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[Continued on nextpage]

(54) Title: PLANTS WITH ELEVATED LEVELS OF GLUCAN

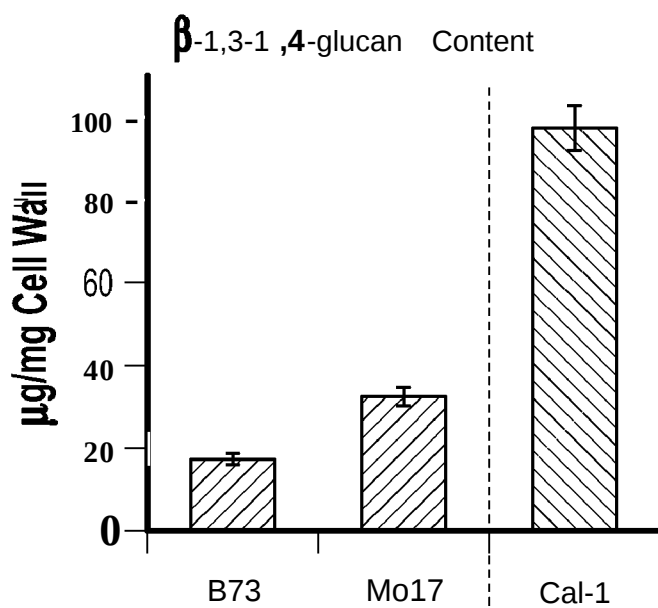


FIG. 7

(57) Abstract: The present disclosure relates to mutations in licheninase genes encoding polypeptides with decreased licheninase activity, which when expressed in plants results in elevated levels of glucan in the plants. In particular, the disclosure relates to licheninase nucleic acids and polypeptides related to glucan accumulation in plants, plants with reduced expression of a licheninase nucleic acid, and methods related to the generation of plants with increased glucan content in the cell walls of leaf tissue.



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).

— *with sequence listing part of description (Rule 5.2(a))*

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

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(15) Information about Correction:

Previous Correction:

see Notice of 14 February 2013

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2012/040544

A. CLASSIFICATION OF SUBJECT MATTER
INV. C12N9/24 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)
C12N C07K

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 , WPI Data, BIOSIS, CHEM ABS Data, Sequence Search , EMBASE

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2005/009164 AI (SHYUR LI E-FEN [TW] ET AL) 13 January 2005 (2005-01-13)	1-3 , 5 , 11
Y	paragraph [0002] - paragraph [0010] ; claims ----- -/- .	4,6-10, 12-28



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

23 January 2013

Date of mailing of the international search report

03/04/2013

Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

International application No

PCT/US2012/040544

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	HSUEH-LING CHENG ET AL: "Arti cle Mutagenesi s of Trp54 and Trp203 Resi dues on Fi brobacter Succinogenes 1,3-1 ,4-beta-D-Gl ucanase Si gni fi cantly Affects Catalyti c Acti vities of the Enzyme", BIOCHEMISTRY, vol . 41, no. 27, 1 July 2002 (2002-07-01) , pages 8759-8766, XP055049680, ISSN: 0006-2960, DOI: 10. 1021/ bi0257661 page 8759, col umn 2, last paragraph - page 8759, col umn 1, paragraph 1 page 8764, col umn 2, last paragraph - page 8756, col umn 2, last paragraph ; figure 1; tabl e 1 -----	4,6-10, 12-28
Y	SABINE GUI LLAUMIE ET AL: "Di fferenti al expressi on of phenyl propanoi d and rel ated genes in brown-mi dri b bml, bm2, bm3, and bm4 young near-i sogeni c mai ze plants" , PLANTA ; AN INTERNATIONAL JOURNAL OF PLANT BIOLOGY, SPRINGER, BERLIN, DE, vol . 226, no. 1, 17 January 2007 (2007-01-17) , pages 235-250, XP019517494, ISSN: 1432-2048, DOI : 10. 1007/S00425-006-0468-9 the whol e document -----	9, 10, 17-20, 24-28
Y	HI RAI SAYAKA ET AL: "RNAi Vectors for mani pul ati on of gene expressi on in higher plants" , THE OPEN PLANT SCI ENCE JOURNAL, BENTHAM OPEN , vol . 2 1 January 2008 (2008-01-01) , pages 21-30, XP009142252 , ISSN: 1874-2947 Retri eved from the Internet: URL: https ://bentham. org/open/topsj/arti cle s/V002/21T0PSJ .pdf [retri eved on 2010-12-21] the whol e document ----- -/--	12-20

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2012/040544

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	FLORIAN KRAEMER ET AL: "IDENTIFYING NEW GENES INFLUENCING THE CELL WALL OF GRASSES USING A FORWARD GENETIC APPROACH", IN VITRO CELLULAR & DEVELOPMENTAL BIOLOGY ANIMAL, vol. 46, no. Suppl. S, 1 June 2010 (2010-06-01), pages S134 - S135, XP055049723, PROCEEDINGS OF THE ANNUAL MEETING OF THE SOCIETY-FOR-IN-VITRO-BIOLOGY/ 12TH CONGRESS OF THE IAPB; ST LOUIS, MO, USA; JUNE 06 - 11, 2010 ISSN: 1071-2690 the whole document -----	1-28

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2012/040544

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. :

1-28

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.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

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

1. claims: 1-28

relating to a mutated lichenase gene (SEQ ID NOs:3 or 7)
and methods and products comprising said gene

2. claims: 29-31 (completely) ; 42-49 (partially)

relating to a method of increasing the levels of glucan in a
plant by reducing the expression of a lichenase gene

3. claims: 32-37 (completely) ; 42-49 (partially)

relating to a method of increasing the amount of glucose
generated from biomass in a saccharification process where
the biomass is obtained from a plant with a reduced
expression of a lichenase gene

4. claims: 38-41 (completely) ; 42-49 (partially)

relating to a method of increasing the yield of a
fermentation product from a fermentation reaction wherein
the fermentation reaction is carried out on a plant with a
reduced expression of a lichenase gene

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2012/040544

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2005009164	A1	13-01-2005	TW 588050 B 21-05-2004
		US 7037696 B1	02-05-2006
		US 2005009164 A1	13-01-2005
