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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

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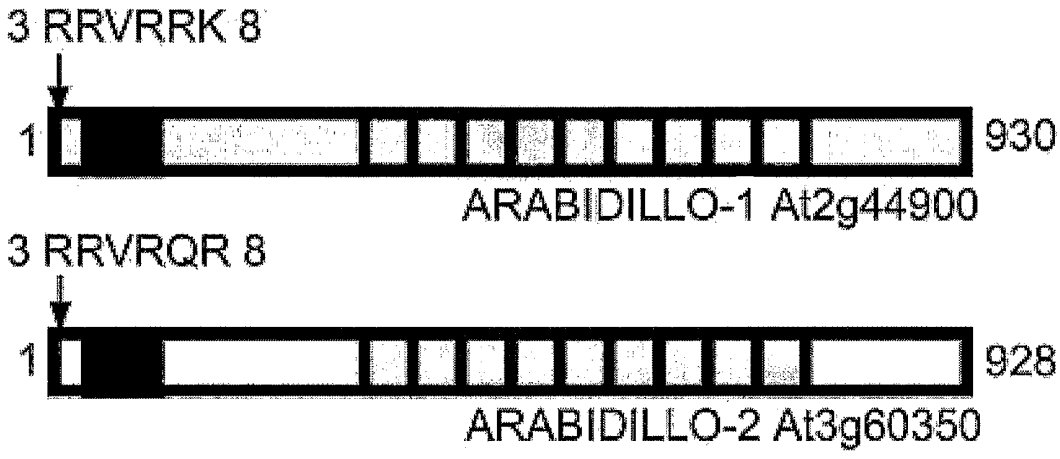
1 November 2007

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: METHODS AND COMPOSITIONS FOR MODULATING ROOT GROWTH IN PLANTS



(57) Abstract: Methods of modulating root growth of a plant and improving abiotic stress tolerance in a plant are disclosed. Also disclosed is an expression cassette for modulating root growth of a plant, a recombinant vector comprising such expression cassette, and a transgenic plant, seed, plant cell, or tissue comprising such expression cassette.

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INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER
INV. C12N15/82 C07K14/415 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)
C12N C07K A01H

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 practical, search terms used)
EPO-Internal, WPI Data, BIOSIS, EMBASE, Sequence Search, EMBL

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DATABASE WPI Week 200532 Derwent Publications Ltd., London, GB; AN 2005-311501 XP002433441 -& KR 2004 111 243 A (KOREA KUMHO PETROCHEMICAL CO LTD) 31 December 2004 (2004-12-31) figures 3,5	33-38
A	abstract	1-16,39, 40

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[X] Further documents are listed in the continuation of Box C.

[X] 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 document 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	Date of mailing of the international search report
15 May 2007	17/08/2007

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Bucka, Alexander

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No
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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	KIM SUNMI ET AL: "ARIA, an Arabidopsis arm repeat protein interacting with a transcriptional regulator of abscisic acid-responsive gene expression, is a novel abscisic acid signaling component" PLANT PHYSIOLOGY (ROCKVILLE), vol. 136, no. 3, November 2004 (2004-11), pages 3639-3648, XP002432843 ISSN: 0032-0889 page 3647, right-hand column	33-38
A	the whole document	1-16,39, 40
A	WO 99/53016 A (UNIV ARIZONA [US]; WINICOV ILGA [US]) 21 October 1999 (1999-10-21) the whole document	1-16, 33-40
A	COATES JULIET C: "Armadillo repeat proteins: Beyond the animal kingdom" TRENDS IN CELL BIOLOGY, ELSEVIER SCIENCE LTD, XX, vol. 13, no. 9, September 2003 (2003-09), pages 463-471, XP002425683 ISSN: 0962-8924 cited in the application the whole document	1-16, 33-40
A	WO 01/96580 A (SCHMULLING THOMAS [DE]; WERNER TOMAS [DE]) 20 December 2001 (2001-12-20) the whole document	1-16, 33-40
A	DOWNES BRIAN P ET AL: "The HECT ubiquitin-protein ligase (UPL) family in Arabidopsis: UPL3 has a specific role in trichome development." PLANT JOURNAL, vol. 35, no. 6, September 2003 (2003-09), pages 729-742, XP002433599 ISSN: 0960-7412 figures 1,3,4	1-16, 33-40
A	BI Y -M ET AL: "Transformation of Arabidopsis with a Brassica SLG/SRK region and ARC1 gene is not sufficient to transfer the self-incompatibility phenotype" MOLECULAR AND GENERAL GENETICS, vol. 263, no. 4, May 2000 (2000-05), pages 648-654, XP002433710 ISSN: 0026-8925 page 649, right-hand column	

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INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2006/003270

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	COATES JULIET C ET AL: "Armadillo-related proteins promote lateral root development in Arabidopsis" PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA, vol. 103, no. 5, January 2006 (2006-01), pages 1621-1626, XP002432844 ISSN: 0027-8424 the whole document	1-16, 33-40

INTERNATIONAL SEARCH REPORT

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Box 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 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 fee, this Authority did not invite payment of any additional fee.

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.:

1-16, completely, 33-40, partially

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

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

1. claims: 1-16, completely, 33-40, partially

   a method of modulating root growth comprising modulating the expression of an Armadillo repeat-containing polypeptide in a plant, a method to produce an Armadillo repeat-containing polypeptide in a plant

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2. claims: 17-32, completely, 33-40, partially

   a method of improving abiotic stress tolerance comprising modulating the expression of an Armadillo repeat-containing polypeptide in a plant, a method to produce an Armadillo repeat-containing polypeptide in a plant

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3. claims: 41-49

   an expression cassette comprising a nucleic acid encoding an Armadillo repeat-containing polypeptide; vectors comprising said expression cassette; plants comprising said vectors

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/IB2006/003270

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
KR 2004111243 A		NONE	
WO 9953016 A	21-10-1999	CA 2323789 A1	21-10-1999
		EP 1071748 A1	31-01-2001
		JP 2004527201 T	09-09-2004
		US 6936708 B1	30-08-2005
WO 0196580 A	20-12-2001	AU 784732 B2	08-06-2006
		AU 8575301 A	24-12-2001
		CA 2412052 A1	20-12-2001
		CN 1474872 A	11-02-2004
		JP 2004535753 T	02-12-2004