



(51) International Patent Classification:
C12N 15/82 (2006.01)

(21) International Application Number:
PCT/EP2008/067233

(22) International Filing Date:
10 December 2008 (10.12.2008)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
07150060.7 17 December 2007 (17.12.2007) EP

(71) Applicant (for all designated States except US): **BASF PLANT SCIENCE GMBH** [DE/DE]; 67056 Ludwigshafen (DE).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **PLESCH, Gunnar** [DE/DE]; Plantagenhof 1, 14482 Potsdam (DE). **PUZIO, Piotr** [DE/BE]; Rene v.d. Puttestraat 1, B-9030 Mariakerke (BE). **BLAU, Astrid** [DE/DE]; Bahnhofstrasse 110, 14532 Stahnsdorf d (DE). **HEROLD, Michael Manfred** [DE/DE]; Quitzowstrasse 87, 10551 Berlin (DE). **WENDEL, Birgit** [DE/DE]; Feuerbachstrasse 53, 12163 Berlin (DE). **KAMLAGE, Beate** [DE/DE]; Varziner Strasse 13/14, 12161 Berlin (DE). **SCHAUWECKER, Florian** [DE/DE]; Herderstrasse 35, 12163 Berlin (DE). **ZANK, Thorsten** [DE/DE]; Seckenheimer Strasse 4-6, 68165 Mannheim (DE). **OSWALD, Oliver** [DE/DE]; Nibelungenstrasse 158, 64686 Lauerthal (DE). **WETJEN, Tom** [DE/DE]; Meerwiesenstrasse 21, 68163 Mannheim (DE).

(74) Agent: **DICK, Alexander**; Isenbruck Bösl Hörschler Wichmann LLP, Eastsite One, Seckenheimer Landstraße 4, 68163 Mannheim (DE).

(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, 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, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, 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, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, NO, PL, PT, RO, SE, SI, SK, 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:
14 January 2010

(54) Title: LIPID METABOLISM PROTEINS, COMBINATIONS OF LIPID METABOLISM PROTEINS AND USES THEREOF

(57) Abstract: Described herein are inventions in the field of genetic engineering of plants, including combinations of polynucleotides encoding LMPs to improve agronomic, horticultural, and quality traits. This invention also relates to the combination of polynucleotides encoding proteins that are related to the presence of seed storage compounds in plants. More specifically, the present invention relates to LMP polynucleotides encoding lipid metabolism proteins (LMP) and the use of these combinations of these sequences, their order and direction in the combination, and the regulatory elements used to control expression and transcript termination in these combinations in transgenic plants. In particular, the invention is directed to methods for manipulating fatty acid-related compounds and for increasing oil and starch levels and altering the fatty acid composition in plants and seeds. The invention further relates to methods of using these novel combinations of polypeptides to stimulate plant growth, and/or root growth and/or to increase yield and/or composition of seed storage compounds.



INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2008/067233

A. CLASSIFICATION OF SUBJECT MATTER
INV. C12N15/82

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

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, Sequence Search, BIOSIS, 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	DATABASE UniProt [Online] 1 January 1998 (1998-01-01), "RecName: Full=Uncharacterized lipoprotein ypdI; Flags: Precursor;" XP002534150 retrieved from EBI accession no. UNIPROT:032528 Database accession no. 032528 see abstract, 100 % identity to SEQ ID NO:437, ORF identified in the E.coli genome U00096 -/--	1-2,5, 7-8



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 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

9 November 2009

Date of mailing of the international search report

25/11/2009

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Kania, Thomas

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2008/067233

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	-& DATABASE EMBL 23 February 2006 (2006-02-23), Kang et al.: XP002554114 retrieved from EBI Database accession no. AAC75435;U00096 see abstract, 100 % identity to SEQ ID NO:436 -----	
X	WO 2007/012576 A2 (BASF PLANT SCIENCE [DE]; ZANK THORSTEN [DE]; OSWALD OLIVER [DE]) 1 February 2007 (2007-02-01) the whole document -----	1-30
A	POTRYKUS JOANNA ET AL: "The ypdI gene codes for a putative lipoprotein involved in the synthesis of colanic acid in Escherichia coli" 15 June 2004 (2004-06-15), FEMS MICROBIOLOGY LETTERS, VOL. 235, NR. 2, PAGE(S) 265-271 , XP002534151 ISSN: 0378-1097 -----	1-30
A	WO 02/074977 A2 (BASF PLANT SCIENCE GMBH [DE]; HAERTEL HEIKO A [US]; MITTENDORF VOLKER) 26 September 2002 (2002-09-26) -----	1-30
A	WO 2006/034228 A2 (BASF PLANT SCIENCE GMBH [DE]; UNIV MICHIGAN [US]; ANDRE CARL [US]; CER) 30 March 2006 (2006-03-30) -----	1-30
A	WO 2006/053743 A2 (BASF PLANT SCIENCE GMBH [DE]; HAERTEL HEIKO A [US]; BHATT GARIMA [US]) 26 May 2006 (2006-05-26) -----	1-30
Y	CERNAC ALEX ET AL: "WRINKLED1 encodes an AP2/EREB domain protein involved in the control of storage compound biosynthesis in Arabidopsis" November 2004 (2004-11), PLANT JOURNAL, VOL. 40, NR. 4, PAGE(S) 575-585 , XP002554095 ISSN: 0960-7412 the whole document -----	15-16, 18-23, 25-30
Y	DATABASE UniProt [Online] 21 March 2006 (2006-03-21), Chen et al.: XP002554096 retrieved from EBI Database accession no. Q2EPY6 abstract -----	15-16, 18-23, 25-30
	-/--	

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2008/067233

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	-& DATABASE EMBL [Online] 13 February 2006 (2006-02-13), Chen et al.: XP002554122 retrieved from EBI Database accession no. DQ370141 abstract -----	
Y	PADHAM ANITA K ET AL: "Characterization of a plastid triacylglycerol lipase from arabidopsis" March 2007 (2007-03), PLANT PHYSIOLOGY (ROCKVILLE), VOL. 143, NR. 3, PAGE(S) 1372-1384 , XP002554097 ISSN: 0032-0889 the whole document -----	15-16, 18-23, 25-30
A	WO 2006/131750 A2 (UNIV YORK [GB]; EASTMOND PETER [GB]) 14 December 2006 (2006-12-14) -----	15-16, 18-23, 25-30
A	WO 02/072775 A2 (BASF PLANT SCIENCE GMBH [DE]; BENNING CHRISTOPHER [US]; CERNAC ALEX [U]) 19 September 2002 (2002-09-19) -----	15-16, 18-23, 25-30
A	FOCKS NICOLE ET AL: "wrinkled1: A novel, low-seed-oil mutant of arabidopsis with a deficiency in the seed-specific regulation of carbohydrate metabolism" September 1998 (1998-09), PLANT PHYSIOLOGY (ROCKVILLE), VOL. 118, NR. 1, PAGE(S) 91-101 , XP002554098 ISSN: 0032-0889 -----	15-16, 18-23, 25-30
A	BAUD SEBASTIEN ET AL: "WRINKLED1 specifies the regulatory action of LEAFY COTYLEDON2 towards fatty acid metabolism during seed maturation in Arabidopsis" June 2007 (2007-06), PLANT JOURNAL, VOL. 50, NR. 5, PAGE(S) 825-838 , XP002554099 ISSN: 0960-7412 -----	15-16, 18-23, 25-30
T	WO 2009/027335 A2 (BASF PLANT SCIENCE GMBH [DE]; ZANK THORSTEN [DE]; OSWALD OLIVER [DE];) 5 March 2009 (2009-03-05) -----	

INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP2008/067233

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.:
1-30(all partially)

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.:

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: 1-30(all partially)

A polynucleotide, polypeptide derived therefrom, antibodies, fusion polypeptides, host cells as well as methods of use thereof for the manufacture of lipids and plants having a modified amount of a seed storage compound, wherein the polynucleotide and polypeptide sequences are according to SEQ ID NO:436 and 437

2. claims: 1-14(all partially)

A polynucleotide, polypeptide derived therefrom, antibodies, host cells as well as methods of use thereof for the manufacture of lipids and plants having a modified amount of a seed storage compound, wherein the polynucleotide and polypeptide sequences are according to SEQ ID NO:438 and 439

3. claims: 1-14(all partially)

idem for SEQ ID NO:440,441

4. claims: 1-14(all partially)

idem for SEQ ID NO:442,443

5. claims: 1-14(all partially)

idem for SEQ ID NO:444,445

6. claims: 15-30(all partially)

A polynucleotide, polypeptide derived therefrom, antibodies, fusion polypeptides, host cells as well as methods of use thereof for the manufacture of lipids and plants having a modified amount of a seed storage compound, wherein the polynucleotide and polypeptide sequences are according to SEQ ID NO:933 and 934

7. claims: 15-30(all partially)

idem for SEQ ID NO:939,940

8. claims: 15-30(all partially)

idem for SEQ ID NO:941,942

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

9. claims: 15-30(all partially)
idem for SEQ ID NO:947,948

10. claims: 15-30(all partially)
idem for SEQ ID NO:953,954

11. claims: 15-30(all partially)
idem for SEQ ID NO:955,956

12. claims: 15-30(all partially)
idem for SEQ ID NO:959,960

13. claims: 15-30(all partially)
idem for SEQ ID NO:965,966

14. claims: 15-30(all partially)
idem for SEQ ID NO:969,970

15. claims: 15-30(all partially)
idem for SEQ ID NO:973,974

16. claims: 15-30(all partially)
idem for SEQ ID NO:975,976

17. claims: 15-30(all partially)
idem for SEQ ID NO:977,978

18. claims: 15-30(all partially)
idem for SEQ ID NO:987,988

19. claims: 15-30(all partially)
idem for SEQ ID NO:985,986

FURTHER INFORMATION CONTINUED FROM PCT/SA/ 210

20. claims: 15-30(all partially)

idem for SEQ ID NO:989,990

21. claims: 15-30(all partially)

idem for SEQ ID NO:1006,1007

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2008/067233

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2007012576 A2	01-02-2007	AR 054509 A1 AU 2006274048 A1 CA 2615837 A1 EP 1910545 A2 US 2009217417 A1	27-06-2007 01-02-2007 01-02-2007 16-04-2008 27-08-2009
WO 02074977 A2	26-09-2002	CA 2441265 A1 EP 1395108 A2 US 2008076179 A1	26-09-2002 10-03-2004 27-03-2008
WO 2006034228 A2	30-03-2006	AR 050881 A1 AU 2005286889 A1 BR PI0515431 A CA 2580736 A1 CN 101076594 A EP 1794307 A2 US 2009265810 A1	29-11-2006 30-03-2006 22-07-2008 30-03-2006 21-11-2007 13-06-2007 22-10-2009
WO 2006053743 A2	26-05-2006	AR 051507 A1 AU 2005306006 A1 CA 2586331 A1 EP 1814997 A2 US 2008127369 A1	17-01-2007 26-05-2006 26-05-2006 08-08-2007 29-05-2008
WO 2006131750 A2	14-12-2006	AU 2006256531 A1 CA 2604087 A1 EP 1891213 A2 US 2008271207 A1	14-12-2006 14-12-2006 27-02-2008 30-10-2008
WO 02072775 A2	19-09-2002	AU 2002254180 A1 CA 2440330 A1 EP 1390381 A2 US 2003097685 A1	24-09-2002 19-09-2002 25-02-2004 22-05-2003
WO 2009027335 A2	05-03-2009	NONE	