

PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

PCT

To: ROBERT E. HANSON P.O. BOX 061080 WACKER DRIVE STATION, WILLIS TOWER CHICAGO, IL 60606

NOTIFICATION OF TRANSMITTAL OF
 THE INTERNATIONAL SEARCH REPORT AND
 THE WRITTEN OPINION OF THE INTERNATIONAL
 SEARCHING AUTHORITY, OR THE DECLARATION

(PCT Rule 44.1)

Applicant's or agent's file reference MONS:469WO	Date of mailing (day/month/year)
International application No. PCT/US 20/14437	International filing date (day/month/year) 21 January 2020 (21.01.2020)
Applicant MONSANTO TECHNOLOGY LLC	

1. ☒ The applicant is hereby notified that the international search report and the written opinion of the International Searching Authority have been established and are transmitted herewith.
Filing of amendments and statement under Article 19:
 The applicant is entitled, if he so wishes, to amend the claims of the international application (see Rule 46):
When? The time limit for filing such amendments is normally two months from the date of transmittal of the international search report.
How? Directly to the International Bureau preferably through ePCT, or on paper to:
 The International Bureau of WIPO, 34, chemin des Colombettes, 1211 Geneva 20, Switzerland

 For more detailed instructions, see the *PCT Applicant's Guide*, International Phase, paragraphs 9.004 – 9.011.
2. ☐ The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect and the written opinion of the International Searching Authority are transmitted herewith.
3. ☐ With regard to any protest against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:

☐ the protest together with the decision thereon has been transmitted to the International Bureau together with any request to forward the texts of both the protest and the decision thereon to the designated Offices.
☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.
4. **Reminders**
 The applicant may submit comments on an informal basis on the written opinion of the International Searching Authority to the International Bureau. These comments will be made available to the public after international publication. The International Bureau will send a copy of such comments to all designated Offices unless an international preliminary examination report has been or is to be established.
 Shortly after the expiration of 18 months from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau before the completion of the technical preparations for international publication (Rules 90bis.1 and 90bis.3).
 Within 19 months from the priority date, but only in respect of some designated Offices, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase until 30 months from the priority date (in some Offices even later); otherwise, the applicant must, within 20 months from the priority date, perform the prescribed acts for entry into the national phase before those designated Offices. In respect of other designated Offices, the time limit of 30 months (or later) will apply even if no demand is filed within 19 months. For details about the applicable time limits, Office by Office, see www.wipo.int/pct/en/texts/time_limits.html and the *PCT Applicant's Guide*, National Chapters.
 Within 22 months from the priority date, the applicant may request that a supplementary international search be carried out by a different International Searching Authority that offers this service (Rule 45bis.1). The procedure for requesting supplementary international search is described in the *PCT Applicant's Guide*, International Phase, paragraphs 8.006-8.032.

Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	Authorized officer Lee Young Telephone No. PCT Helpdesk: 571-272-4300
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PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

PCT

To: ROBERT E. HANSON
P.O. BOX 061080
WACKER DRIVE STATION, WILLIS TOWER
CHICAGO, IL 60606

NOTIFICATION OF TRANSMITTAL OF
THE INTERNATIONAL SEARCH REPORT AND
THE WRITTEN OPINION OF THE INTERNATIONAL
SEARCHING AUTHORITY, OR THE DECLARATION

(PCT Rule 44.1)

Applicant's or agent's file reference MONS:469WO	Date of mailing (day/month/year) 11 JUN 2020
International application No. PCT/US 20/14437	International filing date (day/month/year) 21 January 2020 (21.01.2020)
Applicant MONSANTO TECHNOLOGY LLC	

1. ☒ The applicant is hereby notified that the international search report and the written opinion of the International Searching Authority have been established and are transmitted herewith.
Filing of amendments and statement under Article 19:
 The applicant is entitled, if he so wishes, to amend the claims of the international application (see Rule 46):
When? The time limit for filing such amendments is normally two months from the date of transmittal of the international search report.
How? Directly to the International Bureau preferably through ePCT, or on paper to:
 The International Bureau of WIPO, 34, chemin des Colombettes, 1211 Geneva 20, Switzerland

 For more detailed instructions, see the *PCT Applicant's Guide*, International Phase, paragraphs 9.004 – 9.011.
2. ☐ The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect and the written opinion of the International Searching Authority are transmitted herewith.
3. ☐ With regard to any protest against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:
 - ☐ the protest together with the decision thereon has been transmitted to the International Bureau together with any request to forward the texts of both the protest and the decision thereon to the designated Offices.
 - ☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.
4. **Reminders**
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 Shortly after the expiration of 18 months from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau before the completion of the technical preparations for international publication (Rules 90bis.1 and 90bis.3).
 Within 19 months from the priority date, but only in respect of some designated Offices, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase until 30 months from the priority date (in some Offices even later); otherwise, the applicant must, within 20 months from the priority date, perform the prescribed acts for entry into the national phase before those designated Offices. In respect of other designated Offices, the time limit of 30 months (or later) will apply even if no demand is filed within 19 months. For details about the applicable time limits, Office by Office, see www.wipo.int/pct/en/texts/time_limits.html and the *PCT Applicant's Guide*, National Chapters.
 Within 22 months from the priority date, the applicant may request that a supplementary international search be carried out by a different International Searching Authority that offers this service (Rule 45bis.1). The procedure for requesting supplementary international search is described in the *PCT Applicant's Guide*, International Phase, paragraphs 8.006-8.032.

Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	Authorized officer Lee Young Telephone No. PCT Helpdesk: 571-272-4300
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PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference MONS:469WO		FOR FURTHER ACTION see Form PCT/ISA/220 as well as, where applicable, item 5 below.	
International application No. PCT/US 20/14437	International filing date (day/month/year) 21 January 2020 (21.01.2020)	(Earliest) Priority Date (day/month/year) 22 January 2019 (22.01.2019)	
Applicant MONSANTO TECHNOLOGY LLC			

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 7 sheets.

☐ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

a. With regard to the **language**, the international search was carried out on the basis of:

- ☒ the international application in the language in which it was filed.
☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

b. ☐ This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6bis(a)).

c. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2. ☒ **Certain claims were found unsearchable** (see Box No. II).

3. ☒ **Unity of invention is lacking** (see Box No. III).

4. With regard to the **title**,

- ☒ the text is approved as submitted by the applicant.
☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

- ☒ the text is approved as submitted by the applicant.
☐ the text has been established, according to Rule 38.2, by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. With regard to the **drawings**,

- a. the figure of the **drawings** to be published with the abstract is Figure No. _____
☐ as suggested by the applicant.
☐ as selected by this Authority, because the applicant failed to suggest a figure.
☐ as selected by this Authority, because this figure better characterizes the invention.
- b. ☐ none of the figures is to be published with the abstract.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 20/14437

Box No. I Nucleotide and/or amino acid sequence(s) (Continuation of item 1.c of the first sheet)

1. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international search was carried out on the basis of a sequence listing:
- a. ☒ forming part of the international application as filed:
☒ in the form of an Annex C/ST.25 text file.
☐ on paper or in the form of an image file.
- b. ☐ furnished together with the international application under PCT Rule 13ter.1(a) for the purposes of international search only in the form of an Annex C/ST.25 text file.
- c. ☐ furnished subsequent to the international filing date for the purposes of international search only:
☐ in the form of an Annex C/ST.25 text file (Rule 13ter.1(a)).
☐ on paper or in the form of an image file (Rule 13ter.1(b) and Administrative Instructions, Section 713).
2. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that forming part of the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
3. Additional comments:

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 20/14437

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.: 19
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 extra sheet for Box No. III Observations where unity of invention is lacking -

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 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.:
1-18, 20-21, 23 limited to SEQ ID NO: 4

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.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 20/14437

A. CLASSIFICATION OF SUBJECT MATTER
 IPC - C07K 14/325, C12N 15/82, A01N 63/02 (2020.10)
 CPC - C07K 14/325, C12N 15/8286, A01N 63/02, Y02A 40/162

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)
 See Search History document

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
 See Search History document

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
 See Search History document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2017/0058294 A1 (MONSANTO TECHNOLOGY LLC) 02 March 2017 (02.03.2017) Claim 1, SEQ ID NO: 4	1-18, 20-21, 23
A	UniProtKB A0A3A3GLR0_PANTH (CBM-cenC domain-containing protein) 4 December 2018 [online]. [Retrieved on 04 April 2020]. Retrieved from the internet <URL: https://www.uniprot.org/uniprot/A0A3A3GLR0.txt > whole doc.	1-18, 20-21, 23

☐ 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

"D" document cited by the applicant in the international application

"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

18 May 2020

Date of mailing of the international search report

11 JUN 2020

Name and mailing address of the ISA/US

Mail Stop PCT, Attn: ISA/US, Commissioner for Patents
 P.O. Box 1450, Alexandria, Virginia 22313-1450
 Facsimile No. 571-273-8300

Authorized officer

Lee Young

Telephone No. PCT Helpdesk: 571-272-4300

Continuation of:

Box No. III. Observations where unity of invention is lacking

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be searched, the appropriate additional search fees must be paid.

Groups I+: Claims 1-18, 20-21, 23, drawn to a recombinant nucleic acid molecule comprising a heterologous promoter operably linked to a polynucleotide segment encoding a pesticidal protein or pesticidal fragment thereof. The composition will be searched to the extent that the pesticidal protein comprises the amino acid sequence of SEQ ID NO: 4. It is believed that claims 1-18, 20-21, 23 encompass this first named invention, and thus these claims will be searched without fee to the extent that they encompass SEQ ID NO: 4. Additional pesticidal protein(s) will be searched upon the payment of additional fees. Applicants must specify the claims that encompass any additionally elected pesticidal protein(s). Applicants must further indicate, if applicable, the claims which encompass the first named invention, if different than what was indicated above for this group. Failure to clearly identify how any paid additional invention fees are to be applied to the "+" group(s) will result in only the first claimed invention to be searched. An exemplary election would be a pesticidal protein comprising a polynucleotide segment hybridizes under stringent hybridization conditions to a polynucleotide having the nucleotide sequence of SEQ ID NO: 3 (Claims 1-18, 20-21, 23).

Groups II+: Claims 22, 24-27, drawn to a method of producing seeds, a method for controlling a Lepidopteran species pest or pest infestation, and a method of detecting the presence of a pesticidal protein. Group II+ will be searched upon payment of additional fees. The method may be searched, for example, to the extent that the pesticidal protein encompasses the amino acid sequence of SEQ ID NO: 4, for an additional fee and election as such. It is believed that claims 22, 24, 26-27 read on this exemplary invention. Additional pesticidal protein(s) will be searched upon the payment of additional fees. Applicants must specify the claims that encompass any additionally elected pesticidal protein(s). Failure to clearly identify how any paid additional invention fees are to be applied to the "+" group(s) will result in only the first claimed invention to be searched. Another exemplary election would be a polynucleotide segment hybridizes under stringent hybridization conditions to a polynucleotide having the nucleotide sequence of SEQ ID NO: 3 (Claim 22, 25).

Groups III+: Claims 28-31, drawn to a method for improving the pesticidal activity of a native pesticidal protein against an insect pest species, comprising: engineering a variant pesticidal protein by inserting a DNA fragment encoding an insect midgut receptor binding peptide into a coding sequence encoding the pesticidal protein. Group III+ will be searched upon payment of additional fees. The method may be searched, for example, to the extent that the DNA fragment encoding an insect gut receptor binding peptide encompasses SEQ ID NO: 15, for an additional fee and election as such. It is believed that claims 28-30 read on this exemplary invention. Additional gut receptor binding peptide(s) will be searched upon the payment of additional fees. Applicants must specify the claims that encompass any additionally elected gut receptor binding peptide(s). Failure to clearly identify how any paid additional invention fees are to be applied to the "+" group(s) will result in only the first claimed invention to be searched. Another exemplary election would be a DNA fragment encoding an insect gut receptor binding peptide encompasses SEQ ID NO: 17 (Claim 28-29, 31).

Groups IV+: Claims 32-35, drawn to a recombinant nucleic acid molecule comprising a heterologous promoter operably linked to a polynucleotide segment encoding a pesticidal protein, operably linked to a DNA sequence comprising a reproductive tissue-specific miRNA target binding site element, and a method of use thereof. Group IV+ will be searched upon payment of additional fees. The method may be searched, for example, to the extent that the miRNA targeting binding sites encompasses SEQ ID NO: 18 and the recombinant nucleic acid encompasses SEQ ID NO: 25, for an additional fee and election as such. It is believed that claims 32-35 read on this exemplary invention. Additional miRNA targeting binding site(s) and recombinant nucleic acid(s) will be searched upon the payment of additional fees. Applicants must specify the claims that encompass any additionally elected miRNA targeting binding site(s) and recombinant nucleic acid(s). Failure to clearly identify how any paid additional invention fees are to be applied to the "+" group(s) will result in only the first claimed invention to be searched. Another exemplary election would be a miRNA targeting binding sites encompasses SEQ ID NO: 21 and a recombinant nucleic acid encompasses SEQ ID NO: 26 (Claim 32-35).

The inventions listed as Groups I+, II+, III+ and IV+ do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

Special Technical Features

Groups I+ include the special technical feature of a composition comprising a polynucleotide segment encoding a pesticidal protein that hybridizes under stringent hybridization condition to specific nucleotide sequences, not required by Groups II+, III+ and IV+.

Groups II+ include the special technical feature of a method of producing seeds, a method for controlling a Lepidopteran species pest or pest infestation, and a method of detecting the presence of a pesticidal protein, not required by Groups I+, III+ and IV+.

Groups III+ include the special technical feature of a method for improving the pesticidal activity of a native pesticidal protein against an insect pest species, not required by Groups I+, II+ and IV+.

Groups IV+ include the special technical feature of a DNA sequence comprising a reproductive tissue-specific miRNA target binding site element, not required by Groups I+, II+ and III+.

No technical features are shared between the amino acid sequences or nucleotide sequences of Groups I+, II+, III+ and IV+, and, accordingly, these groups lack unity a priori.

---continued on next sheet---

Continuation of:

Box No. III. Observations where unity of invention is lacking

Additionally, even if Groups I+, II+, III+ and IV+ were considered to share the technical features of including: a recombinant nucleic acid molecule comprising a heterologous promoter operably linked to a polynucleotide segment encoding a pesticidal protein or pesticidal fragment thereof, these shared technical features are previously disclosed (see discussion below).

Common Technical Features

The inventions of Groups I+, II+, III+ and IV+ share the technical feature of a recombinant nucleic acid molecule comprising a heterologous promoter operably linked to a polynucleotide segment encoding a pesticidal protein or pesticidal fragment thereof.

However, these shared technical features do not represent a contribution over prior art in view of US 2017/0058294 A1 to Monsanto Technology LLC (hereinafter "Monsanto"). Monsanto teaches (instant claim 1) a recombinant nucleic acid molecule comprising a heterologous promoter operably linked to a polynucleotide segment encoding a pesticidal protein or pesticidal fragment thereof, wherein c. said polynucleotide segment hybridizes under stringent hybridization conditions to a polynucleotide having specific nucleotide sequences (Claim 1, A recombinant nucleic acid molecule comprising a heterologous promoter operably linked to a polynucleotide segment encoding a pesticidal protein or pesticidal fragment thereof, wherein:.....c. said polynucleotide segment hybridizes under stringent hybridization conditions to a polynucleotide having the nucleotide sequence.).

Some inventions of Groups I+ share the technical feature of a plant, a seed, an insect inhibitory composition, a commodity product, which is disclosed by Monsanto (Claim 10, A plant, or part thereof, comprising the recombinant nucleic acid molecule of claim 1.; Claim 13, A seed of the plant of claim 10.; Claim 14, An insect inhibitory composition.; Claim 20, A commodity product produced from the plant.).

The inventions of Groups II+ share the technical feature of Claims 24, 25 and 26.

Monsanto teaches (instant claim 24) a method for controlling a Lepidopteran species pest or pest infestation, said method comprising: a. contacting the pest with a pesticidally effective amount of a pesticidal protein (Claim 24, A method for controlling a Lepidopteran species pest or pest infestation, said method comprising: a. contacting the pest with an insecticidally effective amount of a pesticidal protein.);

Monsanto teaches (instant claim 25) a method of detecting the presence of the recombinant nucleic acid molecule of claim 1 in a sample comprising plant genomic DNA (para [0023], a method of detecting the presence of a recombinant nucleic acid molecule comprising a polynucleotide segment encoding a pesticidal protein or fragment thereof.), comprising:

- a. contacting said sample with a nucleic acid probe that hybridizes under stringent hybridization conditions with genomic DNA from a plant comprising the recombinant nucleic acid molecule of claim 1, and does not hybridize under such hybridization conditions with genomic DNA from an otherwise isogenic plant that does not comprise the recombinant nucleic acid molecule of claim 1 (para [0023], the method comprises contacting a sample of nucleic acids with a nucleic acid probe that hybridizes under stringent hybridization conditions with genomic DNA from a plant comprising a polynucleotide segment encoding a pesticidal protein or fragment thereof provided herein, and does not hybridize under such hybridization conditions with genomic DNA from an otherwise isogenic plant that does not comprise the segment.);
- b. subjecting said sample and said probe to stringent hybridization conditions; and
- c. detecting hybridization of said nucleic acid probe with said plant genomic DNA of said sample (para [0023], The method may further comprise (a) subjecting the sample and probe to stringent hybridization conditions; and (b) detecting hybridization of the probe with DNA of the sample.).

Monsanto teaches (instant claim 26) a method of detecting the presence of a pesticidal protein, or fragment thereof, in a sample comprising protein (para [0024], methods of detecting the presence of a pesticidal protein or fragment thereof in a sample comprising protein.), comprising:

- a. contacting said sample with an immunoreactive antibody; and b. detecting the presence of said pesticidal protein, or fragment thereof (para [0024], the method comprises: (a) contacting a sample with an immunoreactive antibody; and (b) detecting the presence of the protein. In some embodiments the step of detecting comprises an ELISA, or a Western blot.).

The inventions of Groups III+ share the technical feature of a method for improving the pesticidal activity of a native pesticidal protein against an insect pest species.

However, these shared technical features do not represent a contribution over prior art in view of US 2008/0300210 A1 to German et al. (hereinafter "German").

German teaches (instant claim 28) a method for improving the pesticidal activity of a native pesticidal protein against an insect pest species (Claim 18, A method of preventing transmission of an arthropod-dependent viral plant disease.), comprising: engineering a variant pesticidal protein by inserting a DNA fragment encoding an insect midgut receptor binding peptide into a coding sequence encoding the pesticidal protein; wherein the pesticidal activity of the engineered pesticidal protein is greater than the pesticidal activity of the native pesticidal protein to said insect pest species (para [0010], a genetic construct for inhibiting virus transmission by an arthropod comprising a first polynucleotide that encodes a midgut receptor binding domain of an envelope/membrane glycoprotein from a virus capable of infecting the arthropod and a second polynucleotide that encodes an active toxic fragment of a Bacillus thuringiensis (Bt) toxin. The genetic construct can further comprise a promoter operably linked to the first and second polynucleotides for expressing a fusion protein.).

----continued on next sheet----

Continuation of:

Box No. III. Observations where unity of invention is lacking

The inventions of Groups IV+ share the technical feature of a DNA sequence comprising a reproductive tissue-specific miRNA target binding site element.

However, these shared technical features do not represent a contribution over prior art in view of US 2013/0097735 A1 to Bowen et al. (hereinafter "Bowen").

Bowen teaches (instant claim 32) a recombinant nucleic acid molecule comprising a heterologous promoter operably linked to a polynucleotide segment encoding a pesticidal protein or pesticidal fragment thereof (para [0024], SEQ ID NO:1 is a nucleotide sequence representing a recombinant polynucleotide derived from a *Bacillus thuringiensis* (Bt) species having an open reading frame at nucleotide positions 1-1107 encoding a TIC1498 protein.; [0126], Proteins of the present invention can be expressed from DNA constructs in which the open reading frame encoding the protein is operably linked to elements such as a promoter and any other regulatory elements.), operably linked to a DNA sequence comprising a specific miRNA target binding site element, wherein said miRNA target binding site element is heterologous with respect to said polynucleotide segment encoding a pesticidal protein or pesticidal fragment thereof (para [0126], Other useful elements that can be operably linked to the protein encoding sequences include, but are not limited to, enhancers, introns,....., and miRNA target sites.). Bowen does not specifically teach a reproductive tissue-specific miRNA target binding site element. Given that Bowen teaches that said recombinant nucleic acid is expressed in the plant seeds (para [0138], a transgenic plant with stably-integrated, non-natural recombinant DNA, or seed or pollen derived from a progeny transgenic plant.), it would have been obvious to one of ordinary skill in the art to have applied a reproductive tissue-specific miRNA target binding site element.

As said technical features were known in the art at the time of the invention, these cannot be considered special technical features that would otherwise unify the groups.

Groups I+, II+, III+, and IV+ therefore lack unity under PCT Rule 13 because they do not share a same or corresponding special technical feature.

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

To: ROBERT E. HANSON
P.O. BOX 061080
WACKER DRIVE STATION, WILLIS TOWER
CHICAGO, IL 60606

Date of mailing
(day/month/year)

11 JUN 2020

Applicant's or agent's file reference
MONS:469WO

FOR FURTHER ACTION

See paragraph 2 below

International application No.
PCT/US 20/14437

International filing date (day/month/year)
21 January 2020 (21.01.2020)

Priority date (day/month/year)
22 January 2019 (22.01.2019)

International Patent Classification (IPC) or both national classification and IPC
IPC - C07K 14/325, C12N 15/82, A01N 63/02 (2020.10)
CPC - C07K 14/325, C12N 15/8286, A01N 63/02, Y02A 40/162

Applicant
MONSANTO TECHNOLOGY LLC

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☒ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☒ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA/US
Mail Stop PCT, Attn: ISA/US
Commissioner for Patents
P.O. Box 1450, Alexandria, Virginia 22313-1450
Facsimile No. 571-273-8300

Date of completion of this opinion
18 May 2020

Authorized officer
Lee Young
PCT Help Desk
Telephone No. 571-272-4300

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.

PCT/US 20/14437

Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of:

- ☒ the international application in the language in which it was filed.
☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(b)).

3. ☒ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a **sequence listing**:

- a. ☒ forming part of the international application as filed:
☒ in the form of an Annex C/ST.25 text file.
☐ on paper or in the form of an image file.
b. ☐ furnished together with the international application under PCT Rule 13*ter*.1(a) for the purposes of international search only in the form of an Annex C/ST.25 text file.
c. ☐ furnished subsequent to the international filing date for the purposes of international search only:
☐ in the form of an Annex C/ST.25 text file (Rule 13*ter*.1(a)).
☐ on paper or in the form of an image file (Rule 13*ter*.1(b) and Administrative Instructions, Section 713).

4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that forming part of the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

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Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non obvious), or to be industrially applicable have not been examined in respect of:

☐ the entire international application.

☒ claims Nos. 19

because:

☐ the said international application, or the said claims Nos. _____ relate to the following subject matter which does not require an international search (*specify*):

☒ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. 19 are so unclear that no meaningful opinion could be formed (*specify*):

Claim 19 unsearchable because it is a dependent claim and is not drafted in accordance with the second and third sentences of Rule 6.4(a).

☐ the claims, or said claims Nos. _____ are so inadequately supported by the description that no meaningful opinion could be formed (*specify*):

☒ no international search report has been established for said claims Nos. 19

☐ a meaningful opinion could not be formed without the sequence listing; the applicant did not, within the prescribed time limit:

☐ furnish a sequence listing in the form of an Annex C/ST.25 text file, and such listing was not available to the International Searching Authority in the form and manner acceptable to it; or the sequence listing furnished did not comply with the standard provided for in Annex C of the Administrative Instructions.

☐ furnish a sequence listing on paper or in the form of an image file complying with the standard provided for in Annex C of the Administrative Instructions, and such listing was not available to the International Searching Authority in the form and manner acceptable to it; or the sequence listing furnished did not comply with the standard provided for in Annex C of the Administrative Instructions.

☐ pay the required late furnishing fee for the furnishing of a sequence listing in response to an invitation under Rule 13ter.1(a) or (b).

☐ See Supplemental Box for further details.

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Box No. IV Lack of unity of invention

1. ☒ In response to the invitation (Form PCT/ISA/206) to pay additional fees the applicant has, within the applicable time limit:
- ☐ paid additional fees.
 - ☐ paid additional fees under protest and, where applicable, the protest fee.
 - ☐ paid additional fees under protest but the applicable protest fee was not paid.
 - ☒ not paid additional fees.

2. ☐ This Authority found that the requirement of unity of invention is not complied with and chose not to invite the applicant to pay additional fees.

3. This Authority considers that the requirement of unity of invention in accordance with Rule 13.1, 13.2 and 13.3 is

- ☐ complied with.
- ☒ not complied with for the following reasons:

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be searched, the appropriate additional search fees must be paid.

Groups I+: Claims 1-18, 20-21, 23, drawn to a recombinant nucleic acid molecule comprising a heterologous promoter operably linked to a polynucleotide segment encoding a pesticidal protein or pesticidal fragment thereof. The composition will be searched to the extent that the pesticidal protein comprises the amino acid sequence of SEQ ID NO: 4. It is believed that claims 1-18, 20-21, 23 encompass this first named invention, and thus these claims will be searched without fee to the extent that they encompass SEQ ID NO: 4. Additional pesticidal protein(s) will be searched upon the payment of additional fees. Applicants must specify the claims that encompass any additionally elected pesticidal protein(s). Applicants must further indicate, if applicable, the claims which encompass the first named invention, if different than what was indicated above for this group. Failure to clearly identify how any paid additional invention fees are to be applied to the "+" group(s) will result in only the first claimed invention to be searched. An exemplary election would be a pesticidal protein comprising a polynucleotide segment hybridizes under stringent hybridization conditions to a polynucleotide having the nucleotide sequence of SEQ ID NO: 3 (Claims 1-18, 20-21, 23).

Groups II+: Claims 22, 24-27, drawn to a method of producing seeds, a method for controlling a Lepidopteran species pest or pest infestation, and a method of detecting the presence of a pesticidal protein. Group II+ will be searched upon payment of additional fees. The method may be searched, for example, to the extent that the pesticidal protein encompasses the amino acid sequence of SEQ ID NO: 4, for an additional fee and election as such. It is believed that claims 22, 24, 26-27 read on this exemplary invention. Additional pesticidal protein(s) will be searched upon the payment of additional fees. Applicants must specify the claims that encompass any additionally elected pesticidal protein(s). Failure to clearly identify how any paid additional invention fees are to be applied to the "+" group(s) will result in only the first claimed invention to be searched. Another exemplary election would be a polynucleotide segment hybridizes under stringent hybridization conditions to a polynucleotide having the nucleotide sequence of SEQ ID NO: 3 (Claim 22, 25).

Groups III+: Claims 28-31, drawn to a method for improving the pesticidal activity of a native pesticidal protein against an insect pest species, comprising: engineering a variant pesticidal protein by inserting a DNA fragment encoding an insect midgut receptor binding peptide into a coding sequence encoding the pesticidal protein. Group III+ will be searched upon payment of additional fees. The method may be searched, for example, to the extent that the DNA fragment encoding an insect gut receptor binding peptide encompasses SEQ ID NO: 15, for an additional fee and election as such. It is believed that claims 28-30 read on this exemplary invention. Additional gut receptor binding peptide(s) will be searched upon the payment of additional fees. Applicants must specify the claims that encompass any additionally elected gut receptor binding peptide(s). Failure to clearly identify how any paid additional invention fees are to be applied to the "+" group(s) will result in only the first claimed invention to be searched. Another exemplary election would be a DNA fragment encoding an insect gut receptor binding peptide encompasses SEQ ID NO: 17 (Claim 28-29, 31).

Groups IV+: Claims 32-35, drawn to a recombinant nucleic acid molecule comprising a heterologous promoter operably linked to a polynucleotide segment encoding a pesticidal protein, operably linked to a DNA sequence comprising a reproductive tissue-specific miRNA target binding site element, and a method of use thereof. Group IV+ will be searched upon payment of additional fees. The method may be searched, for example, to the extent that the miRNA targeting binding sites encompasses SEQ ID NO: 18 and the recombinant nucleic acid encompasses SEQ ID NO: 25, for an additional fee and election as such. It is believed that claims 32-35 read on this exemplary invention. Additional miRNA targeting binding site(s) and recombinant nucleic acid(s) will be searched upon the payment of additional fees. Applicants must specify the claims that encompass any additionally elected miRNA targeting binding site(s) and recombinant nucleic acid(s). Failure to clearly identify how any paid additional invention fees are to be applied to the "+" group(s) will result in only the first claimed invention to be searched. Another exemplary election would be a miRNA targeting binding sites encompasses SEQ ID NO: 21 and a recombinant nucleic acid encompasses SEQ ID NO: 26 (Claim 32-35).

-----continued in Supplemental Box-----

4. Consequently, this opinion has been established in respect of the following parts of the international application:

- ☐ all parts.
- ☒ the parts relating to claims Nos. 1-18, 20-21, 23 limited to SEQ ID NO: 4

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Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	1-18, 20-21, 23	YES
	Claims	NONE	NO
Inventive step (IS)	Claims	1-18, 20-21, 23	YES
	Claims	NONE	NO
Industrial applicability (IA)	Claims	1-18, 20-21, 23	YES
	Claims	NONE	NO

2. Citations and explanations:

Claims 1-18, 20-21, 23 meet the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest to SEQ ID NO: 4.

Regarding claim 1, US 2017/0058294 A1 to Monsanto Technology LLC (hereinafter "Monsanto") teaches a recombinant nucleic acid molecule comprising a heterologous promoter operably linked to a polynucleotide segment encoding a pesticidal protein or pesticidal fragment thereof, wherein a. said pesticidal protein comprises a specific amino acid sequence (Claim 1, a. said pesticidal protein comprises the amino acid sequence of SEQ ID NO: 4.), c. said polynucleotide segment hybridizes under stringent hybridization conditions to a polynucleotide having specific nucleotide sequences (Claim 1, A recombinant nucleic acid molecule comprising a heterologous promoter operably linked to a polynucleotide segment encoding a pesticidal protein or pesticidal fragment thereof, wherein: ... c. said polynucleotide segment hybridizes under stringent hybridization conditions to a polynucleotide having the specific nucleotide sequence.). Monsanto does not specifically teaches SEQ ID NO: 4.

Monsanto teaches a pesticidal protein comprising amino acid sequence SEQ ID NO: 4 (Claim 1), that is 74% match to claimed SEQ ID NO: 4.

UniProtKB A0A3A3GLR0_PANTH (CBM-cenC domain-containing protein) (hereinafter "A0A3A3GLR0") teaches an amino acid sequence that is 75% match to claimed SEQ ID NO: 4.

There is no prior art that teaches or fairly suggests to one of ordinary skill in the art, in view of the teachings of Monsanto and A0A3A3GLR0, to have provided a pesticidal protein consisting of an amino acid sequence of SEQ ID NO: 4.

Regarding claims 2-18, 20-21, 23, the claims are dependent on claim 1, and thus, meet the criteria set out in PCT Article 33(2)-(3), as discussed above.

Claims 1-18, 20-21, 23 have industrial applicability as defined by PCT Article 33(4) because the subject matter can be made or used in industry.

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Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of:

Box No. IV. Lack of unity of invention

The inventions listed as Groups I+, II+, III+ and IV+ do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

Special Technical Features

Groups I+ include the special technical feature of a composition comprising a polynucleotide segment encoding a pesticidal protein that hybridizes under stringent hybridization condition to specific nucleotide sequences, not required by Groups II+, III+ and IV+.

Groups II+ include the special technical feature of a method of producing seeds, a method for controlling a Lepidopteran species pest or pest infestation, and a method of detecting the presence of a pesticidal protein, not required by Groups I+, III+ and IV+.

Groups III+ include the special technical feature of a method for improving the pesticidal activity of a native pesticidal protein against an insect pest species, not required by Groups I+, II+ and IV+.

Groups IV+ include the special technical feature of a DNA sequence comprising a reproductive tissue-specific miRNA target binding site element, not required by Groups I+, II+ and III+.

No technical features are shared between the amino acid sequences or nucleotide sequences of Groups I+, II+, III+ and IV+, and, accordingly, these groups lack unity a priori.

Additionally, even if Groups I+, II+, III+ and IV+ were considered to share the technical features of including: a recombinant nucleic acid molecule comprising a heterologous promoter operably linked to a polynucleotide segment encoding a pesticidal protein or pesticidal fragment thereof, these shared technical features are previously disclosed (see discussion below).

Common Technical Features

The inventions of Groups I+, II+, III+ and IV+ share the technical feature of a recombinant nucleic acid molecule comprising a heterologous promoter operably linked to a polynucleotide segment encoding a pesticidal protein or pesticidal fragment thereof.

However, these shared technical features do not represent a contribution over prior art in view of US 2017/0058294 A1 to Monsanto Technology LLC (hereinafter "Monsanto"). Monsanto teaches (instant claim 1) a recombinant nucleic acid molecule comprising a heterologous promoter operably linked to a polynucleotide segment encoding a pesticidal protein or pesticidal fragment thereof, wherein c. said polynucleotide segment hybridizes under stringent hybridization conditions to a polynucleotide having specific nucleotide sequences (Claim 1, A recombinant nucleic acid molecule comprising a heterologous promoter operably linked to a polynucleotide segment encoding a pesticidal protein or pesticidal fragment thereof, wherein:.....c. said polynucleotide segment hybridizes under stringent hybridization conditions to a polynucleotide having the nucleotide sequence.).

Some inventions of Groups I+ share the technical feature of a plant, a seed, an insect inhibitory composition, a commodity product, which is disclosed by Monsanto (Claim 10, A plant, or part thereof, comprising the recombinant nucleic acid molecule of claim 1.; Claim 13, A seed of the plant of claim 10.; Claim 14, An insect inhibitory composition.; Claim 20, A commodity product produced from the plant.).

The inventions of Groups II+ share the technical feature of Claims 24, 25 and 26.

Monsanto teaches (instant claim 24) a method for controlling a Lepidopteran species pest or pest infestation, said method comprising: a. contacting the pest with a pesticidally effective amount of a pesticidal protein (Claim 24, A method for controlling a Lepidopteran species pest or pest infestation, said method comprising: a. contacting the pest with an insecticidally effective amount of a pesticidal protein.).

Monsanto teaches (instant claim 25) a method of detecting the presence of the recombinant nucleic acid molecule of claim 1 in a sample comprising plant genomic DNA (para [0023], a method of detecting the presence of a recombinant nucleic acid molecule comprising a polynucleotide segment encoding a pesticidal protein or fragment thereof.), comprising:

a. contacting said sample with a nucleic acid probe that hybridizes under stringent hybridization conditions with genomic DNA from a plant comprising the recombinant nucleic acid molecule of claim 1, and does not hybridize under such hybridization conditions with genomic DNA from an otherwise isogenic plant that does not comprise the recombinant nucleic acid molecule of claim 1 (para [0023], the method comprises contacting a sample of nucleic acids with a nucleic acid probe that hybridizes under stringent hybridization conditions with genomic DNA from a plant comprising a polynucleotide segment encoding a pesticidal protein or fragment thereof provided herein, and does not hybridize under such hybridization conditions with genomic DNA from an otherwise isogenic plant that does not comprise the segment.);

b. subjecting said sample and said probe to stringent hybridization conditions; and

c. detecting hybridization of said nucleic acid probe with said plant genomic DNA of said sample (para [0023], The method may further comprise (a) subjecting the sample and probe to stringent hybridization conditions; and (b) detecting hybridization of the probe with DNA of the sample.).

-----continued in next Supplemental Box-----

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of:

Box No. IV. Lack of unity of invention

Monsanto teaches (instant claim 26) a method of detecting the presence of a pesticidal protein, or fragment thereof, in a sample comprising protein (para [0024], methods of detecting the presence of a pesticidal protein or fragment thereof in a sample comprising protein.), comprising:

a. contacting said sample with an immunoreactive antibody; and b. detecting the presence of said pesticidal protein, or fragment thereof (para [0024], the method comprises: (a) contacting a sample with an immunoreactive antibody; and (b) detecting the presence of the protein. In some embodiments the step of detecting comprises an ELISA, or a Western blot.).

The inventions of Groups III+ share the technical feature of a method for improving the pesticidal activity of a native pesticidal protein against an insect pest species.

However, these shared technical features do not represent a contribution over prior art in view of US 2008/0300210 A1 to German et al. (hereinafter "German").

German teaches (instant claim 28) a method for improving the pesticidal activity of a native pesticidal protein against an insect pest species (Claim 18, A method of preventing transmission of an arthropod-dependent viral plant disease.), comprising: engineering a variant pesticidal protein by inserting a DNA fragment encoding an insect midgut receptor binding peptide into a coding sequence encoding the pesticidal protein; wherein the pesticidal activity of the engineered pesticidal protein is greater than the pesticidal activity of the native pesticidal protein to said insect pest species (para [0010], a genetic construct for inhibiting virus transmission by an arthropod comprising a first polynucleotide that encodes a midgut receptor binding domain of an envelope/membrane glycoprotein from a virus capable of infecting the arthropod and a second polynucleotide that encodes an active toxic fragment of a *Bacillus thuringiensis* (Bt) toxin. The genetic construct can further comprise a promoter operably linked to the first and second polynucleotides for expressing a fusion protein.).

The inventions of Groups IV+ share the technical feature of a DNA sequence comprising a reproductive tissue-specific miRNA target binding site element.

However, these shared technical features do not represent a contribution over prior art in view of US 2013/0097735 A1 to Bowen et al. (hereinafter "Bowen").

Bowen teaches (instant claim 32) a recombinant nucleic acid molecule comprising a heterologous promoter operably linked to a polynucleotide segment encoding a pesticidal protein or pesticidal fragment thereof (para [0024], SEQ ID NO:1 is a nucleotide sequence representing a recombinant polynucleotide derived from a *Bacillus thuringiensis* (Bt) species having an open reading frame at nucleotide positions 1-1107 encoding a TIC1498 protein.; [0126], Proteins of the present invention can be expressed from DNA constructs in which the open reading frame encoding the protein is operably linked to elements such as a promoter and any other regulatory elements.), operably linked to a DNA sequence comprising a specific miRNA target binding site element, wherein said miRNA target binding site element is heterologous with respect to said polynucleotide segment encoding a pesticidal protein or pesticidal fragment thereof (para [0126], Other useful elements that can be operably linked to the protein encoding sequences include, but are not limited to, enhancers, introns,....., and miRNA target sites.). Bowen does not specifically teach a reproductive tissue-specific miRNA target binding site element. Given that Bowen teaches that said recombinant nucleic acid is expressed in the plant seeds (para [0138], a transgenic plant with stably-integrated, non-natural recombinant DNA, or seed or pollen derived from a progeny transgenic plant.), it would have been obvious to one of ordinary skill in the art to have applied a reproductive tissue-specific miRNA target binding site element.

As said technical features were known in the art at the time of the invention, these cannot be considered special technical features that would otherwise unify the groups.

Groups I+, II+, III+, and IV+ therefore lack unity under PCT Rule 13 because they do not share a same or corresponding special technical feature.

SEARCH HISTORY

Application Number	PCT/US 20/14437
Search Conducted By	MC
Search Approved By	MC

CPC/IPC Classifications Searched	IPC(8)- C07K 14/325, C12N 15/82, A01N 63/02 (2020.10) CPC- C07K 14/325, C12N 15/8286, A01N 63/02, Y02A 40/162
Date Conducted	18 May 2020

Documentation Searched	(keyword search, terms below)
Search Terms Used	Lepidopteran, pests, bacillus thuringiensis, cerus, antisense, miRNA, toxin, pesticidal, targeting
Date Conducted	18 May 2020

Electronic Database Searched	PatBase
Files Searched	Full-text: AU BE BR CA CH CN DE DK EP ES FI FR GB IN JP KR SE TH TW US WO Bibliographic: (Europe) AT BA BE BG CH CS CY CZ DD DK EE ES FI GE GR HR HU IE IS IT LT LU LV MC MD MT NL NO PL PT RO RS SE SI SK SM TR UA YU (Asia) EA GC HK ID IL IN KZ MN MY PH RU SG SU TH TJ TW UZ VN (North America) CA CR CU DO GT HN MX NI PA SV TT (South America) AR BR CL CO EC PE UY (Australasia) AU NZ (Africa) AP DZ EG KE MA MW OA ZA ZM ZW
Date Conducted	18 May 2020

Search Logic:

- 1) PA=(MONSANTO) (25282)
- 2) INV=(BOWEN, David or CHAY, Catherine A or CHEN, Danqi) (411)
- 3) 2 and ft=(pesticidal) (19)
- 4) 3 and ft=(plant and seed and insect) (19)
- 5) 4 and ft=(commodity) (18)
- 6) 5 and ft=(lepidopteran) (18)
- 7) 6 and ft=(midgut receptor) (0)

- 8) 6 and ft=(miRNA) (3)
- 9) 8 and ft=(hybridization) (3)
- 10) ft=(midgut receptor) (23)
- 11) 10 and ft=(pesticidal) (18)
- 12) NWIZ=ALL:20080300210 (4)
- 13) 12 and ft=(midgut) (1)
- 14) ft=(miRNA w20 tissue specific) (378)
- 15) 14 and ft=(pesticidal w30 link*) (0)
- 16) 14 and ft=(pesticidal) (1)
- 17) ft=(miRNA w20 target binding site) (55)
- 18) 17 and ft=(pesticidal) (0)
- 19) 17 and ft=(toxin) (4)
- 20) 19 and ft=(insect) (1)
- 21) ft=(pesticidal w20 targeting) (51)
- 22) 21 and ft=(miRNA) (28)
- 23) NWIZ=ALL:20170058294 (7)
- 24) NWIZ=ALL:20110296555 (3)
- 25) IC=(C07K14/325 or C12N15/82 or A01N63/02) (39516)
- 26) CPC=(C07K14/325 or C12N15/8286 or A01N63/02 or Y02A40/162) (3383)
- 27) 25 or 26 (39698)
- 28) 27 and ft=(pesticidal) (1879)
- 29) 28 and ft=(miRNA) (201)
- 30) 29 and ft=(target binding site) (0)

Electronic Database Searched	Google
Files Searched	Google Patents
Date Conducted	18 May 2020
Search Logic: lepidopteran About 16,492 results lepidopteran midgut About 1,297 results pesticidal miRNA plant About 3,213 results cerus plant antisense About 2,877 results	

Electronic Database Searched	Google
Files Searched	Google Scholar
Date Conducted	18 May 2020
Search Logic: lepidopteran pests bacillus thuringiensis About 41,400 results lepidopteran pests bacillus thuringiensis midgut About 12,500 results lepidopteran pests bacillus thuringiensis iRNA About 2,490 results	

Electronic Database Searched	GenCore ver 6.4.1
Files Searched	N_Geneseq_201621 GenEmbl Published_Applications_NA_Main Published_Applications_NA_New EST Issued_Patents_NA
Date Conducted	09 March 2020
Search Logic: SEQ ID NOs: 1-4, 15-18, 25	

ID A0A3A3GLR0_PANTH Unreviewed; 797 AA.
AC A0A3A3GLR0;
DT 05-DEC-2018, integrated into UniProtKB/TrEMBL.
DT 05-DEC-2018, sequence version 1.
DT 11-DEC-2019, entry version 6.
DE RecName: Full=CBM-cenC domain-containing protein {ECO:0000259|Pfam:PF02018};
GN ORFNames=DQX05_05905 {ECO:0000313|EMBL:RJG25612.1};
OS Paenibacillus thiaminolyticus (Bacillus thiaminolyticus).
OC Bacteria; Firmicutes; Bacilli; Bacillales; Paenibacillaceae; Paenibacillus.
OX NCBI_TaxID=49283 {ECO:0000313|EMBL:RJG25612.1, ECO:0000313|Proteomes:UP000266177};
RN [1] {ECO:0000313|EMBL:RJG25612.1, ECO:0000313|Proteomes:UP000266177}
RP NUCLEOTIDE SEQUENCE [LARGE SCALE GENOMIC DNA].
RC STRAIN=BO5 {ECO:0000313|EMBL:RJG25612.1,
RC ECO:0000313|Proteomes:UP000266177};
RA Piskunova J.V., Dubiley S.A., Severinov K.V.;
RT "Paenibacillus SK2017-BO5.";
RL Submitted (SEP-2018) to the EMBL/GenBank/DDBJ databases.
CC -!- CAUTION: The sequence shown here is derived from an EMBL/GenBank/DDBJ
CC whole genome shotgun (WGS) entry which is preliminary data.
CC {ECO:0000313|EMBL:RJG25612.1}.
CC -----
CC Copyrighted by the UniProt Consortium, see <https://www.uniprot.org/terms>
CC Distributed under the Creative Commons Attribution (CC BY 4.0) License
CC -----
DR EMBL; QYZD01000003; RJG25612.1; -; Genomic_DNA.
DR Proteomes; UP000266177; Unassembled WGS sequence.
DR GO; GO:0016798; F:hydrolase activity, acting on glycosyl bonds; IEA:InterPro.
DR Gene3D; 2.60.120.260; -; 1.
DR InterPro; IPR003305; CenC_carb-bd.
DR InterPro; IPR008979; Galactose-bd-like_sf.
DR InterPro; IPR022180; Vip3.
DR Pfam; PF02018; CBM_4_9; 1.
DR Pfam; PF12495; Vip3A_N; 1.
PE 4: Predicted;
FT DOMAIN 542..658
FT /note="CBM-cenC"
FT /evidence="ECO:0000259|Pfam:PF02018"
SQ SEQUENCE 797 AA; 89937 MW; A26D6C8B57D2B2BD CRC64;
MKQNNNLSVR ALPSFIDVFN GIYGFATGIQ DIFNMIFGTD TGDLTLEEVL KNQDLLYDIS
GKLEGISGDL SEIIAQGNLN TELAKELLKI ANEQNNVLTD VNNKLNAINS MLHIYLPKIT
NMLSDVMKQN YÄLSLQIEYL SKQLQEISDK LDVINLNVLI NSTLTEITPA YQRLKYVNEK
FDDLTLATEK TLRAKKGSFN EDIFDNDTLE NLTELTELAK SVTKNDVDSF EFLHTFHDV
LIGNNLFGRS ALKTAAELIT KDEIKTSGSE IGKVYSFLIV LTCLQAKAFL TLTACRKL LG
LSDIDYTNIL NQHLNDEKNV FRDNILPTLS NKFSNPYAK TTGSDNYAKV ILEAEPGYAL
VGFEIINDPI PVLKAYQAKL KQNYQVDHQS LSEIVYLDIN KLFCPKNSEQ KYYTKSLTFP
DGYVITKITF EKKLNNLRYE ATANFYDPST GDIDLNEKQV ESTFVQADYI SINVSDDDG
YMLGVISET FLSPINSFEL EVDEKSKILT LTCKSYLREY LLESDLINKE TSLIAPPNVF
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DRGLPSFRNF SIKEKFE

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