugiana</i> = <i>A. pulchellana</i> – <i>Eulia pulchellana</i> = <i>E. politana</i> = <i>Tortrix politana</i>			
	<b>Insects pests</b>				
	<b>Virus-like disease</b>				
	Flavescence dorée, bois noir (Black wood)		1	DE 2010	
	<b>Viral diseases</b>				
	Grapevine fanleaf virus		4	CZ 2011, EP 2000, EP 2009	CL 2013, US 1999, US 1999
	Grapevine leafroll-associated virus		4	EP 2000, EP 2001	US 1998, 1999, 2001, 2013
<b>Subtotal 18</b>			<b>7 European patents</b>		

<b>POTATO</b>	<b>Fungal diseases</b>					
	Late blight	<i>Phytophthora infestans</i>	<b>16</b>	NL 2002, 2003, 2007, 2008(2) DE 2001, 2012, 2014 CH 2006 EP 1999, EP 2000	AR 2014, JP 1999, CN 2008, KR 2008(2), US 1999	RU 2013
	Early blight	<i>Alternaria solani</i>	<b>3</b>		RU 2014, JP 2010	RO 1999 (Before its entry in EU)
	<b>Insect pests</b>					
	Potato aphid	<i>Macrosiphum euphorbiae</i> , <i>M. solani</i> , <i>Siphonophora</i>	<b>6</b>	NL 1998 EP 2001, EP 2002	US 2000(3) RU 2006, 2008	
	Potato beetle, Colorado beetle, Ten-striped spearman, Ten-lined potato beetle, Potato bug	<i>solanifolii</i> , <i>Mysus persicae</i> <i>Leptinotarsa decemlineata</i> , <i>Chrysomela decemlineata</i> , <i>Doryphora decemlineata</i> , <i>Polygramma decemlineata</i> <i>Diabrotica</i>				
	<b>Nematode pest</b>					
	Golden nematode	<i>Globodera rostochiensis</i> , <i>G. pallida</i>	<b>12</b>	NL 1998, 2000 DE 2001 FR 2011	JP 2004, 2007 RU 2013, US 2013	RO 1997(4) (Before its entry in EU)
	<b>Viral diseases</b>					
	Potato virus Y (PVY), Potato leafroll virus		<b>5</b>	FR 2000 EE 2009		RO 1997(2), 1999 (Before its entry in EU)
<b>Subtotal 42</b>			<b>20 European patents</b>			

BEET	Fungal diseases			
	Powdery mildew	<i>Erysiphe polygoni, E. betae</i>	1	US 2013
	Insect pests			
	Flea beetle, beet flea	<i>Chaetocnema tibialis</i>	1	RU 2008
	Viral diseases			
	Beet western yellow virus, Beet mild yellowing virus, Beet necrotic yellow vein virus		5	EP 1998 FR 2000 NL 2000 EP 2000
Subtotal 7			4 European patents	
OLIVE	Bacterial diseases			
	Olive-knot disease	<i>Pseudomonas syringae</i> pv. <i>savastanoi</i>	2	US 1998, 2006
Subtotal 2			0 European patent	
TOTAL			350	84