(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
1 February 2007 (01.02.2007)

PCT

(10) International Publication Number
WO 2007/012576 A3

(51) International Patent Classification:
C12N 15/82 (2006.01) *A01H 5/00* (2006.01)

(21) International Application Number:
PCT/EP2006/064276

(22) International Filing Date: 14 July 2006 (14.07.2006)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/595,649 25 July 2005 (25.07.2005) US

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

(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: **ZANK, Thorsten** [DE/DE]; Seckenheimer Str. 4-6, 68165 Mannheim (DE). **OSWALD, Oliver** [DE/DE]; Nibelungenstr. 158, 64686 Lautertal (DE).

(74) Agent: **KOCK, Michael**; BASF Aktiengesellschaft, 67056 Ludwigshafen (DE).

(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.

(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, HU, IE, IS, IT, LT, LU, LV, MC, NL, 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*
— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*
— *with sequence listing part of description published separately in electronic form and available upon request from the International Bureau*

(88) Date of publication of the international search report:
9 August 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: COMBINATION OF LIPID METABOLISM PROTEINS AND USES THEREOF

(57) Abstract: Described herein are inventions in the field of genetic engineering of plants, including combinations of nucleic acid molecules encoding LMPs to improve agronomic, horticultural, and quality traits. This invention relates generally to the combination of nucleic acid sequences encoding proteins that are related to the presence of seed storage compounds in plants. More specifically, the present invention relates to LMP nucleic acid sequences 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 level 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 to increase yield and/or composition of seed storage compounds.

WO 2007/012576 A3

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2006/064276

A. CLASSIFICATION OF SUBJECT MATTER
INV. C12N15/82 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 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, BIOSIS, CHEM ABS Data, Sequence Search

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	WO 2005/052162 A (NAT RES COUNCIL [CA]; MIETKIEWSKA ELZBIETA [CA]; TAYLOR DAVID C [CA];) 9 June 2005 (2005-06-09) * abstract, p. 3:21-5:3, example 10,11, table I-V, claims * -----	1-5, 8-10,13, 15 6,11,12, 16
Y	CERNAC ALEX ET AL: "WRINKLED1 encodes an AP2/EREB domain protein involved in the control of storage compound biosynthesis in Arabidopsis" PLANT JOURNAL, vol. 40, no. 4, November 2004 (2004-11), pages 575-585, XP002420086 ISSN: 0960-7412 * abstract, p. 575,576, 578, 581-583, fig. 2 * ----- -/--	1-16

[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 February 2007	29/06/2007

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	PUONTI-KAERLAS, J

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2006/064276

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 02/072775 A2 (BASF PLANT SCIENCE GMBH [DE]; BENNING CHRISTOPHER [US]; CERNAC ALEX [U) 19 September 2002 (2002-09-19) * p. 2:35-5:2, 5:37-8:19, 21:9-22:17, 25:26-30:36, example 2,3,4 *	1-16
A	WO 99/49050 A2 (DU PONT [US]; CAHOON EDGAR B [US]; HITZ WILLIAM D [US]; KINNEY ANTHONY) 30 September 1999 (1999-09-30)	
A	US 6 828 475 B1 (METZ JAMES GEORGE [US] ET AL) 7 December 2004 (2004-12-07)	
A	SINGH SURINDER ET AL: "Transgenic expression of a DELTA12-epoxygenase gene in Arabidopsis seeds inhibits accumulation of linoleic acid" PLANTA (BERLIN), vol. 212, no. 5-6, April 2001 (2001-04), pages 872-879, XP002420087 ISSN: 0032-0935	
A	MEHRTENS FRANK ET AL: "The Arabidopsis transcription factor MYB12 is a flavonol-specific regulator of phenylpropanoid biosynthesis" PLANT PHYSIOLOGY (ROCKVILLE), vol. 138, no. 2, June 2005 (2005-06), pages 1083-1096, XP002420088 ISSN: 0032-0889	
A	WIBERG EVA ET AL: "The distribution of caprylate, caprate and laurate in lipids from developing and mature seeds of transgenic Brassica napus L" PLANTA (BERLIN), vol. 212, no. 1, December 2000 (2000-12), pages 33-40, XP002420089 ISSN: 0032-0935	
A	VAN EENENNAAM ALISON L ET AL: "Elevation of seed alpha-tocopherol levels using plant-based transcription factors targeted to an endogenous locus." METABOLIC ENGINEERING APR 2004, vol. 6, no. 2, April 2004 (2004-04), pages 101-108, XP002420090 ISSN: 1096-7176	

-/--

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2006/064276

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DOMERGUE F ET AL: "Relief for fish stocks: oceanic fatty acids in transgenic oilseeds" TRENDS IN PLANT SCIENCE, ELSEVIER SCIENCE, OXFORD, GB, vol. 10, no. 3, March 2005 (2005-03), pages 112-116, XP004776171 ISSN: 1360-1385	
A	WO 2004/071467 A2 (DU PONT [US]; KINNEY ANTHONY J [US]; CAHOON EDGAR B [US]; DAMUDE HOWAR) 26 August 2004 (2004-08-26)	
A	CAHOON EDGAR B ET AL: "Production of fatty acid components of meadowfoam oil in somatic soybean embryos" PLANT PHYSIOLOGY, AMERICAN SOCIETY OF PLANT PHYSIOLOGISTS, ROCKVILLE, MD, US, vol. 124, no. 1, September 2000 (2000-09), pages 243-251, XP002252847 ISSN: 0032-0889	

INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP2006/064276

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 (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:

Invention 1

claims 1-16 (partially)
A nucleic acid comprising two or more polynucleotide sequences according to SEQ ID NO: 1 and subject-matter related thereto

1.1. claims: 1-16 (partially)

as invention 1 but relating to SEQ ID NO: 2

Inventions 2-7

claims 1-16 (partially)
as invention 1 but relating to SEQ ID NOs: 3,4,5,6,7 and 8, respectively

---

Invention 8

claIims 1-16 partially)
a nucleic acid comprising two or more polynucleotide sequences, being a combination of SEQ ID NO: 1 and SEQ ID NO: 2

Inventions 9-14

claims 1-16 (partially)
as invention 8 but relating to SEQ ID NO: 1 and SEQ ID NOs: 3,4,5,6,7 or 8

Inventions 15-20

claims 1-16 (partially)
as invention 8 but relating to SEQ ID NO: 2 and SEQ ID NOs: 3-8

Inventions 21-25

claims 1-16 (partially)
as invention 8 but relating to SEQ ID NO: 3 and SEQ ID NOs: 4-8

Inventions 26-29

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

claims 1-16 (partially)
as invention 8 but relating to SEQ ID NO: 4 and SEQ ID NOs: 5-8

Inventions 30-32

claims 1-16 (partially)
as invention 8 but relating to SEQ ID NO: 5 and SEQ ID NOs: 6-8

Inventions 33-34

claims 1-16 (partially)
as invention 8 but relating to SEQ ID NO: 6 and SEQ ID NOs: 7-8

Invention 35

claims 1-16 (partially)
as invention 8 but relating to SEQ ID NO: 7 and SEQ ID NO: 8

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2006/064276

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2005052162 A	09-06-2005	CA 2547320 A1	09-06-2005
		EP 1699927 A1	13-09-2006
WO 02072775 A2	19-09-2002	AU 2002254180 A1	24-09-2002
		CA 2440330 A1	19-09-2002
		EP 1390381 A2	25-02-2004
		US 2003097685 A1	22-05-2003
WO 9949050 A2	30-09-1999	AU 763296 B2	17-07-2003
		AU 3184999 A	18-10-1999
		BR 9908381 A	11-06-2002
		CA 2319727 A1	30-09-1999
		EP 1064387 A2	03-01-2001
		HU 0102912 A2	28-11-2001
		JP 2002528048 T	03-09-2002
		NO 20004680 A	15-11-2000
		NZ 505988 A	31-10-2003
US 6828475 B1	07-12-2004	NONE	
WO 2004071467 A2	26-08-2004	BR PI0406688 A	04-04-2006
		CA 2512589 A1	26-08-2004
		EP 1592392 A2	09-11-2005