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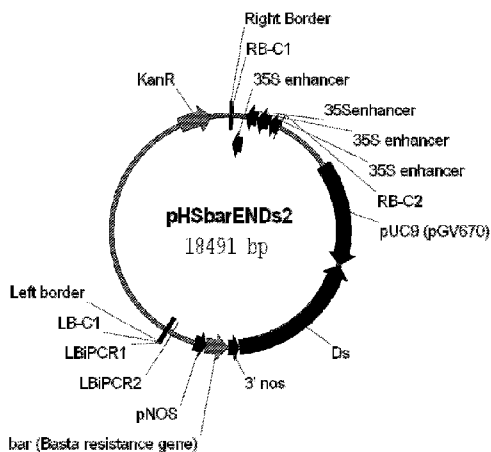
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- (81) **Designated States (unless otherwise indicated, for every kind of national protection available):** AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ,

[Continued on next page]

(54) **Title:** DROUGHT TOLERANT PLANTS AND RELATED CONSTRUCTS AND METHODS INVOLVING GENES ENCODING MATE-EFFLUX POLYPEPTIDES

(57) **Abstract:** Isolated polynucleotides and polypeptides and recombinant DNA constructs useful for conferring drought tolerance, compositions (such as plants or seeds) comprising these recombinant DNA constructs, and methods utilizing these recombinant DNA constructs. The recombinant DNA construct comprises a polynucleotide operably linked to a promoter that is functional in a plant, wherein said polynucleotide encodes a MATE-efflux polypeptide.

FIG. 1



OM, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

**(84) Designated States** (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

**Published:**

- with international search report (Art. 21(3))
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))
- with sequence listing part of description (Rule 5.2(a))

**(88) Date of publication of the international search report:**

9 August 2012

# INTERNATIONAL SEARCH REPORT

International application No PCT/US2011/065779
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**A. CLASSIFICATION OF SUBJECT MATTER**  
 INV. C07K14/415 C12N15/82  
 ADD. A01H5/00

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)  
 C07K C12N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, BIOSIS, CHEM ABS Data, Sequence Search, EMBASE, WPI Data

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	L. LI: "Functional Cloning and Characterization of a Plant Efflux Carrier for Multidrug and Heavy Metal Detoxification", JOURNAL OF BIOLOGICAL CHEMISTRY, vol. 277, no. 7, 5 December 2001 (2001-12-05), pages 5360-5368, XP055021152, ISSN: 0021-9258, DOI: 10.1074/jbc.M108777200 page 5361, column 1, paragraph 1; figure 2 -----	15-17
X	WO 2008/034648 A1 (METANOMICS GMBH [DE]; PUZIO PIOTR [DE]; BLAU ASTRID [DE]; WALK TILMANN) 27 March 2008 (2008-03-27) paragraphs [115.3.1.1], [262.1.1.1], [262.1.2.2], [262.1.3.3]; claims; sequence 93172 -/--	1-18

Further documents are listed in the continuation of Box C.

See patent family annex.

\* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier application or patent but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

4 June 2012

Date of mailing of the international search report

19/06/2012

Name and mailing address of the ISA/

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# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US2011/065779

## Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1.  Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
  
2.  Claims Nos.:  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
  
3.  Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1.  As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2.  As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3.  As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4.  No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

see additional sheet

### Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No  
PCT/US2011/065779

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	<p>&amp; DATABASE Geneseq [Online]</p> <p>29 October 2009 (2009-10-29), "Nucleotide sequence SEQ ID 93172.", retrieved from EBI accession no. GSN:AWK19968 Database accession no. AWK19968 sequence</p> <p>&amp; DATABASE Geneseq [Online]</p> <p>29 October 2009 (2009-10-29), "Amino acid sequence SEQ ID 93271; MATE efflux protein-like", retrieved from EBI accession no. GSP:AWK20067 Database accession no. AWK20067 sequence</p>	
X	<p>-----</p> <p>WO 2006/076423 A2 (MONSANTO TECHNOLOGY LLC [US]) 20 July 2006 (2006-07-20) page 7, last paragraph - page 8, last paragraph; claims; sequence 18 &amp; DATABASE Geneseq [Online]</p> <p>21 August 2008 (2008-08-21), "Arabidopsis thaliana DNA sequence, SEQ ID 18.", retrieved from EBI accession no. GSN:AR086985 Database accession no. AR086985 sequence</p>	1-18
A	<p>-----</p> <p>US 2004/034888 A1 (LIU JINGDONG [US] ET AL) 19 February 2004 (2004-02-19) paragraph [0042]; claims; sequences 26405, 64593 &amp; DATABASE Geneseq [Online]</p> <p>21 April 2005 (2005-04-21), "Plant full length insert polynucleotide seqid 26405.", retrieved from EBI accession no. GSN:ADX51665 Database accession no. ADX51665 sequence</p> <p>&amp; DATABASE Geneseq [Online]</p> <p>21 April 2005 (2005-04-21), "Plant full length insert polypeptide seqid 64593.", retrieved from EBI accession no. GSP:ADY08778 Database accession no. ADY08778 sequence</p> <p>-----</p> <p style="text-align: center;">-/--</p>	1-18

# INTERNATIONAL SEARCH REPORT

International application No

PCT/US2011/065779

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DIENER ANDREW C ET AL: "Arabidopsis ALF5, a multidrug efflux transporter gene family member, confers resistance to toxins", PLANT CELL, vol. 13, no. 7, July 2001 (2001-07), pages 1625-1637, XP055021366, ISSN: 1040-4651 the whole document -----	1-18

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/US2011/065779
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2008034648 A1	27-03-2008	AU 2007299219 A1	27-03-2008
		CA 2644273 A1	27-03-2008
		EP 2090662 A2	19-08-2009
		WO 2008034648 A1	27-03-2008
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		WO 2006076423 A2	20-07-2006
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US 2004034888 A1	19-02-2004	US 2004031072 A1	12-02-2004
		US 2004034888 A1	19-02-2004
		US 2006236419 A1	19-10-2006
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**FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210**

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-18(partially)

relating to a so called MATE-efflux polypeptide (SEQ ID NO:18), the corresponding polynucleotide (SEQ ID NO:17) and methods and products comprising said sequences

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2-11. claims: 1-18(partially)

as invention 1 but relating to the polypeptides of SEQ ID NOs:20, 22, 24, 26, 30, 31, 35, 37, 38 or 39 and the corresponding polynucleotides

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12. claims: 1-14, 16-18(all partially)

relating to a so called MATE-efflux polypeptide (SEQ ID NO:41), the corresponding polynucleotide and methods and products comprising said sequences

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13-60. claims: 1-14, 16-18(all partially)

as invention 12 but relating to the polypeptides of SEQ ID NOs:42-49, 51-65, 69, 71, 73, 75, 77, 79, 81, 83, 85, 87, 88-101 or 102 and the corresponding polynucleotides

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