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(81) Designated States *(national)*: AE, AG, AL, AM, AT, AT (utility model), AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, CZ (utility model), DE, DE (utility model), DK, DK (utility model), DM, DZ, EE, EE (utility model), ES, FI, FI (utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (utility model), SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW.

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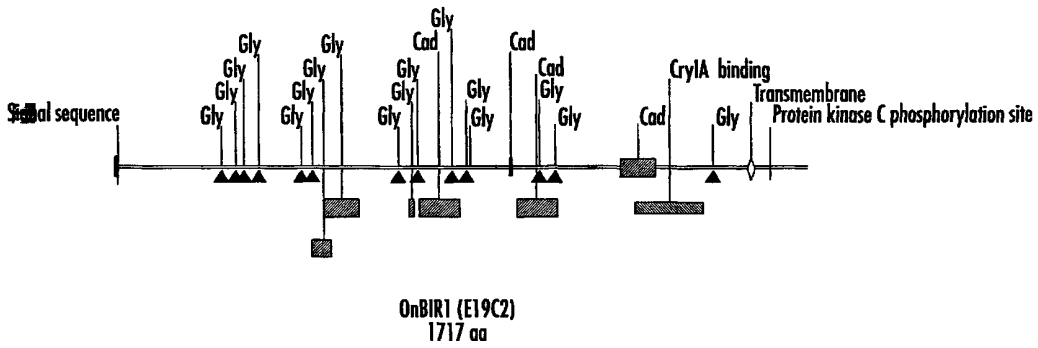
For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: BT TOXIN RECEPTORS FROM LEPIDOPTERAN INSECTS AND METHODS OF USE



(57) Abstract: The invention relates to *Bt* toxin resistance management. The invention particularly relates to the isolation and characterization of nucleic acid and polypeptides for a novel *Bt* toxin receptor. The nucleic acid and polypeptides are useful in identifying and designing novel *Bt* toxin receptor ligands including novel insecticidal toxins.

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INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 C12N15/12 C12N15/62 C12N5/10 C07K14/705 C07K16/28
G01N33/50

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)
IPC 7 C12N C07K G01N

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)
WPI Data, PAJ, CAB Data, STRAND, BIOSIS, EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	NAGAMATSU YASUNORI ET AL: "Cloning, sequencing, and expression of the Bombyx mori receptor for Bacillus thuringiensis insecticidal CryIA(a) toxin." BIOSCIENCE BIOTECHNOLOGY AND BIOCHEMISTRY, vol. 62, no. 4, April 1998 (1998-04), pages 727-734, XP002164759 ISSN: 0916-8451 cited in the application the whole document ---	1,2,4, 9-15
X	WO 96 12964 A (UNIV WYOMING) 2 May 1996 (1996-05-02) the whole document ---	1,2,4, 9-15, 19-22
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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"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
13 June 2001	29.06.01

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	Hornig, H

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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	VADLAMUDI RATNA K ET AL: "Cloning and expression of a receptor for an insecticidal toxin of Bacillus thuringiensis." JOURNAL OF BIOLOGICAL CHEMISTRY, vol. 270, no. 10, 1995, pages 5490-5494, XP002164760 ISSN: 0021-9258 cited in the application the whole document	1,2,4, 9-15
X	KEETON TIMOTHY P ET AL: "Ligand specificity and affinity of BT-R-1, the Bacillus thuringiensis Cry1A toxin receptor from Manduca sexta, expressed in mammalian and insect cell cultures." APPLIED AND ENVIRONMENTAL MICROBIOLOGY, vol. 63, no. 9, 1997, pages 3419-3425, XP002164761 ISSN: 0099-2240 cited in the application the whole document	1,2,4, 9-15
X	KEETON TIMOTHY P ET AL: "Effects of midgut-protein-preparative and ligand binding procedures on the toxin binding characteristics of BT-R1, a common high-affinity receptor in Manduca sexta for Cry1A Bacillus thuringiensis toxins." APPLIED AND ENVIRONMENTAL MICROBIOLOGY, vol. 64, no. 6, June 1998 (1998-06), pages 2158-2165, XP002164762 ISSN: 0099-2240 cited in the application the whole document	1,2,4, 9-15
A	GILL SARJEET S ET AL: "Identification, isolation, and cloning of a Bacillus thuringiensis CryIAc toxin-binding protein from the midgut of the lepidopteran insect Heliothis virescens." JOURNAL OF BIOLOGICAL CHEMISTRY, vol. 270, no. 45, 1995, pages 27277-27282, XP002164763 ISSN: 0021-9258 cited in the application the whole document	

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INTERNATIONAL SEARCH REPORT

Intern .nal Application No
PCT/US 00/31674

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	LEE MI KYONG ET AL: "Aminopeptidase N purified from gypsy moth brush border membrane vesicles is a specific receptor for Bacillus thuringiensis CryIAc toxin." APPLIED AND ENVIRONMENTAL MICROBIOLOGY, vol. 62, no. 8, 1996, pages 2845-2849, XP002164764 ISSN: 0099-2240 cited in the application the whole document ---	
E	WO 01 34807 A (CANDAS MEHMET ;BULLA LEE A JR (US)) 17 May 2001 (2001-05-17) claims 1-28; figures 1,2 ---	1-15
A	GARCZYNSKI S F ET AL: "IDENTIFICATION OF PUTATIVE INSECT BRUSH BORDER MEMBRANE-BINDING MOLECULES SPECIFIC TO BACILLUS-THURINGIENSIS DELTA ENDOTOXIN BY PROTEIN BLOT ANALYSIS" APPLIED AND ENVIRONMENTAL MICROBIOLOGY, vol. 57, no. 10, 1991, pages 2816-2820, XP000992668 ISSN: 0099-2240 the whole document ---	
A	OLTEAN DANIELA I ET AL: "Partial purification and characterization of Bacillus thuringiensis Cry1A toxin receptor A from Heliothis virescens and cloning of the corresponding cDNA." APPLIED AND ENVIRONMENTAL MICROBIOLOGY, vol. 65, no. 11, November 1999 (1999-11), pages 4760-4766, XP002169506 ISSN: 0099-2240 the whole document -----	

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 00/31674

Box I Observations where certain claims were found unsearchable (Continuation of item 1 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 II Observations where unity of invention is lacking (Continuation of item 2 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.:

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: (1-25)-partially

An isolated nucleic acid molecule having the nucleotide sequence encoding a Bt toxin receptor, selected from Ostrinia nubilalis respectively SEQ ID No. 1; said nucleic acid, wherein said toxin is Cry1A/Cry1A(b); an isolated polypeptide having the amino acid sequence set forth in SEQ ID NO. 2; a fusion polypeptide comprising said polypeptide, an expression cassette comprising a nucleotide sequence encoding said fusion polypeptide; an antibody preparation specific for said polypeptide; a vector comprising said expression cassette; a cell comprising said vector; a transformed cell of interest having stably incorporated within its genome said nucleotide sequence, SEQ ID No.1; a method for screening for ligands that bind said Bt toxin receptor comprising SEQ ID No. 2;

2. Claims: (1-25)-partially

Idem as invention 1 but limited to Heliothis zea, respectively SEQ ID Nos. 3 and 4;

3. Claims: (1-25)-partially

Idem as invention 1 but limited to Spodoptera frugiperda, respectively SEQ ID Nos. 5 and 6;

INTERNATIONAL SEARCH REPORT

Information on patent family members

Intern nal Application No
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9612964 A	02-05-1996	US 5693491 A	02-12-1997
		AU 711066 B	07-10-1999
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		NZ 296265 A	28-05-1999
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		ZA 9508851 A	11-06-1996
WO 0134807 A	17-05-2001	NONE	