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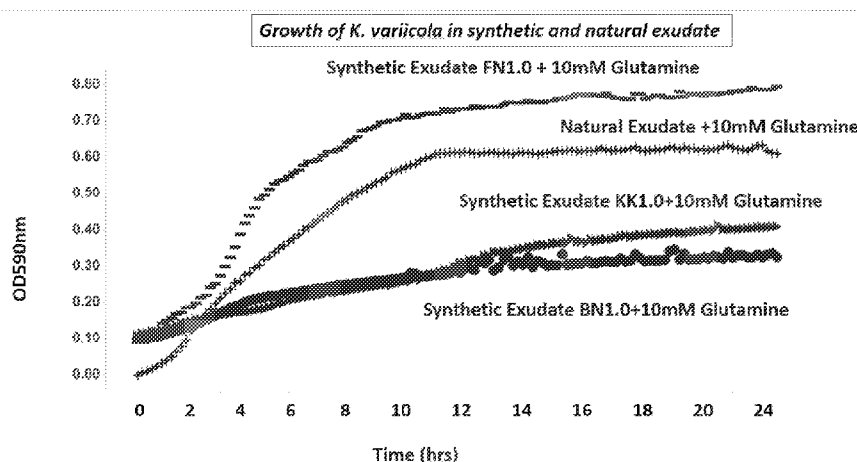
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(54) Title: METHODS, COMPOSITIONS, AND MEDIA FOR IMPROVING PLANT TRAITS

FIG. 1A



(57) Abstract: Methods of predicting in planta phenotypes of microbial strains are provided. The methods can include culturing microbial strains in a plant exudate medium and assaying in vitro phenotypes of the microbial strains. The methods may also include using the in vitro phenotypes to predict in planta phenotypes of the microbial strains. Methods of using the microbial strains in field trials are also provided.



GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

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INTERNATIONAL SEARCH REPORT

International application No
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A. CLASSIFICATION OF SUBJECT MATTER

INV. A01H3/00 A01N63/20 C12N1/00
ADD.

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)

A01H A01N C12R C12N

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 practicable, search terms used)

EP0-Internal, BIOSIS, Sequence Search, EMBASE, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 256 889 A1 (ALLELIX INC [CA]) 24 February 1988 (1988-02-24) example 1 ----- -/--	1,2,10, 16,123, 125, 129-136, 138



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

"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

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INTERNATIONAL SEARCH REPORT

International application No

PCT/US2019/068152

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WU KAI ET AL: "Root exudates from two tobacco cultivars affect colonization of <i>Ralstonia solanacearum</i> and the disease index", EUROPEAN JOURNAL OF PLANT PATHOLOGY, SPRINGER NETHERLANDS, NL, vol. 141, no. 4, 14 December 2014 (2014-12-14), pages 667-677, XP035459356, ISSN: 0929-1873, DOI: 10.1007/S10658-014-0569-4 [retrieved on 2014-12-14] -----	1-32, 123-140
A	RICHARD JACOBY ET AL: "The Role of Soil Microorganisms in Plant Mineral Nutrition-Current Knowledge and Future Directions", FRONTIERS IN PLANT SCIENCE, vol. 8, 19 September 2017 (2017-09-19), pages 1-19, XP055677406, CH ISSN: 1664-462X, DOI: 10.3389/fpls.2017.01617 page 4 - page 7 -----	1-32, 123-140
A	MA LI ET AL: "Effect of nicotine from tobacco root exudates on chemotaxis, growth, biocontrol efficiency, and colonization by <i>Pseudomonas aeruginosa</i> NXHG29", ANTONIE VAN LEEUWENHOEK, SPRINGER, DORDRECHT; NL, vol. 111, no. 7, 3 February 2018 (2018-02-03), pages 1237-1257, XP036525420, ISSN: 0003-6072, DOI: 10.1007/S10482-018-1035-7 [retrieved on 2018-02-03] -----	130-134, 136
A	WO 2018/132774 A1 (PIVOT BIO INC [US]) 19 July 2018 (2018-07-19) -----	1-32, 123-140
X,P	WO 2019/140125 A1 (BAYER CROPS SCIENCE LP [US]) 18 July 2019 (2019-07-18) the whole document -----	1,2,10, 15,16, 123-125, 129,130, 138

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2019/068152

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.:
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 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 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.:

1-32, 123-128(completely); 129-140(partially)

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.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-32, 123-128(completely); 129-140(partially)

A method of predicting an in planta phenotype of a microbial strain, a method of predicting a phenotype of a plant grown with a microbial strain wherein the prediction is based on the in vitro phenotype of the microbial strain when cultured in a plant exudate medium, as well as subject-matter related thereto.

2. claims: 33-70(completely); 129-140(partially)

A method of selecting a genetically modified microbial strain having an altered in planta phenotype, as well as subject-matter related thereto.

3. claims: 71-86(completely); 129-140(partially)

A method of selecting a plant-associated microbe that is attracted to a component of a plant exudate medium, as well as subject-matter related thereto.

4. claims: 87-94(completely); 129-140(partially)

A method of generating a variant microbial strain having altered plant colonization activity as compared to a parent microbial strain of said variant microbial strain, as well as subject-matter related thereto.

5. claims: 95-105(completely); 129-140(partially)

A method of conducting a field trial of a plant beneficial microbial strain, as well as subject-matter related thereto.

6. claims: 106-122(completely); 129-140(partially)

A method of improving growth of a plant, the method comprising exposing said plant to a microbe that has a desired growth rate in plant exudate medium, as well as subject-matter related thereto.

7. claims: 141-157

An engineered microbe which comprises a modification which alters chemoattraction to a component of a plant exudate medium, as well as subject-matter related thereto.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2019/068152

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EP 0256889	A1	24-02-1988	CA 1335366 C 25-04-1995
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