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14 May 1992 (14.05.92)

(54) Title: METHODS AND COMPOSITIONS FOR THE PRODUCTION OF STABLY TRANSFORMED, FERTILE MONOCOT PLANTS AND CELLS THEREOF

(57) Abstract

This invention relates to a reproducible system for the production of stable, genetically transformed maize cells, and to methods of selecting cells that have been transformed. One method of selection disclosed employs the *Streptomyces bar* gene introduced by microprojectile bombardment into embryogenic maize cells which were grown in suspension cultures, followed by exposure to the herbicide bialaphos. The methods of achieving stable transformation disclosed herein include tissue culture methods and media, methods for the bombardment of recipient cells with the desired transforming DNA, and methods of growing fertile plants from the transformed cells. This invention also relates to the transformed cells and seeds and to the fertile plants grown from the transformed cells and to their pollen.

* See back of page

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INTERNATIONAL SEARCH REPORT

International Application No PCT/US 90/04462

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC[5]: C 12 N 15/82, A 01 H 4/00, A 01 H 5/00, C 12 N 5/00

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC[5]	C 12 N, A 01 H

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category [10]	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
X	Nature, vol. 338, 16 March 1989, K. Shimamoto et al.: "Fertile transgenic rice plants regenerated from transformed protoplasts", pages 274-276, see the whole article	1,2,4,5,7-9, 13-15,17,19, 20-22,24,25, 47
Y	--	18,26
X	Chemical Abstracts, vol. 110, 1989 (Columbus, Ohio, US) M.E. Horn et al.: "Transgenic plants of orchard grass (Dactylis glomerata L.) from protoplasts", see page 208, abstract no. 89869a, & Plant Cell Rep. 1988, 7(7), 469-72	1,32
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X	EP, A, 0299552 (SOLVAY) 18 January 1989 see example II	23
	--	
X	Science, vol. 240, 8 April 1988 C.A. Rhodes et al.: "Genetically transformed maze plants from protoplasts",	41 ./.

* Special categories of cited documents: [10]

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"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

"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

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
20th June 1991	09. 08. 91
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	Natalie Weinberg

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No
	pages 204-207, see the abstract cited in the application	
X	EP, A, 0290395 (SANDOZ) 9 November 1988 see example 5	31,43,44-46, 48-50
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Y	Journal of Cellular Biochemistry, Suppl. 13D, 27 March - 7 April 1989 abstract M122, Alan R. Liss, Inc. (New York, US) W.J. Gordon-Kamm et al.: "Stable transformation of embryogenic maize cultures by microprojectile bombardment", page 259, see the abstract	3,6,16,27-31
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III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No
	W.J. Gordon-Kamm et al.: "Transformation of maize cells and regeneration of fertile transgenic plants", pages 603-618 see the whole article --	
P,X	EP, A, 0348348 (CIBA-GEIGY) 27 December 1989 see examples 13-28,32,34,36,40,41,45,46, 50 --	1,2,4,5,7-10 13,14,17-25, 30-32,41-50, 33,37
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A	Biotechnology, vol. 7, June 1989 R.D. Shillito et al.: "Regeneration of fertile plants from protoplasts of elite inbred maize", pages 581-587, see page 582, left-hand column, "Cryopreservation of embryogenic suspension cultures" --	10
A	J. Cell. Biochem., Suppl. 13 D, abstract M149 M.C. Ross et al.: "Transient and stable transgenic cells and calli of tobacco and maize following microprojectile bombardment", page 268 see the abstract --	6,27-31
A	Biotechnology, vol. 7, June 1989 L.M. Prioli et al.: "Plant regeneration and recovery of fertile plants from protoplasts of maize (Zea mays L.)",	32,36,37 ./.

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No
	pages 589-594, see page 593, "Experimental protocol"	
A	EP, A, 0275069 (DNA PLANT TECHNOLOGY) 20 July 1988 see pages 6-12; claims	3,18,43
A	DE, A, 3738874 (INSTITUT BOTANIKI KIEV) 17 November 1988 see examples 5,6	3
X	EP, A, 0202668 (MITSUI) 26 November 1986 see examples	51-52
Y	EP, A, 0282164 (MITSUI) 14 September 1988 see the whole document	51-54
Y	US, A, 4370160 (ZIEMELIS) 25 January 1983 see column 8, lines 65-68; column 12, example 6	51-54
A	WO, A, 85/02972 (PLANT GENETICS) 18 July 1985 see page 1, lines 4-8; page 2, lines 26-35; page 7, lines 17-28; page 9	51-60
A	EP, A, 0280400 (DOW CORNING) 31 August 1988 see column 3, lines 9-12	51-60
A	Chemical Abstracts, vol. 110, 1989, (Columbus, Ohio, US) A.J. Schmidt et al.: " Media and environmental effects on phenolics production from tobacco cell cultures ", see abstract 230156z, & Biotechnol. Bioeng. 1989, 33(11),37-44	51-60
A	EP, A, 0262971 (PLANT CELL RESEARCH INSTITUTE) 6 April 1988 see page 8, lines 16-21	51-60
E	WO, A, 90/10691 (GRACE SIERRA) 20 September 1990 see the whole document	51
A	EP, A, 0141373 (PLANT GENETICS INC.) 15 May 1985 see page 3, lines 29-36; page 4, lines 19-27; page 16, lines 30-36	52,53

FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

V. ☐ OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE [1]

This international search report has not been established in respect of certain claims under Article 17(2) (a) for the following reasons:

1. ☐ Claim numbers ....., because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claim numbers ....., 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. ☐ Claim numbers....., because they are dependent claims and are not drafted in accordance with the second and third sentences of PCT Rule 6.4(a).

VI. ☒ OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING [2]

This International Searching Authority found multiple inventions in this international application as follows:

Claims 1-50, 51-60. Please see Form PCT/ISA/206

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.

2. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3. ☐ 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 claim numbers:

4. ☐ As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

Remark on Protest

☐ The additional search fees were accompanied by applicant's protest.

☐ No protest accompanied the payment of additional search fees.

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. US 9004462 SA 39624

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 17/07/91
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ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. US 9004462 SA 39624

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