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D E C I S I O N
of 8 August 2000

Case Number: W 0001/00 - 3.3.4

Application Number: PCT/US 98/17519

Publication Number: WO 99/10498

IPC: C12N 15/52

Language of the proceedings: EN

Title of invention:

Genes encoding enzymes for lignin biosynthesis and uses thereof

Applicant:

PIONEER HI-BRED INTERNATIONAL, INC.

Headword:

Lignin biosynthesis/PIONEER

Relevant legal provisions:

PCT Art. 34(3)
PCT R. 13, 68.2, 68.3(c)

Keyword:

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Decisions cited:

W 0013/87, G 0001/89

Catchword:

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Case Number: W 0001/00 - 3.3.4
International Application No. PCT/US 98/17519

D E C I S I O N
of the Technical Board of Appeal 3.3.4
of 8 August 2000

Applicant: PIONEER HI-BRED INTERNATIONAL, INC.
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Subject of the Decision: Protest according to Rule 68.3(c) of the Patent Cooperation Treaty made by the applicants against the invitation of the European Patent Office (International Preliminary Examining Authority) to restrict the claims or pay additional fees dated 26 August 1999.

Composition of the Board:

Chairwoman: U. Kinkeldey
Members: L. Galligani
C. Holtz

Summary of Facts and Submissions

- I. International patent application PCT/US 98/17519 (published as WO-A-99/10498) was filed on 24 August 1998 with twenty-six claims.

Claims 1, 18, 20 and 24 read as follows:

"1. An isolated nucleic acid comprising a member selected from the group consisting of:

- (a) a first polynucleotide having at least 60% identity to a second polynucleotide encoding a polypeptide selected from the group consisting of SEQ ID NOS: 1-18 and 73-75, wherein said first polynucleotide encodes a polypeptide which when presented as an immunogen elicits the production of an antibody which is specifically reactive to said second polypeptide;
- (b) a polynucleotide which is complementary to said first polynucleotide of (a); and
- (c) a polynucleotide comprising at least 25 contiguous nucleotides from a first polynucleotide of (a) or a polynucleotide of (b)."

"18. An isolated nucleic acid comprising a polynucleotide encoding a polypeptide wherein:

- (a) said polypeptide comprises at least 10 contiguous amino acid residues from a first polypeptide selected from the group consisting of SEQ ID NOS: 1-18 and 73-75, and wherein said polypeptide, when presented as an immunogen, elicits the production

of an antibody which specifically binds to said first polypeptide;

- (b) said polypeptide does not bind to antisera raised against said first polypeptide which has been fully immunosorbed with said first polypeptide;
- (c) said polypeptide has a molecular weight in non-glycosylated form within 10% of said first polypeptide."

"20. A transgenic plant comprising a recombinant expression cassette comprising a plant promoter operably linked to an isolated nucleic acid of claim 1."

"24. A method of modulating lignin biosynthesis in a plant, comprising:

- (a) transforming a plant cell with a recombinant expression cassette comprising a lignin biosynthesis polynucleotide operably linked to a promoter;
- (b) growing the plant cell under plant growing conditions; and
- (c) inducing expression of said polynucleotide for a time sufficient to modulate lignin biosynthesis in said plant."

Claims 2, 7, 10 to 12 were directed to isolated nucleic acids according to claim 1; claims 3 and 4 concerned a recombinant expression cassette; claims 5 and 6 concerned a host cell; claims 8 and 9 were directed to

proteins encoded by the nucleic acids of claim 2; claims 21 to 23 concerned embodiments of claim 20, while claims 25 to 26 concerned embodiments of claim 24. As for claims 13 to 17 and 19 see Section II, second paragraph *infra*.

II. On 5 February 1999 the European Patent Office (EPO), acting as an International Search Authority (ISA), invited the applicants to pay within a time limit of 45 days seven additional search fees pursuant to Article 17(3)(a), Rule 40.1 and 40.3 PCT and issued a partial search report on claims 1 to 12, 18, 20 to 23 (all partially: invention mentioned as group (f)) and claim 24 to 26. The invitation stated the 8 groups of inventions (groups (a) to (h)) to which the application was found to relate.

As for claim 13 to 17 and 19 it was stated that no meaningful search within a reasonable time span could be carried out because their subject-matter was directed to a multiplicity of polynucleotide sequences and proteins by using a large group of different primers listed in SEQ ID NO: 37-72 and 79-84 and the claimed polynucleotide sequences (proteins) themselves were not sufficiently clearly defined.

III. On 19 March 1999 the applicants paid seven additional fees under protest pursuant to Rule 40.2(c) PCT.

IV. On 22 July 1999 the ISA transmitted the International Search Report, which in respect of claims 13 to 17 and 19 stated that they were unsearchable (cf Section II, last sentence above).

V. On the same date, the ISA communicated to the

applicants the result of its review under Rule 40.2(e) PCT and ordered the refund of the additional search fees, this being then notified on 27 July 1999.

VI. On 23 August 1999 the applicants were notified that the EPO acting as International Preliminary Examining Authority (IPEA) had received on 19 March 1999 the request for international preliminary examination.

VII. on 26 August 1999, the IPEA informed the applicants that the application did not comply with the requirements of unity of invention and invited them to pay within a time limit of 1 month seven additional fees pursuant to Article 34(3), Rule 68.2 PCT. The invitation stated the 8 groups of inventions (referred to as (a) to (h)) to which the application was found to relate, namely:

1. Claims 1 to 12, 18, 20 to 23 (all partially: **part a**), claims 24 to 26: 4-coumarate:CoA ligase (4CL) (SEQ ID NOS: 1-3, 19-21).
2. Claims 1 to 12, 18, 20 to 23 (all partially: **part b**), claims 24 to 26: Caffeic O-methyltransferase (C-OMT) (SEQ ID NOS: 4-7, 22-25).
3. Claims 1 to 12, 18, 20 to 23 (all partially: **part c**), claims 24 to 26: Cinnamate-4-hydroxylase (C4H) (SEQ ID NOS: 8-9, 26-27).
4. Claims 1 to 12, 18, 20 to 23 (all partially: **part d**), claims 24 to 26: Cinnamylalcohol dehydrogenase (CAD) (SEQ ID NOS: 10-12, 28-30).

5. Claims 1 to 12, 18, 20 to 23 (all partially: **part e**), claims 24 to 26: Caffeoyl-CoA 3-O-methyltransferase (CCoA-OMT) (SEQ ID NOS: 13-15, 31-33, 74, 77).
6. Claims 1 to 12, 18, 20 to 23 (all partially: **part f**), claims 24 to 26: Cinnamoyl-CoA-reductase (CCR) (SEQ ID NOS: 16 and 34).
7. Claims 1 to 12, 18, 20 to 23 (all partially: **part g**), claims 24 to 26: Ferulate-5-hydroxylase (F5H) (SEQ ID NOS: 17, 35, 73, 76).
8. Claims 1 to 12, 18, 20 to 23 (all partially: **part h**), claims 24 to 26: Diphenyl oxidase (DPO) (SEQ ID NOS: 18, 36, 75, 78).

It was indicated that, having regard to the following document:

(2) WO-A-97/12982

the subject-matter of part (f) (in relation to cinnamoyl-CoA reductase) of claims 1 to 12, 18, 20 to 23 as well as that of claims 24 to 26 lacked novelty since SEQ ID NO: 3 of the quoted document was 98.1% identical in a 371 amino acid overlap with SEQ ID NO: 16 ("total 371 amino acids") and 93.3% identical in a 1392 base pairs overlap with SEQ ID NO: 34 ("total 1559 base pairs"). Consequently, there was non-unity a *posteriori* as there was no technical relationship left among the claimed inventions of groups (a) to (e) and (g) to (h) which were no longer linked by a single inventive concept.

VIII. On 24 September 1999 the applicants paid seven additional fees under protest pursuant to Rule 68(3)(c) PCT. They argued that the common inventive concept was represented by the fact that all the claimed nucleic acid and polypeptide sequences related to lignin biosynthesis and to a process for modifying the lignin content in plants. In this process each component worked in conjunction with one or more of the other components in lignin biosynthesis.

IX. On 28 October 1999 the IPEA communicated to the applicants the result of its review under Rule 68.3(e) PCT. The finding of lack of unity was confirmed essentially for the same reasons reported above in Section VII, last paragraph.

Therefore, the applicants were invited to pay within one month the protest fee.

On the same date, the IPEA issued a written opinion on claims 1 to 26, excluding claims 13 to 17, and 19 for which no international search report had been established.

X. The protest fee was paid by the applicants on 19 November 1999.

Reasons for the Decision

1. The protest is admissible.
2. According to Rule 13.1 PCT, the international patent application shall relate to one invention only or to a group of inventions so linked as to form a single

inventive concept. If the IPEA considers that the claims lack this unity, it is empowered, under Article 34(3)(a) PCT, to invite the Applicant to pay additional fees.

3. Lack of unity may be directly evident *a priori*, ie before the examination of the merits of the claims in comparison with the state of the art revealed by the search (cf, for example, decision W 13/87 of 9 August 1988). Alternatively, an objection can also be raised *a posteriori*, ie after having taken the prior art revealed by the search into closer consideration. This practice is laid down in the PCT Preliminary Examination Guidelines, Chapter III, 7 (PCT/GL/3 dated 1 March 1993) and in Section 206 and Annex B to the Administrative Instructions (cf PCT GAZETTE, Special Issue, 25 June 1998) which are the basis for a uniform practice of all International Searching and Examining Authorities. Such consideration of the prior art represents only a provisional opinion on novelty and inventive step which is in no way binding upon the authorities subsequently responsible for the further examination of the application (cf decision G 1/89 of the Enlarged Board of Appeal, OJ EPO 1991, 155, see in particular point 8.1. of the Reasons).
4. According to Rule 13.3 PCT, the determination whether a group of inventions is so linked as to form a single general inventive concept shall be made without regard to whether the inventions are claimed in separate claims or as alternatives within a single claim.
5. The question in the present case is whether or not the alternative groups of nucleic acids (a) to (h), which encode various enzymes involved in lignin biosynthesis

and which correspond to SEQ ID NOS: 1-18 and 73-75 referred to in claims 1 to 12, 18, 20 to 23, are so linked as to form a single general inventive concept.

6. In this respect, the argument put forward by the applicants is essentially that the unitary link is constituted by the fact that the claimed polynucleotides are all related to lignin biosynthesis and can be used in the method for modulating lignin biosynthesis according to claims 24 to 26 (cf Section VIII above).
7. This argument cannot be accepted for the following reasons:
 - (i) Polynucleotide sequences encoding enzymes involved in lignin biosynthesis, which fall under the broad scope of the claims at issue, are known from the prior art. In the communication dated 26 August 1999, the IPEA made in particular reference to document (2), which discloses SEQ ID NO: 3. This sequence is 98.1% identical in a 371 amino acid overlap with SEQ ID NO: 16 and 93.3% identical in a 1392 base pairs overlap with SEQ ID NO: 34 and thus fulfils the conditions of the claims. The said sequence encodes Cinnamoyl-CoA-Reductase (group (f)) and is also meant for use in controlling lignin contents in plants.
 - (ii) As also indicated in the written opinion of the IPEA dated 28 October 1999 (cf Paragraph V therein), other prior art documents cited in the search report disclose polynucleotide sequences which fall under the scope of the claims at issue and encode enzymes involved in lignin

biosynthesis, said sequences being used in a recombinant technology method for regulating plant lignin composition, see, for example, documents:

- (1) WO-A-97/23599, which discloses a sequence encoding Ferulate-5-hydroxylase (F5H) (group (g));
 - (3) Plant Physiol., 1993, Vol. 102, pages 1147 to 1156, which discloses a sequence encoding 4-coumarate:CoA ligase (4CL) (group (a)).
- (iii) The findings in (i) and (ii) lead to the conclusion not only that eg claim 1 at issue does not avoid the prior art, but also that general methods for modulating lignin biosynthesis like the method of claim 24 were known in the art.
- (iv) Under these circumstances, a method for inducing expression of a polynucleotide sequence encoding an enzyme involved in lignin biosynthesis such as the method of claim 24 cannot per se constitute a "special technical feature" in the sense of Rule 13.2 PCT linking together the plurality of polynucleotide sequences of the claims in a single inventive concept. Nor can the unitary link be constituted by the fact that the enzymes (a) to (h) all participate in the biosynthesis of lignin, as these enzymes are structurally and metabolically different from each other and, moreover, polynucleotide sequences encoding some of them are also known from the prior art.
- (v) In the light of the prior art, the technical

problems underlying the eight groups of inventions are all **different** since they consist in finding for each group of the enzymes (a) to (h) further specific polynucleotide sequences suitable for modulating lignin biosynthesis in plants. The solutions to such different technical problems are necessarily different in view of the structural and functional differences among the enzymes and are not so interrelated from a technical point of view as to form a single general inventive concept.

8. For the foregoing reasons, the international application does not comply with the requirement of Rule 13.1 PCT and the invitation to pay additional fees was justified.

Order

For these reasons it is decided that:

The protest according to Rule 68(3)(c) PCT is dismissed.

The Registrar:

The Chairwoman:

M. Beer

U. Kinkeldey