Appendix I. The Potential for Gene Flow from Glyphosate-Tolerant Alfalfa (*Medicago sativa* L.) to Related Species

blank page

The Potential for Gene Flow from Glyphosate-Tolerant Alfalfa (*Medicago sativa* L.) to Related Species

1.0 Introduction

The potential for hybridization and subsequent impact of hybridization between sexually compatible species in the *M. sativa* (alfalfa) complex naturalized in North America is discussed in this report. Information on the success of crosses between taxonomically related species and a survey of related species naturalized in North America indicates that there is no evidence for sexually compatible relatives of *M. sativa* growing in North America.

The *M. sativa* complex has been sexually hybridized with 12 other perennial *Medicago* species (reviewed in section VII, Subsection E.1 of Petition Number 04-110-01p). Two reports of successful crosses between annual medics and *M. sativa* have been reported but both are disputed by academic experts. A report by Skalska et al. (1992) was identified through a recent literature search where the authors claimed success at crossing annual medics with *M. sativa*. While the results from this report are disputed, they have no relevance to potential outcrossing in North America because the annual medics are not found in North America. Reported successful crosses between *M. lupulina* (annual medic naturalized and widespread in North America) and *M sativa* also are disputed by several experts and are reviewed in this report.

1.1 Alfalfa taxonomy and Related Species

The taxonomy of alfalfa and related species are reviewed in section II and VII of Petition 04-110-01p (Rogan and Fitzpatrick, 2004). A brief summary is provided below. The taxonomy of the genus *Medicago* has been modified periodically, and numerous reclassifications and synonyms are used (see table 1 and 2 for examples of synonyms).

Medicago sativa L. belongs in the order Fabales, family Fabaceae, tribe Trifolieae, and genus *Medicago*. The genus *Medicago* is very extensive, consisting of more than 60 different species; two thirds of the species are annuals and one third are perennials (Quiros and Bauchan, 1988).

Commercially cultivated alfalfa properly belongs to the *M. sativa* complex, a group of closely related subspecies that are interfertile and share the same karyotype. The most commonly cultivated alfalfa in the world is *M. sativa* subsp. *sativa*, but subspecies *falcata* is also cultivated on a limited basis, primarily under rangeland conditions and in colder regions (e.g., Canada and Siberia). Other subspecies in the complex include subsp. *glutinosa*, subsp. *coerulea*, subsp. x *tunetana*, subsp. x *varia*, subsp. x *polychroa*, and subsp. x *hemicycla* (Quiros and Bauchan, 1988). Two other closely related species, *M. prostrata* and *M. glomerata*, can be considered capable of limited natural hybridization with alfalfa (Quiros and Bauchan, 1988). *M. prostrata* and *M. glomerata* do not occur naturally in North America (table 3). *M. glomerata* is generally listed as one parent of subsp. x *tunetana*, which occurs in North Africa (Lesins and Lesins, 1979).

Cultivated and closely related species of alfalfa originated in Asia Minor, Transcaucasia, Turkmenistan and Iran. Particularly in Europe, Asia, the Middle East, and North Africa, current native populations of members in the *M. sativa* complex, as well as other perennial *Medicago* species, exist to which cultivated alfalfa would hybridize (Sinskaya, 1961; Lesins and Lesins, 1979; Ivanov, 1988). Based on a search for Medicago populations in the United States (http://www.natureserve.org/explorer) 14 matches were found (see table 4). All of the 14 matches were to plants non-native to North America and were either conspecific to *Medicago sativa* (three) or naturally sexually incompatible with *M. sativa* complex (eleven).

1.2 Updated Literature Search of Interspecific Hybridization in Medicago

In October 2007, literature databases were searched (AGRICOLA, BIOSIS, CAB, Chemical Abstracts, Chemical Engineering and Biotechnology Abstracts, Life Science Abstracts, MEDLINE) to reveal any recent or historical natural cross-hybridization information for alfalfa. Literature search results as well as the search terms used are listed in appendix I-2. The literature search identified numerous reports regarding natural and assisted attempts of hybridization within the *M. sativa* complex. Skalska et al. (1992) reported that limited seed set occurred after hand crossing of pollen from four annual medic taxa onto *M. sativa* flowers. Skalska et al. (1992) inferred that the species were therefore "crossable" (see appendix I-2, section 2 for Abstract English translation); however, according to an expert in alfalfa and annual medic breeding, E. Charles Brummer, Ph.D., Iowa State University (appendix I-4, paraphrase of Personal Communication), this single report of crossing to these annual medic species is unconvincing, has not been cited subsequently in the literature, and use of the taxonomy by Skalska et al. (1992) may be incorrect. Further, the hybridization to other annual medics has never been reported elsewhere. Evolutionarily, *M. sativa* is very distant from the annual members of *Medicago*. Regardless, the annual species named by Skalska et al. (1992) do not occur in North America, which limits the likelihood of unintentional establishment of transgenic hybrids as might occur in other plants with sympatric species in the same environment (Reichman et al., 2006).

1.3 Putative *M. lupulina* X *M. sativa* Hybrids

M. lupulina (black medic) is an annual (possibly a sometimes short-lived perennial) self-pollinating species and is known to occur throughout the United States. *Medicago lupulina* (black medic) is the species that might be of most concern within the list of 18 annual species in the United States *Medicago lupulina* is considered a weed in lawns and waste places and in forages because its seeds frequently contaminate forage legume seed crops. Successful hybridizations between *M. sativa* and *M. lupulina* were reported (Southworth, 1928; Fryer, 1930; Schrock, 1943). The validity of the *M. lupulina* x *M. sativa* putative hybridization reports were not substantiated and the hybrid cross has not been repeatable, although it was attempted numerous times (Petition appendix 4). The validity of this hybridization has been disputed since at least 1972 (Lesins and Gillies, 1972; Lesins and Lesins, 1979; Turkington and Cavers, 1979; and the petition section VII-E.1 and appendix 4). According to Bagavathiannan and Van Acker (2009), hybridization between *M. sativa* and *M. lupulina* in nature is unlikely. According to Quiros and Bauchan (1988) and McCoy and Bingham (1988), no annual species are known to naturally hybridize with *M. sativa*. Expert alfalfa breeders provided comments on this cross in

the petition's appendix 4. Based on a lack of any unambiguous scientific evidence Animal and Plant Health Inspection Service (APHIS) concurs with the expert comments presented in the Petition appendix 4 (Rogan and Fitzpatrick, 2004) that *M. lupulina* x *M. sativa* hybridization is very unlikely to occur.

1.4 Potential Impacts from Outcrossing of Lines J101 and J163 to Wild Relatives

In 2005, APHIS evaluated the potential for hybridization and gene introgression to occur from J101 and J163 to sexually compatible wild (free-living) relatives, and considered whether such introgression would result in increased weediness. As previously discussed, there is no evidence for free-living or cultivated relatives of *M. sativa* in the United States or North America that are sexually compatible with *M. sativa* except for other *M. sativa* subspecies. Thus, movement of the transgene via pollen from events J101 and J163 to other members of the *Medicago* genus (see table 3) is unlikely to occur in the United States. Having established that there are no related wild relatives in the United States, movement of the *cp4 epsps* gene can only occur to cultivated or feral alfalfa populations.

- No *Medicago* species are native to the Western Hemisphere; hence, there will be no impact from the release of Glyphosate-Tolerant (GT) alfalfa on the natural genetic resources of these species from release in the United States..
- GT alfalfa is fully compatible with other alfalfa cultivars. Tolerance to glyphosate would not confer any competitive advantage to hybrids between GT alfalfa and non-GT alfalfa unless these plants were to be challenged by glyphosate. This would occur in managed ecosystems where glyphosate is applied for broad-spectrum weed control; in cases of drift of glyphosate due to improper application; or in other crop varieties developed to exhibit glyphosate tolerance and in which glyphosate is used to control weeds. As with GT alfalfa volunteers, these individuals, should they arise and where they require control, could be controlled using other available chemical and/or mechanical means.

Appendix I-1. References

Bagavathiannan, M.V., and R.C. Van Acker. 2009. The Biology and Ecology of Feral Alfalfa (*Medicago sativa* L.) and its Implications for Novel Trait Confinement in North America. Critical Reviews in Plant Sciences. 28:1 69-87.

Fryer, J.R. 1930. Cytological studies in *Medicago*, *Melilotis* and *Trigonella*. Can. J. Res. 3:3-50.

Ivanov, A.I. 1988. Alfalfa. Amerind Publishing Co., New Delhi.

Lesins, K.A., and C.B.Gillies. 1972. Taxonomy and Cytogenetics of *Medicago*. pp. 53-86. In Hanson, C.H. (ed.) Alfalfa Science and Technology. ASA-CSSA-SSSA, Madison, Wisconsin.

Lesins, K.A., and I. Lesins. 1979. Genus *Medicago* (Leguminosae): A Taxogenetic Study. Dr. W. Junk Publishers, Kluwer, Boston Inc., Hingham, Mass. USA.

McCoy, T.J. and Bingham, E.T. 1988. Cytology and cytogenetics of alfalfa. P. 737-776. In Hanson, A.A., Barnes, D.K., and Hill Jr., R.R. (eds.) Alfalfa and Alfalfa Improvement. ASA-CSSA-SSSA, Madison, Wisconsin. 1084 pp.

Nenz, E., Pupilli, F., Damiani, F., and Arcioni, S. 1996. Somatic hybrid plants between the forage legumes *Medicago sativa* L. and *Medicago arbore*a L. Theor. Appl. Genet. 93:183-189.

Piccirilli, M., and Arcioni, S. 1992. New interspecific hybrids in the genus *Medicago* through in vitro culture of fertilized ovules. P. 325-330. In Ottaviano, E., Mulcahy, D.L., Sari Gorla, M. and Bergamini Mulcahy, G. (eds.) Angiosperm Pollen and Ovules. Springer-Verlag New York, Inc.

Quiros, C.F., and G.R. Bauchan. 1988. The Genus *Medicago* and the Origin of the *Medicago sativa* Complex. pp. 93-124. In Hanson, A.A., Barnes, D.K., and Hill Jr., R.R. (eds.) Alfalfa and Alfalfa Improvement. ASA-CSSA-SSSA, Madison, Wisconsin.

Reichman, J.R., L.S. Watrud, E.H. Lee, C.A. Burdick, M.A. Bollman, M.J. Storm, G.A. King, and C. Mallory-Smith. 2006. Establishment of transgenic herbicide-resistant creeping bentgrass (*Agrostis stolonifera* L.) in nonagronomic habitats. *Molecular Ecology*. 15(3):4243-4255.

Rogan, G. and S. Fitzpatrick. 2004. Petition for Determination of Nonregulated Status: Roundup Ready® Alfalfa (*Medicago sativa* L.) Events J101 and J163. 1-406

Sangduen, N., Sorensen, E.L., and Liang, G.H. 1982. A perennial x annual *Medicago* cross. Can. J. Genet. Cytol. 24:361-365.

Schrock, O. 1943. Beobachtungen an einem Bastard zwischen Luzerne (*Medicago media*) und Gelbklee (*Medicago lupulin*a) and seiner Nachkommenschaft. Der Zuchter 15:4-10.

Skalska, M., E. Stachurska and B. Sylwestrzak. 1992. Interspecific crossing in lucerny. Biuletyn Instytutu Hodowli i Aklimatyzacji Roslin 183: 219-224 (Polish).

Southworth, W. 1928. Influences Which Tend to Effect Seed Production in Alfalfa and an Attempt to Raise a High Seed Producing Strain by Hybridization. Sci. Agric. 9:1-29.

Sinskaya, E.N. (ed.). 1961. Flora of cultivated plants of the USSR. XII. Part 1. Medic, sweetclover, fenugreek. Jerusalem, Israel Program for Scientific Translation.

Turkington, R. and Cavers, P.B. 1979. The biology of Canadian weeds. 33. *Medicago lupulina* L. Can. J. Plant Sci. 59:99-110.

Table I-1. Eight Taxa Comprising the *Medicago sativa* L. Complex and Common Synonyms

- *Medicago sativa* subsp. *caerulea*
  - (≡) ***Medicago caerulea*** Less. ex Ledeb. (basionym)
  - (=) ***Medicago hemicoerulea*** Sinskaya
  - (=) ***Medicago sativa* subsp. *microcarpa*** Urb.
- *Medicago sativa* subsp. *falcata*
  - (=) ***Medicago borealis*** Grossh.
  - (=) ***Medicago difalcata*** Sinskaya
  - (≡) ***Medicago falcata*** L. (basionym)
  - ***Medicago falcata* subsp. *glandulosa*** (W. D. J. Koch) Greuter & Burdet [= ***Medicago sativa* subsp. *falcata* var. *viscosa***]
  - ***Medicago falcata* var. *glandulosa*** W. D. J. Koch [= ***Medicago sativa* subsp. *falcata* var. *viscosa***]
  - (=) ***Medicago falcata* var. *romanica*** (Prodán) O. Schwarz & Klink.
  - ***Medicago glandulosa*** Davidov [= ***Medicago sativa* subsp. *falcata* var. *viscosa***]
  - ***Medicago procumbens* var. *viscosa*** Rchb. [≡ ***Medicago sativa* subsp. *falcata* var. *viscosa***]
  - (=) ***Medicago quasifalcata*** Sinskaya
  - (=) ***Medicago romanica*** Prodán
    Medicago sativa* f. *viscosa (Rchb.) Urb. [≡ ***Medicago sativa* subsp. *falcata* var. *viscosa***]
  - ***Medicago sativa* subsp. *viscosa*** (Rchb.) C. R. Gunn [≡ ***Medicago sativa* subsp. *falcata* var. *viscosa***]
  - (=) ***Medicago tenderiensis*** Opperman ex Klokov
- *Medicago sativa* subsp. *falcata* var. *viscosa*
  - (=) ***Medicago falcata* subsp. *glandulosa*** (W. D. J. Koch) Greuter & Burdet
  - (=) ***Medicago falcata* var. *glandulosa*** W. D. J. Koch
  - (=) ***Medicago glandulosa*** Davidov
  - (≡) ***Medicago procumbens* var. *viscosa*** Rchb. (basionym)
  - (≡) ***Medicago sativa* f. *viscosa*** (Rchb.) Urb.
  - (≡) ***Medicago sativa* subsp. *viscosa*** (Rchb.) C. R. Gunn
- *Medicago sativa* subsp. *glomerata* (syn. *M. glutinosa*)
  - (≡) ***Medicago glomerata*** Balb. (basionym)
  - (=) ***Medicago glutinosa*** M. Bieb.
  - (=) ***Medicago gunibica*** Vassilcz.
  - (=) ***Medicago sativa* f. *glutinosa*** (M. Bieb.) Urb.
- *Medicago sativa* nothosubsp. *hemicycla*
  - (≡) ***Medicago hemicycla*** Grossh. (basionym)
- *Medicago sativa* subsp. *sativa*
  - (=) ***Medicago agropyretorum*** Vassilcz.
  - (=) ***Medicago asiatica*** Sinskaya
  - (=) ***Medicago mesopotamica*** Vassilcz.
  - (=) ***Medicago praesativa*** Sinskaya
  - (=) ***Medicago rivularis*** Vassilcz.
  - (=) ***Medicago sogdiana*** Vassilcz.
  - (=) ***Medicago transoxana*** Vassilcz.
- *Medicago sativa* nothosubsp. *tunetana*
  - (=) ***Medicago grossheimii*** Vassilcz.
  - (=) ***Medicago polychroa*** Grossh.
  - (=) ***Medicago sativa* subsp. *faurei*** Maire
  - (=) ***Medicago sativa* f. *gaetula*** Urb.
  - (≡) ***Medicago tunetana*** (Murb.) Vassilcz.
- *Medicago sativa* nothosubsp. *varia*
  - (=) ***Medicago falcata* var. *ambigua*** Trautv.
  - (=) ***Medicago glutinosa* subsp. *praefalcata*** Sinskaya
  - (=) ***Medicago komarovii*** Vassilcz.
  - (=) ***Medicago media*** Pers.
  - (=) ***Medicago sativa* subsp. *ambigua*** (Trautv.) Tutin
  - (=) ***Medicago sativa* subsp. *praefalcata*** (Sinskaya) C. R. Gunn
  - (≡) ***Medicago sativa* var. *varia*** (Martyn) Urb.
  - (=) ***Medicago schischkinii*** Sumnev.

Table I-1. Eight Taxa Comprising the *Medicago sativa* L. Complex and Common Synonyms
o (=) ***Medicago tianschanica*** Vassilcz. o (=) ***Medicago trautvetteri*** Sumnev. o (=) ***Medicago vardanis*** Vassilcz. o (≡) ***Medicago ×varia*** Martyn (basionym)

Source: USDA, ARS, National Genetic Resources Program. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: http://www.ars-grin.gov/cgi-bin/npgs/html/taxon.pl?104921 (12 November 2007)

Table I-2. Numerous Species within the Genus *Medicago* with Synonyms

- **Medicago agropyretorum** Vassilcz. -> **Medicago sativa** L. subsp. **sativa**
- **Medicago arabica** (L.) Huds.
- **Medicago arabica** (L.) Huds. subsp. **inermis** Ricker -> **Medicago arabica** (L.) Huds. ***A***
- **Medicago arborea** L.
- **Medicago asiatica** Sinskaya -> **Medicago sativa** L. subsp. **sativa**
- **Medicago borealis** Grossh. -> **Medicago sativa** L. subsp. **falcata** (L.) Arcang.
- **Medicago caerulea** Less. ex Ledeb. -> **Medicago sativa** L. subsp. **caerulea** (Less. ex Ledeb.) Schmalh.
- **Medicago cancellata** Bieb.
- **Medicago carstiensis** Jacq.
- **Medicago cordata** Desr. -> **Medicago arabica** (L.) Huds. ***A***
- **Medicago cuneata** Woods -> **Medicago orbicularis** (L.) Bartal. ***A***
- **Medicago cupaniana** Guss. -> **Medicago lupulina** L. ***A***
- **Medicago denticulata** Willd. -> **Medicago polymorpha** L. ***A***
- **Medicago difalcata** Sinskaya -> **Medicago sativa** L. subsp. **falcata** (L.) Arcang.
- **Medicago disciformis** DC.
- **Medicago falcata** L. -> **Medicago sativa** L. subsp. **falcata** (L.) Arcang.
- **Medicago falcata** L. var. **romanica** (Prodán) O. Schwarz & Klink. -> **Medicago sativa** L. subsp. **falcata** (L.) Arcang.
- **Medicago hispida** Gaertn. -> **Medicago polymorpha** L. ***A***
- **Medicago hysterix** Ten. -> **Medicago nigra** (L.) Krock. ***s***
- **Medicago intertexta** (L.) Mill.
- **Medicago laciniata** (L.) Mill.
- **Medicago littoralis** Rohde ex Loisel
- **Medicago lupulina** L.
- **Medicago lupulina** L. var. **cupaniana** (Guss.) Boiss. -> **Medicago lupulina** L. ***A***
- **Medicago maculata** Sibth. -> **Medicago arabica** (L.) Huds. ***A***
- **Medicago marginata** Willd. -> **Medicago orbicularis** (L.) Bartal. ***A***
- **Medicago marina** L.
- **Medicago mesopotamica** Vassilcz. -> **Medicago sativa** L. subsp. **sativa**
- **Medicago minima** (L.) Bartal.
- **Medicago nigra** (L.) Krock. -> **Medicago polymorpha** L. ***A***
- **Medicago officinalis** (L.) E. H. Krause -> **Melilotus officinalis** (L.) Pallas
- **Medicago orbicularis** (L.) Bartal.
- **Medicago orbicularis** (L.) Bartal. var. **marginata** (Willd.) Benth. -> **Medicago orbicularis** (L.) Bartal. ***A***
- **Medicago orbicularis** (L.) Bartal. var. **microcarpa** Rouy, nom. illeg. -> **Medicago orbicularis** (L.) Bartal. ***A***
- **Medicago pentacycla** DC. -> **Medicago nigra** (L.) Krock. ***s***
- **Medicago polycarpa** Willd. -> **Medicago polymorpha** L. ***A***
- **Medicago polymorpha** L.
- **Medicago polymorpha** L. var. **arabica** L. -> **Medicago arabica** (L.) Huds. ***A***
- **Medicago polymorpha** L. var. **confinis** Koch
- **Medicago polymorpha** L. var. **lapponica** Burnet
- **Medicago polymorpha** L. var. **microdon** Ehr.

Table I-2. Numerous Species within the Genus *Medicago* with Synonyms

- **Medicago polymorpha** L. var. **orbicularis** L. -> **Medicago orbicularis** (L.) Bartal. ***A***
- **Medicago praesativa** Sinskaya -> **Medicago sativa** L. subsp. **sativa**
- **Medicago prostrata** Jacq.
- **Medicago pubescens** (Edgew. ex Baker) Sirj.
- **Medicago quasifalcata** Sinskaya -> **Medicago sativa** L. subsp. **falcata** (L.) Arcang.
- **Medicago rigidula** (L.) All.
- **Medicago rivularis** Vassilcz. -> **Medicago sativa** L. subsp. **sativa**
- **Medicago romanica** Prodán -> **Medicago sativa** L. subsp. **falcata** (L.) Arcang.
- **Medicago rugosa** Desr.
- **Medicago sativa** L.
- **Medicago sativa** L. subsp. **caerulea** (Less. ex Ledeb.) Schmalh.
- **Medicago sativa** L. subsp. **falcata** (L.) Arcang.
- **Medicago sativa** L. subsp. **microcarpa** Urb. -> **Medicago sativa** L. subsp. **caerulea** (Less. ex Ledeb.) Schmalh.
- **Medicago sativa** L. subsp. **sativa**
- **Medicago scutellata** (L.) Mill.
- **Medicago sogdiana** Vassilcz. -> **Medicago sativa** L. subsp. **sativa**
- **Medicago suffruticosa** Ramond ex DC.
- **Medicago tenderiensis** Opperman ex Klokov -> **Medicago sativa** L. subsp. **falcata** (L.) Arcang.
- **Medicago transoxana** Vassilcz. -> **Medicago sativa** L. subsp. **sativa**
- **Medicago tribuloides** Desr. -> **Medicago truncatula** Gaertn.
- **Medicago truncatula** Gaertn.
- **Medicago x varia** Martyn

Species on this page (A = names approved by most authorities, ***s*** = approved as synonyms)
Source: The University of Melbourne, Web site maintained by: Michel H. Porcher, Copyright © 1995 - 2020, I.L.F.R. Last modified by The University of Melbourne: 12 / 09 / 2005
Found on-line at: http://www.plantnames.unime b.edu.au/Sorting/Medicago.html
Multilingual Multiscript Plant Name Database
http://www.plantnames.unimelb.edu.au/Sorting/e-mailSorting Medicago names

Table I-3. *Medicago* Species Hybridized to Alfalfa and Their Distribution

Species	Distribution	Hybridization Method	Result[1]
M. arborea	Southern Europe from Canary Islands to Greece	Protoplast fusion	Viable hybrids formed between these sexually incompatible species (Nenz et al., 1996).
M. cancellata	Southeastern European Russia, north of Caucasus	Hand-pollination	Successful, but ploidy may interfere in crosses of certain genotypes because cancellata is a hexaploid.
M. daghestanica	Mid-mountain zone of Daghestan, Russia	Hand-pollination Ovule/embryo culture Hand-pollination using trispecies bridge	No seed produced. Successful. Alfalfa was hand crossed to a daghestanica x pironae hybrid that had been colchicine doubled to a tetraploid; resulted in hybrid seed.
M. dzhawakhetica	Mountains of Transcauscasia	Hand-pollination	Successful when using uneven ploidy levels. F_1 were triploid and produced nonviable pollen. Backcrosses to alfalfa possible.

Table I-3. *Medicago* Species Hybridized to Alfalfa and Their Distribution

Species	Distribution	Hybridization Method	Result[1]
M. glomerata	Southern Europe to North Africa (Quiros and Bauchan, 1988)	Hand-pollination Natural	Successful Putative ancestor to subsp. x tunetana
M. hybrida	Corbier mountains and east Pyrenees	Ovule/embryo culture	Successful, no other data.
M. lupulina	Europe, most of Asia, North Africa, North America	Hand-pollination	DISPUTED/DISCOUNTED AS FALSE; Some reported hybrids, but contemporary experts contend they were selfed [also see Turkington and Cavers (1979)].
M. marina	Mediterranean and Black Sea shores, Atlantic coast of Iberia and France	Hand-pollination Ovule/embryo culture	Unsuccessful. Weak hybrids that did not produce flowers.
M. papillosa	Pontus mountains of north-eastern Anatolia to adjacent Caucasus mountains	Hand-pollination	Successful when using uneven ploidy levels.
M. pironae	Eastern Alps in northeast Italy	Ovule/embryo culture; Trispecies bridges	As for daghestanica, viz. ovole/embryo culture worked directly, but for hand-pollination, a trispecies bridge was required.
M. prostrata	Eastern Austria and Italy, eastern Adriatic coast to Greece	Hand-pollination	Successful, especially when prostrata is female
M. rhodopea	Mountain ranges of Bulgaria	Hand-pollination Ovule/embryo culture	Successful, but aberrant ploidies in progeny. Successful with normal chromosome complements.
M. rugosa	Mediterranean Region	Hand-pollination with embryo rescue	Single sterile plant only, no progeny produced (Piccirilli and Arcioni, 1992)
M. rupestris	Crimean mountains	Hand-pollination Ovule/embryo culture	Not successful. Successful, but F_1 plants had very low fertility and backcross progeny were only produced using ovule/embryo culture.
M. saxatilis	Crimean mountains	Hand-pollination	Successful, particularly when alfalfa was maternal parent.
M. scutellata	Mediterranean region	Hand-pollination	Single plant only, no progeny produced; never replicated (Sangduen et al., 1982).

[1]All data are taken from Lesins and Lesins (1979) or McCoy and Bingham (1988) unless otherwise noted. Table excludes all references to natural cross-pollination among subspecies in the *M. sativa* complex (see main text for further information).

Table I-4. Members of the Genus *Medicago* Found in North America as Listed by NatureServe Explorer.

***Medicago* sp. in North America**	**Evidence for Natural Hybridization to *Medicago sativa* Complex**	**Range of Occurrence**
M. arabica Spotted Medic	No	**CAN**: BC, NB **USA**: AL, AR, CA, CT, DC, FL, GA, IL, LA, MA, ME, MO, MS, NC, NJ, OK, OR, PA, RI, SC, TX, VA, VT, WA
M. laciniata Cut-leaf Medic	No	**CAN**: ON **USA**: MA, ME
M. littoralis Water Medic	No	**USA**: NJ
M. lupulina Black Medic	No. Reports of hand-cross hybrids are disputed and discounted as false hybrids by numerous experts.	**CAN**: AB, BC, MB, NB, NF, NS, ON, PE, QC, SK **USA**: AK, AL, AR, AZ, CA, CO, CT, DC, DE, FL, GA, HI, IA, ID, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, MT, NC, ND, NE, NH, NJ, NM, NV, NY, OH, OK, OR, PA, RI, SC, SD, TN, TX, UT, VA, VT, WA, WI, WV, WY
M. minima Small Medic-grass	No	**USA**: AL, AR, AZ, CA, CT, FL, HI, KS, LA, MA, MD, MI, MO, NC, NJ, NY, OK, OR, TN, TX, VA, WA
M. monspeliaca Hairy Medic	No	**USA**: AL, ME, MD, NY
M. orbicularis Button Medic	No	**CAN:** BC, ON **USA:** AL, CA, FL, GA, IL, LA, MD, MS, NC, NJ, OK, TN, TX
M. polymorpha Toothed Medic	No	**CAN:** BC, NB, ON, QC, SK **USA:** AK, AL, AR, AZ, CA, CT, FL, GA, HI, ID, LA, MA, ME, MI, MO, MS, MT, NC, NE, NJ, NM, NV, NY, OH, OK, OR, PA, RI, SC, TN, TX, UT, VA, VT, WA, WY
M. praecox Mediterranean Medic	No	**USA**: CA, MA
M. rugosa Wrinkled Medic	No. A single hybrid plant was produced via hand-pollination and embryo rescue; no viable progeny produced	**USA**: HI
M. sativa Alfalfac	Yes, Conspecific	**CAN**: AB, BC, MB, NB, NF, NS, ON, PE, QC, SK, YT **USA**: AK, AL, AR, AZ, CA, CO, CT, DC, DE, FL, GA, HI, IA, ID, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, MT, NC, ND, NE, NH, NJ, NM, NV, NY, OH, OK, OR, PA, RI, SC, SD, TN, TX, UT, VA, VT, WA, WI, WV, WY
M. sativa ssp. *falcate* Yellow Alfalfa	Yes, Conspecific	**CAN**: AB, BC, MB, NS, ON, PE, QC, SK **USA**: AK, DE, IA, IL, KS, MA, MD, MI, MN, MS, MT, ND, NE, NJ, NV, PA, SD, UT, VA, WA, WY
M. sativa ssp. Sativa	Yes, Conspecific	**CAN**: AB , BC , MB , NB , NF , NS , NT , ON , PE , QC , SK **USA**: AK , AL , AZ , CA , CO , CT , DE , FL , GA, HI , IA , ID , IL , IN , KS , KY , LA , MA, MD , ME , MI , MN , MO , MS , MT , NC , ND , NE , NH , NJ , NM , NV , NY , OH , OK , OR , PA , RI , SC , SD , TN , TX , UT , VA , VT , WA , WI , WV , WY
M. turbinata	No	**USA:** NJ, OR

Note: All data presented in NatureServe Explorer at http://www.natureserve.org/explorer were updated to be current with NatureServe's central databases as of August 5, 2007.
Note: This report was printed on November 11, 2007

Trademark Notice: "NatureServe", NatureServe, NatureServe Explorer, The NatureServe logo, and all other names of NatureServe programs referenced herein are trademarks of NatureServe. Any other product or company names mentioned herein are the trademarks of their respective owners.
Copyright Notice: Copyright © 2007 NatureServe, 1101 Wilson Boulevard, 15th Floor, Arlington Virginia 22209, U.S.A. All Rights Reserved. Each document delivered from this server or Website may contain other proprietary notices and copyright information relating to that document. The following citation should be used in any published materials which reference the Website.

Appendix I-2. Literature Search

1.0 Literature Search on Interspecific Hybridization within the *Medicago* Complex

Literature databases were searched (AGRICOLA, BIOSIS, CAB, Chemical Abstracts, Chemical Engineering and Biotechnology Abstracts, Life Science Abstracts, MEDLINE) to reveal any additional recent or historical natural cross hybridization information for alfalfa. Literature search results as well as the search terms used are listed in this appendix. The literature search confirmed that there are no sexually compatible relatives of *Medicaga sativa* in North America. Thus, the risk for cross pollination and subsequent transgene introgression is limited to cultivated and feral alfalfa populations growing in North America. This information was reviewed by APHIS in Petition Number 04-110-01p, section II (Subsection C), and section VII (Subsection E.1).

1.1 Databases Searched

TOPIC/TITLE: SEARCH ON INTERSPECIFIC, HYBRID, AND ALFALFA TERMS
SOURCES USED:

CAB Abstracts
COPYRIGHT (C) 2007 CAB INTERNATIONAL (CABI)
FILE COVERS 1973 TO 2 Aug 2007

AGRICOLA
FILE COVERS 1970 TO 5 Jul 2007
Compiled and distributed by the National Agricultural Library of the Department of Agriculture of the United States of America. It contains copyrighted material. All rights reserved. (2007)

MEDLINE
FILE LAST UPDATED: 5 Aug 2007.
FILE COVERS 1950 TO DATE.

BIOSIS
Copyright (c) 2007 The Thomson Corporation
FILE COVERS 1926 TO DATE.
RECORDS LAST ADDED: 1 August 2007

Life Sciences Abstracts
COPYRIGHT (C) 2007 Cambridge Scientific Abstracts (CSA)
FILE COVERS 1978 TO 26 Jul 2007

Chemical Engineering and Biotechnology Abstracts
COPYRIGHT (c) 2007 DECHEMA eV
FILE LAST UPDATED: 27 JUL 2007
FILE COVERS 1966 TO DATE

Chemical Abstracts

COPYRIGHT (C) 2007 AMERICAN CHEMICAL SOCIETY (ACS)
Copyright of the articles to which records in this database refer is held by the publishers listed in the PUBLISHER (PB) field (available for records published or updated in Chemical Abstracts after December 26, 1996), unless otherwise indicated in the original publications.

FILE COVERS 1907 - 7 Aug 2007 VOL 147 ISS 7
FILE LAST UPDATED: 6 Aug 2007

1.2 Search Strategy

L1 146304 ALFALFA OR LUCERNE OR MEDICAGO OR M(W) SATIVA
L2 15129 OUTCROSS? OR OUT(W) CROSS? OR INTERSPECFI?(3A)(BREED? OR HYBRID?
OR CROSS?)
L3 60195 OUTCROSS? OR OUT(W) CROSS? OR INTERSPECIFI?(3A)(BREED? OR HYBRID
? OR CROSS?)
L4 45074 L3 NOT L2
L5 90163 CROSSBREED? OR CROSSBRED? OR (CROSS(3A)(BREED? OR BRED? OR POLLI
NAT?))
L6 1109 L5 AND INTERSPECIFI?
L7 44089 L4 NOT L6
L8 130 L1 AND (L2 OR L6)
L9 137147 ALFALFA OR LUCERNE OR (MEDICAGO OR M)(W) SATIVA
L10 100 L9 AND (L2 OR L6)
L11 365 L9 AND L4
L12 350 L11 NOT L10
L13 82470 (RELATE?)(3A) SPECIES
L14 268 L13 AND L9
L15 8033 L9 AND (CROSS? OR HYBRID?)
L16 57 L14 AND L15
L17 56 L16 NOT L10
Answer set saved and duplicates removed at a later date
L11 29 DUP REM L10 (27 DUPLICATES REMOVED)
L18 342 L12 NOT L17
L19 342 L18 NOT P/DT
L20 245 L19 AND ENGLISH/LA
Answer set saved and duplicates removed at a later date
L29 157 DUP REM L28 (88 DUPLICATES REMOVED)
L21 97 L19 NOT L20
Answer set saved and duplicates removed at a later date

L48 95 DUP REM L47 (2 DUPLICATES REMOVED)

Notice Concerning Copyright Restrictions
These results may include copyrighted materials. This electronic copy becomes the property of the requester and no further transmission or reproduction of this copy is permitted.

Appendix I-3. Alfalfa Terms

1.0 Related species as a phrase, hybrid & alfalfa terms

L11 ANSWER 1 OF 29 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 1

Title

Rhizobium lusitanum sp. nov. a bacterium that nodulates Phaseolus vulgaris

Source

International Journal of Systematic and Evolutionary Microbiology, (2006) Vol. 56, No. 11, pp. 2631-2637. 49 ref. Publisher: Society for General Microbiology. Reading ISSN: 1466-5026 URL: http://ijs.sgmjournals.org DOI: 10.1099/ijs.0.64402-0

Abstract

The species Phaseolus vulgaris is a promiscuous legume nodulated by several species of the family Rhizobiaceae. During a study of rhizobia nodulating this legume in Portugal, we isolated several strains that nodulate P. vulgaris effectively and also Macroptilium atropurpureum and Leucaena leucocephala, but they form ineffective nodules in Medicago sativa. According to phylogenetic analysis of the 16S rRNA gene sequence, the strains from this study belong to the genus Rhizobium, with Rhizobium rhizogenes and Rhizobium tropici as the closest related species , with 99.9 and 99.2 percent similarity, respectively, between the type strains of these species and strain P1-7T. The nodD and nifH genes carried by strain P1-7T are phylogenetically related to those of other species nodulating Phaseolus. This strain does not carry virulence genes present in the type strain of R. rhizogenes, ATCC 11325T. Analysis of the recA and atpD genes confirms this phylogenetic arrangement, showing low similarity with respect to those of R. rhizogenes ATCC 11325T (91.9 and 94.1% similarity, respectively) and R. tropici IIB CIAT 899T (90.6% and 91.8% similarity, respectively). The intergenic spacer of the strains from this study is phylogenetically divergent from those of R. rhizogenes ATCC 11235T and R. tropici CIAT 899T, with 85.9 and 82.8 percent similarity, respectively, with respect to strain P1-7T. The tRNA profile and two-primer random amplified polymorphic DNA pattern of strain P1-7T are also different from those of R. rhizogenes ATCC 11235T and R. tropici CIAT 899T. The strains isolated in this study can be also differentiated from R. rhizogenes and R. tropici by several phenotypic characteristics. The results of DNA-DNA hybridization showed means of 28 and 25 percent similarity between strain P1-7T and R. rhizogenes ATCC 11235T and R. tropici CIAT 899T, respectively. All these data showed that the strains isolated in this study belong to a novel species of the genus Rhizobium, for which we propose the name Rhizobium lusitanum sp. nov.; the type strain is P1-7T (=LMG 22705T=CECT 7016T).

Language

English

L11 ANSWER 2 OF 29 LIFESCI COPYRIGHT 2007 CSA on STN

Title

Rhizobium daejeonense sp. nov. isolated from a cyanide treatment bioreactor

Source

International Journal of Systematic and Evolutionary Microbiology [Int. J. Syst. Evol. Microbiol.], (20051100) vol. 55, no. 6, pp. 2543-2549. ISSN: 1466-5026.

Abstract

A polyphasic study was carried out to determine the taxonomic position of two aerobic, cyanide-degrading bacterial strains, designated L61 super(T) and L22, which had been isolated from a bioreactor for the treatment of nickel-complexed cyanide. The two isolates exhibited almost identical taxonomic characteristics. Phylogenetic analysis inferred from comparative 16S rRNA gene sequences indicated that the isolates fall in a sublineage of the genus Rhizobium comprising the type strains of Rhizobium giardinii, Rhizobium radiobacter, Rhizobium rubi, Rhizobium larrymoorei, Rhizobium vitis, Rhizobium undicola, Rhizobium loessense, Rhizobium galegae and Rhizobium huautlense. Cells of the two isolates are Gram-negative, aerobic, motile and non-spore-forming rods (0 super(.)6-0 super(.)7x1 super(.)1-1 super(.)3 mu m), with peritrichous flagella. The DNA G+C content is 60 super(.)1-60 super(.)9 mol%. Cellular fatty acids are C sub(16 : 0) (2 super(.)2-3 super(.)3 %), C sub(18 : 0) (2 super(.)1-3 super(.)2 %), C sub(19 : 0) cyclo [omega]8c (9 super(.)9-16 super(.)8 %), C sub(20 : 3)[omega]6,9,12c (2 super(.)7-3 super(.)3 %), summed feature 3 (7 super(.)2-7 super(.)7 %) and summed feature 7 (67 super(.)8- 73 super(.)7 %). The strains formed nodules on a legume plant, Medicago sativa. A nifH gene encoding denitrogenase reductase, the key component of the nitrogenase enzyme complex, was detected in L61 super(T) by PCR amplification by using a nifH-specific primer system. Strains L61 super(T) and L22 were distinguished from the type strains of recognized Rhizobium species in the same sublineage based on low DNA-DNA hybridization values (2-4 %) and/or a 16S rRNA gene sequence similarity value of less than 96 percent. Moreover, some phenotypic properties with respect to substrate utilization as a carbon or nitrogen source, antibiotic resistance and growth conditions could be used to discriminate L61 super(T) and L22 from Rhizobium species in the same sublineage. Based on the results obtained in this study, L61 super(T) and L22 are considered to be representatives of a novel species of Rhizobium, for which the name Rhizobium daejeonense sp. nov. is proposed. The type strain is L61 super(T) (=KCTC 12121 super(T)=IAM 15042 super(T)=CCBAU 10050 super(T)). Published online ahead of print on 12 August 2005 as DOI 10.1099/ijs.0.63667-0. The GenBank/EMBL/DDBJ accession numbers for the 16S rRNA gene sequences of strains L61 super(T) and L22 are AY341343 and DQ089696, respectively. The GenBank/EMBL/DDBJ accession number for the partial nifH gene sequence of strain L61 super(T) is AY428644. A transmission electron micrograph of cells of strain L61 super(T), a minimum- evolution phylogenetic tree and a table detailing the fatty acid compositions of L61 super(T), L22 and related Rhizobium species are available as supplementary material in IJSEM Online.

Language

English

L11 ANSWER 3 OF 29 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 2

Title

Variation in rDNA locus number and position among legume species and detection of 2 linked rDNA loci in the model Medicago truncatula by FISH

Source

Genome, (2005) Vol. 48, No. 3, pp. 556-561. 37 ref. Publisher: National Research Council of Canada. Ottawa ISSN: 0831-2796 DOI: 10.1139/g05-015

Abstract

Within Fabaceae, legume species have a variable genome size, chromosome number, and ploidy level. The genome distribution of ribosomal genes, easily detectable by fluorescent in situ hybridization (FISH), is a good tool for anchoring physical and genetic comparative maps. The organization of 45S rDNA and 5S loci was analysed by FISH in the 4 closely related species : Pisum sativum, Medicago truncatula, Medicago sativa (2 diploid taxa), and Lathyrus sativus. The 2 types of rDNA arrays displayed interspecific variation in locus number and location, but little intraspecific variation was detected. In the model legume, M. truncatula, the presence of 2 adjacent 45S rDNA loci was demonstrated, and the location of the rDNA loci was independent of the general evolution of the genome DNA. The different parameters relative to clustering of the rDNA loci in specific chromosome regions and the possible basis of rDNA instability are discussed.

Language

English

L11 ANSWER 4 OF 29 HCAPLUS COPYRIGHT 2007 ACS on STN

Title

Methods of transforming plants and identifying parental origin of a chromosome in those plants

Source

PCT Int. Appl., 79 pp. CODEN: PIXXD2

Abstract

Methods for plant transformation, for improving transformation efficiency, and for producing transgenic plants are provided. The methods comprise crossing a recipient plant from a genetic line of a plant species of interest with a donor plant selected from a transformation competent genetic line of the same plant species or of another closely related plant species to obtain a hybrid plant. Tissues obtained from the hybrid plant are transformation competent. These tissues can then be transformed with one or more nucleotide sequences of interest and selected for transgenic events having the nucleotide sequence of interest integrated within a chromosome derived from the recipient plant. Transformed cells can be selected and transgenic hybrid plants regenerated. The nucleotide sequence of interest can be introgressed into the genetic line from which the original recipient parent was derived, or into other genetic lines. Transformed plants and seeds are addnl. provided.

Table I-5. Patent Information

Patent Number	Kind	Date	Application Number	Date
WO 2002006500	A2	20020124	WO 2001-US22377	20010717
(1) WO 2002006500	A3	20021227		
US 2003046724	A1	20030306	US 2001-907411	20010717
US 2004194161	A1	20040930	US 2004-784418	20040223
US 7022894	B2	20060404		
US 2006101540	A1	20060511	US 2005-280890	20051116

(1) **W:** AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW **RW:** GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW, AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR, BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG

Language

English

L11 ANSWER 5 OF 29 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 3

Title

Development of S-SAP markers based on an LTR-like sequence from Medicago sativa L

Source

Molecular Genetics and Genomics, (2002) Vol. 267, No. 1, pp. 107-114. 31 ref.
Publisher: Springer-Verlag. Berlin ISSN: 1617-4615

Abstract

The Sequence-Specific Amplification Polymorphism (S-SAP) method, recently derived from the Amplified Fragment Length Polymorphism (AFLP) technique, produces amplified fragments containing a retrotransposon long terminal repeat (LTR) sequence at one end and a host restriction site at the other. We report the application of this procedure to the LTR of the Tms1 element from M. sativa. Genomic dot-blot analysis indicated that Tms1 LTRs represent about 0.056 percent of the M. sativa genome, corresponding to 16x103 copies per haploid genome. An average of 66 markers were amplified for each primer combination. Overall 49 polymorphic fragments were reliably scored and mapped in a F1 population obtained by crossing diploid M. falcata with M. coerulea. The utility of the LTR S-SAP markers was higher than that of AFLP or SAMPL (Selective Amplification of Microsatellite Polymorphic Loci) markers. The efficiency index of the LTR S-SAP assay was 28.3, whereas the corresponding values for AFLP and SAMPL markers were 21.1 and 16.7, respectively. The marker index for S-SAP was 13.1, compared to 8.8 for AFLP and 9.5 for SAMPL. Application of the Tms1 LTR-based S-SAP to double-stranded cDNA resulted in a complex banding pattern, demonstrating the presence of Tms1 LTRs within exons. As the technique was successfully applied to other species of the genus Medicago, it should prove suitable for studying genetic diversity within, and relatedness among lucerne species.

Language

English

L11 ANSWER 6 OF 29 HCAPLUS COPYRIGHT 2007 ACS on STN

Title

Molecular marker analyses in alfalfa and related species

Source

Advances in Cellular and Molecular Biology of Plants (2001), 6(DNA-Based Markers in Plants (2nd Edition)), 169-180 CODEN: ACMBEF; ISSN: 1381-1932

Abstract

A review on the use of genetic markers to analyze the evolution, breeding, and genetics of alfalfa. The main application areas of mol. markers include anal. of interspecific hybridization , evaluation of genetic variation within and among populations, development of genetic linkage maps, and correspondence of parental genetic similarity with hybrid or synthetic yield.

Language

English

L11 ANSWER 7 OF 29 MEDLINE on STN

Title

Rapid identification of Medicago nodulating strains by using two oligonucleotide probes complementary to 16S rDNA sequences.

Source

Canadian journal of microbiology, (1997 Sep) Vol. 43, No. 9, pp. 854-61. Journal code: 0372707. ISSN: 0008-4166.

Abstract

Symbiotic bacteria associated with the Medicago genus are separated into two closely related species named Sinorhizobium meliloti and Sinorhizobium medicae. To discriminate rapidly between these two bacterial species, two 15-base DNA probes, 16Smfs and 16Smed, were designed from the alignment of 16S rDNA sequences to differentiate S. meliloti from S. medicae. Their specificities were evaluated by dot-blot hybridization experiments on 25 reference strains representing 13 species of Rhizobium and Sinorhizobium, and by comparison with all 16S rDNA sequences available in the GenBank data base. No cross -reaction was found with 16Smed, which was thus considered species specific for S. medicae. By contrast, as expected according to the 16S rDNA sequence alignment, the labeled 16Smfs probe cross -hybridized with the DNAs of S. meliloti, Sinorhizobium fredii, and Sinorhizobium saheli but not with the DNA of S. medicae. Since S. saheli and S. fredii do not nodulate Medicago, 16Smed and 16Smfs can be routinely used to characterize the two Sinorhizobium species nodulating Medicago from pure cultures or from Medicago root nodules. Fifty strains isolated from eight annual Medicago species were then characterized by using colony hybridizations. Sinorhizobium meliloti was more frequently obtained (> 80% isolates) than was S. medicae. Both Sinorhizobium species seemed to be trapped by annual Medicago and no plant-host specificity was detected.

Language

English

L11 ANSWER 8 OF 29 AGRICOLA Compiled and distributed by the National Agricultural Library of the Department of Agriculture of the United States

Title

Evolutionary rate variation within Mus APRT.

Source

Genome, Oct 1996. Vol. 39, No. 5. p. 914-920 Publisher: Ottawa, Ontario, Canada : National Research Council of Canada. CODEN: GENOE3; ISSN: 0831-2796

Abstract

Rodents are thought to have relatively high rates of evolution, twice as fast as the rates for mammals in other orders. However, the uniformly high rates of evolution inferred for the order Rodentia from Mus musculus and Rattus norvegicus are not consistently found for other rodent species. Using a maximum likelihood phylogenetic algorithm (DNAML), we show here that Mus spicilegus has a fivefold different rate of evolution in 1100 bp around the adenine phosphoribosyltransferase gene (APRT) since its divergence from a common ancestor with Mus musculus. A greater than threefold difference in rates is also found in a comparison of the number of evolutionary events directly detected from the APRT sequences of these two closely related Mus species. The evolutionary events can be directly detected, since M. spicilegus, M. musculus, and the four rodent outgroup species used to determine the ancestral sequence are so closely related. One of the major differences between M. spicilegus and M. musculus that might affect evolutionary rate is the degree of commensalism with man. The Mus species therefore provide a useful model for testing various hypotheses for the causes of rate variations between genes, and possibly, between lineages.

Language

English

L11 ANSWER 9 OF 29 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 4

Title

Somatic hybrid plants between the forage legumes Medicago sativa L. and Medicago arborea L

Source

Theoretical and Applied Genetics, (1996) Vol. 93, No. 1/2, pp. 183-189. 30 ref. ISSN: 0040-5752

Abstract

Interspecific somatic hybrid plants were obtained by symmetrical electrofusion of mesophyll protoplasts of Medicago sativa with callus protoplasts of M. arborea. Somatic hybrid calli were picked manually from semi-solid culture medium after they were identified by their dual colour in fluorescent light. Twelve putative hybrid calli were selected and one of them regenerated plants. The morphogenesis of the somatic hybrid calli was induced by the synthetic growth regulator 1,2-benzisoxazole-3-acetic acid. Somatic hybrid plants showed intensive genome rearrangements, as evidenced by isozyme and RFLP analysis. The morphology of somatic hybrid plants was in general intermediate between the parents. The production of hybrids by protoplast fusion between sexually incompatible Medicago species is related to the in vitro

responsiveness of the parental protoplasts. The possibility of using somatic hybrid plants in lucerne breeding is discussed.

Language

English

L11 ANSWER 10 OF 29 MEDLINE on STN

Title

Use of RAPD analysis for in situ identification of Ascosphaera aggregata and Ascosphaera larvis in larval cadavers of the alfalfa leafcutting bee, Megachile rotundata.

Source

Journal of invertebrate pathology, (1996 Jul) Vol. 68, No. 1, pp. 78-83. Journal code: 0014067. ISSN: 0022-2011.

Abstract

Chalkbrood of the alfalfa leafcutting bee, Megachile rotundata, is caused by the fungus Ascosphaera aggregata. We used random amplified polymorphic DNA (RAPD) analysis for the in situ identification of A. aggregata and a related species , Ascosphaera larvis, in larval cadavers of M. rotundata. A simple DNA extraction method was developed to preferentially isolate DNA from fungal spores on the cadaver surface, or from ascocysts beneath the cuticle. Similar banding patterns were obtained in A. aggregata-infected larval cadavers from different sources and geographic areas. The RAPD banding pattern of cadavers infected with A. aggregata differed from that of healthy leafcutting bee prepupae. RAPD analyses of cadavers infected with A. aggregata and A. larvis resulted in similar banding profiles as those obtained from corresponding pure fungal cultures of the two species. This suggests that the RAPD bands of infected cadavers were amplified from fungal DNA, rather than from other DNA associated with the leafcutting bee cadaver. The banding patterns of "sporulating" and "non-sporulating" chalkbrood cadavers exhibited no differences; this provides the first definitive evidence that both forms of the disease result from infection with A. aggregata.

Language

English

L11 ANSWER 11 OF 29 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 5

Title

The comparative phosphorus requirements of some temperate perennial legumes

Source

Plant and Soil, (1991) Vol. 133, No. 1, pp. 17-30. 37 ref. ISSN: 0032-079X

Abstract

P responses of Lupinus polyphyllus, L. arboreus and 7 temperate perennial pasture legumes were compared in a field trial over a range of 9 P rates, from 0 to 800 kg/ha. Lupinus spp. produced more than 5 t DM/ha in the absence of added P and showed no response to fertilizer. In contrast, the pasture legumes initially failed to grow without added P and responded to applications of between 200 and 800 kg/ha. At the higher P rates, DM production of pasture legumes was equivalent to that of Lupinus spp. In the first 2 years of the trial, the most productive pasture legume species at the higher rates of

added P were also the most productive at the lower rates. P requirements for 90 percent of maximum yield varied greatly between species , but were closely related to maximum yield. Thus species with low P requirements for maximum yield were not necessarily P-efficient species. In the third and subsequent years of the trial Lotus corniculatus performed better than the other pasture legumes at the lower rates of added P. In contrast to other studies Lotus pedunculatus [L. uliginosus] showed no ability to outyield Trifolium repens at low rates of P. Critical P concentration of the pasture species for the late spring-early summer period declined in the order T. repens (0.34%) > L. pedunculatus (0.30%) > T. pratense (0.28%) > T. hybridum (0.27%) > T. ambiguum (0.26%) > L. corniculatus (0.23%). Mineralizable N levels were determined in soils under 3 species in the 7th year of the trial. At the lowest rates of added P, mineralizable N levels were much higher under L. polyphyllus than under T. repens or L. corniculatus. With increasing P rate, levels under the latter species increased, and at 100 kg P/ha were equivalent to those under L. polyphyllus with no added P.

Language

English

L11 ANSWER 12 OF 29 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 6

Title

Potential use of PCR-amplified ribosomal intergenic sequences in the detection and differentiation of Verticillium wilt pathogens

Source

Physiological and Molecular Plant Pathology, (1991) Vol. 39, No. 1, pp. 1-11. 28 ref. ISSN: 0885-5765

Abstract

The ribosomal genes from the 2 major pathogenic species, V. albo-atrum and V. dahliae, are essentially identical, but small differences were identified in the internal transcribed spacers (ITS 1 and ITS 2) of the 2 species. A cluster of 3 non-homologous nucleotides was observed in ITS 1 and a cluster of 2 in ITS 2. These differences permitted the synthesis of oligonucleotides that hybridized differentially with the rDNA of the 2 species and allowed for an efficient, fungus-specific amplification of either DNA sequence by a polymerase chain reaction (PCR). The results illustrate the effective use of intergenic sequences for the detection of fungus in a crop such as lucerne and also suggest that PCR-amplified intergenic sequences may provide sensitive probes for the differentiation of closely related species even when the mature rRNAs are too homologous or contain no exploitable sequence differences.

Language

English

L11 ANSWER 13 OF 29 HCAPLUS COPYRIGHT 2007 ACS on STN

Title

Immunotaxonomy of nodule-specific proteins

Source

Cytobios (1990), 61(244), 7-19 CODEN: CYTBAI; ISSN: 0011-4529

Abstract

Polyclonal antisera were prepared sep. from soluble protein exts. of nodules from 2 ureide-transporting legumes, Glycine max and Sesbania exaltata. The antisera were used to probe nodule exts. from 11 species from 6 Papilionaceae (Fabaceae) tribes. Comparison of nodule and root exts. by Ouchterlony double-diffusion, rocket immunoelectrophoresis, and Western blotting were used to identify nodule-specific proteins (the so-called nodulins) among the species surveyed. The number of precipitin lines formed during double diffusion and rocket immunoelectrophoresis and the number of bands on Western blots of lithium dodecyl sulfate-solubilized polypeptides increased with commonality in nodule metabolism (ureide or amide transport) and similarity in nodule morphology (determinate or indeterminate meristem). The number of precipitin lines and bands on Western blots did not necessarily increase among species considered to be taxonomically similar. LegHb, the only protein (a combination of both plant and rhizobial gene products) generally identified as common among the tribes, exhibited considerable variation in immunol. cross -reaction among the species. Very few, if any, nodule-specific proteins are common to all species nor are there any that are completely species-specific. A number of nodulins appear to be shared among metabolically similar species which are taxonomically related.

Language

English

L11 ANSWER 14 OF 29 CABA COPYRIGHT 2007 CABI on STN

Title

Dispersed repeats and structural reorganization in subclover chloroplast DNA

Source

Molecular Biology and Evolution, (1989) Vol. 6, No. 4, pp. 355-368. 44 ref. ISSN: 0737-4038

Abstract

Gene mapping was carried out on the chloroplast DNA (ctDNA) of Trifolium subterraneum varieties Tallarook and Woogenellup by hybridization of cloned restriction fragments with various probes, including cloned fragments of lucerne ctDNA. The results revealed that the chloroplast genome of T. subterraneum contains 10 rearranged gene clusters. Eight large inversions were sufficient to explain this reorganization; however, the actual evolutionary divergence between Trifolium and Medicago may have been more complex. A fine-scale analysis of a set of ribosomal protein genes revealed insertions, deletions and transpositions. Associated with this unusually unstable genome were 2 structural features potentially involved in the rearrangements. A dispersed family of repeats, with each element about 1 kb in length, was present in at least 6 copies. A previous survey of a wide taxonomic range of species indicated that these elements are unique to the ctDNA of T. subterraneum and 2 closely related species. Several of the repeated elements were associated with genomic rearrangements, and 1 repeat was inserted within a normally highly conserved series of genes. It is suggested that this set of dispersed repeats may be the first family of transposable elements found in any organelle genome. In addition, the T. subterraneum chloroplast genome is much larger than those in other closely related legumes, even when account is taken of the presence of the repeated

elements. Some of the extra DNA had no sequence similarity to other chloroplast genomes and is thought to represent insertion of DNA from another genome. These unusual features may be implicated in the rapid and major reorganization of the ctDNA in T. subterraneum.

Language

English

L11 ANSWER 15 OF 29 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 7

Title

Effect of variation within and between Medicago and Melilotus species on the composition and dynamics of indigenous populations of Rhizobium meliloti

Source

Soil Biology & Biochemistry, (1988) Vol. 20, No. 1, pp. 31-38. 4 tab. 28 ref. ISSN: 0038-0717

Abstract

The effect of variation within and between legume species of the Medicago cross - inoculation group on the composition of populations of indigenous Rhizobium meliloti inhabiting nodules was evaluated with Melilotus alba, Medicago lupulina and Medicago sativa grown on three soils each collected from a site occupied by a long established population of one of these legumes (homologous species). Characterization of over 1400 nodule isolates on the basis of phage sensitivity revealed totals of 37, 75 and 87 distinct phage types of indigenous R. meliloti from the three soils, respectively. The distributions of phage types differed markedly between soils and on one soil an individual type dominated the nodule population accounting for over 60 percent of the isolates. The incidence and variety of phage types differed significantly between legume species grown on two of three soils indicating species variation in nodulation preferences for indigenous R. meliloti. Individual plants within each legume species were heterogeneous with respect to preferences for phage types although, overall, the extent of this variation differed between species and appeared related to pollination characteristics. The data indicate that the homologous legume species for a particular soil, irrespective of its pollination characteristics, consistently tended toward greater inter-plant homogeneity of nodulation preferences for indigenous R. meliloti than heterologous species grown on the same soil. On the basis of the evidence presented it is suggested that the legume host is an important factor determining the composition of its associated Rhizobium population. The implications of the results are discussed in relation to agricultural practice.

Language

English

L11 ANSWER 16 OF 29 CABA COPYRIGHT 2007 CABI on STN

Title

Tissue culture of legumes for crop improvement

Source

Plant Breeding Reviews, (1984) Vol. 2, pp. 215-264. 16pp. of ref. ISSN: 0730-2207

Abstract

Information is reviewed with respect to the following crop species (or genera) and species related to them which have potential breeding value: Arachis hypogaea, Cajanus cajan, Cicer arietinum, Glycine max, Lotus corniculatus, Medicago sativa , Phaseolus vulgaris, P. acutifolius, P. coccineus, Pisum sativum, Psophocarpus tetragonolobus, Stylosanthes, Trifolium, Vicia faba, Vigna unguiculata, V. mungo, V. radiata, Ornithopus and Crotalaria juncea. For many of the species the topics considered include all or some of the following: callus, cell-suspension, protoplast, anther, embryo, ovule, and shoot apical-meristem culture. A short section is devoted to somatic hybridization involving legume + legume and legume + nonlegume combinations.

Language

English

L11 ANSWER 17 OF 29 CABA COPYRIGHT 2007 CABI on STN

Title

Interbreeding of Lygus elisus Van Duzee and L. desertinus Knight in the field

Source

Southwestern Entomologist, (1982) Vol. 7, No. 1, pp. 60-64. 3 ref. ISSN: 0147-1724

Abstract

The closely related species Lygus elisus Van D. and L. desertinus Knight occur on a variety of food-plants throughout western North America and are frequently found together. Studies were carried out in Arizona in 1980-81 on examples of the 2 species collected from nettleleaf goosefoot (Chenopodium murale) and lucerne to determine whether interbreeding occurs in the field. A high proportion (81%) of females of L. desertinus collected near Yuma, where the species coexists with L. elisus, produced offspring of both L. desertinus and L. elisus types. At Marana, near Tucson, where L. elisus is rare, only 17 percent of L. desertinus females produced mixed offspring. The results indicated that the 2 species are interbreeding in the Yuma area.

Language

English

L11 ANSWER 18 OF 29 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 8

Title

Peroxidase and leucine-aminopeptidase in diploid Medicago species closely related to alfalfa: multiple gene loci, multiple allelism, and linkage

Source

Theoretical and Applied Genetics, (1981) Vol. 60, No. 4, pp. 221-228. 23 ref. ISSN: 0040-5752

Abstract

Gel electrophoresis of leaf and root tissue of seedlings of selfed and crossed accessions of M. sativa and M. falcata revealed three anodal sets and one cathodal set of peroxidase isozymes which indicated the existence of four linked multiallelic loci (Prx1, Prx2, Prx3 and Prx4). In addition, two anodal sets of leucine aminopeptidase isozymes indicated the existence of two multiallelic loci (Lap1 and Lap2) that may be linked.

Language

English

L11 ANSWER 19 OF 29 CABA COPYRIGHT 2007 CABI on STN

Title

Enzyme electrophoresis as an aid for alfalfa breeding

Source

Agricultural Reviews and Manuals, Science and Education Administration, USDA, (1981) No. ARM-NC-19, pp. 61. also Report of the twenty-seventh alfalfa improvement conference. July 8-10, 1980, University of Wisconsin, Madison. 4 ref. Price: Journal article; Conference paper.

Abstract

The uses of enzyme electrophoresis in Medicago sativa breeding are discussed under the following headings: (1) the identification of mother plants of breeding lines preserved in nursery plots, (2) the detection of natural cross pollination and hybridization , (3) the determination of genetic variability of accessions in a germplasm collection, (4) the detection of possible centres of diversity of Medicago species closely related to M. sativa , (5) the testing of maximum heterozygosity, and (6) the construction of linkage groups.

Language

English

L11 ANSWER 20 OF 29 CABA COPYRIGHT 2007 CABI on STN

Title

Development of procedures for detection and inheritance of resistance to Phytophthora megasperma Drechs. in diploid and tetraploid Medicago spp

Source

Dissertation Abstracts International, B, (1980) Vol. 41, No. 5, pp. 1589B. Order No: 8015208.

Abstract

Part of this work has been summarized elsewhere [see PBA 50, 7324]. For 58 S0 plants the correlation between mature root reaction and stem reaction to inoculation was highly significant. A similar correlation was seen in the S1 plants and F1 plants of a resistant X susceptible cross. Of 25 Medicago species accessions, all closely related to M. sativa , the most resistant were M. coerulea 'PI299046' and M. falcata 'PI377727'. The inheritance of resistance in diploid M. sativa 'CADL' was controlled by two dominant complementary genes, Pm1 and Pm2, while inheritance in M. coerula 'PI299046' was complex. In tetraploid M. sativa , two genetic systems conditioned resistance, viz. one in which susceptibility was incompletely dominant and the other in which the dominant complementary Pm1 and Pm2 were present. All plants from a cross of two resistant tetraploid M. sativa clones were resistant and this synthetic was designated WAPRS.

Language

English

L11 ANSWER 21 OF 29 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 9

Title

Aphidius eadyi n.sp. (Hymenoptera: Aphidiidae), a widely distributed parasitoid of the pea aphid, Acyrthosiphon pisum (Harris) in the Palearctic

Source

Entomologica Scandinavica, (1980) Vol. 11, No. 4, pp. 473-480. 5 fig. 11 ref. ISSN: 0013-8711

Abstract

Aphidius eadyi sp.n., a parasite of Acyrthosiphon pisum (Harris) (a pest of lucerne , peas and other leguminous crops) in the West Palaearctic Region, is described. Its distribution and interspecific relations (crossing experiments) to the related species Aphidius smithi Sharma & Subba Rao are elucidated. The new species has been found to be a promising agent for the biological control of Acyrthosiphon pisum, but does not parasitise the lucerne pest A. kondoi Shinji [see next abstract].

Language

English

L11 ANSWER 22 OF 29 BIOSIS COPYRIGHT (c) 2007 The Thomson Corporation on STN

Title

CYTOLOGICAL AND FERTILITY RELATIONSHIPS OF DIFFERENT MEDICAGO SPECIES AND CYTO GENETIC BEHAVIOR OF THEIR HYBRIDS.

Source

Genetica Agraria, (1979) Vol. 33, No. 2-4, pp. 245-268. CODEN: GEAGAC. ISSN: 0016-6685.

Abstract

Crosses (2x · 2x, 4x · 4x and 2x · 4x) between different M. species [M. hemicycla, M. coerulea, M. falcata, M. sativa , M. gaetula, M. glutinosa] were made with the purpose of studying the relationship among the species through cytogenetic analysis, the extent of homology between their chromosomes and the possible origin of the tetraploid forms. Different ploidy level was the major obstacle to successful hybridization in interspecific crosses. In fact, an induced autotetraploid showed a higher crossability with the tetraploid species than the correspondent diploid species from which it originated. All the species used, once the difference in ploidy level was eliminated, crossed rather easily and the F1 hybrids showed a good degree of fertility both as seed production by self-pollination and inter-crossing and as pollen viability; diploid species had regular meiosis, tetraploid species showed some pairing abnormalities which were also observed in the F1 hybrids , especially those from 2x · 4x and 4x · 2x crosses. In general, the genomes of the species examined had a good chromosome homology. The multivalent frequencies were roughly the same in M. sativa and M. glutinosa. They were higher in the other tetraploid species and in the induced autotetraploid of M. hemicycla. Some F1 hybrids showed much higher multivalent frequencies; the values observed were always lower than the theoretical ones; the presence of quadrivalents even with low frequency, suggests an autotetraploid origin of M. sativa and of the other tetraploid species studied.

The results also indicate that all these species are closely related and therefore may be considered variants of 7 original species.

Language

ENGLISH

L11 ANSWER 23 OF 29 BIOSIS COPYRIGHT (c) 2007 The Thomson Corporation on STN

Title

Evaluation of a nondestructive acetylene reduction assay of nitrogen fixation for pasture legumes grown in pots.

Source

New Zealand Journal of Experimental Agriculture, (1978) Vol. 6, No. 1, pp. 65-68. CODEN: NZJEA3. ISSN: 0301-5521.

Abstract

Plants of Trifolium repens L. 'Grasslands Huia' (white clover), T. pratense L. 'Grasslands Turoa' (Montgomery red clover), T. hybridum L. (alsike clover), T. pratense L. 'Grasslands Pawera' (broad red clover), T. subterraneum L. 'Tallarook' (subterranean clover), Medicago sativa L. 'Grasslands Wairau' (lucerne) and Lotus pedunculatus Cav. (synonym: L. uliginosus Schkuhr, L. major Sm) 'Grasslands Maku' (lotus) were grown in pots with adequate moisture at day/night temperatures of 15° C/10° C and 23° C/10° C, and under moisture stress at 23° C/10° C. At weekly intervals during 5 and 6 wk growth periods successive non-destructive acetylene reduction (AR) assays were performed by incubating potted plants in 5 liter plastic containers for 2 h with 200 ml acetylene. N2 fixation over the same periods was calculated from chemical analysis of plant tissue. AR and N2 fixation rates were closely related within species and treatments, but the molar ratio of C2H2 reduced: N2 fixed differed between clovers (mean ratio 2.8:1), lucerne (3.4:1) and lotus (4.3:1). Moisture stress increased the AR:N2 fixed ratio, but temperature had no consistent effect. Repeated assays had no effect on herbage DM [dry matter] accumulation and herbage percent N.

Language

ENGLISH

L11 ANSWER 24 OF 29 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 10

Title

Pachytene chromosomes of perennial Medicago species. II. Distantly related species whose karyotypes resemble M. sativa

Source

Hereditas, (1972) Vol. 72, No. 2, pp. 289-302. 20 ref. Meeting Info.: Gillies, C. B. : Pachytene chromosomes of perennial Medicago species. I. Species closely related to M. sativa.

Abstract

M. daghestanica, M. pironae and their sterile hybrid had similar idiograms and the two species are probably closely related. The idiograms differed from those of the M. sativa -falcata-glutinosa complex only in proportional lengths of the chromosomes, hence the two groups may have a common ancestor.M. rhodopea and M. rhodopea X M. rupestris

had almost identical idiograms, leading to the conclusion that M. rhodopea and M. rupestris are closely related. The idiogram of M. rhodopea was very similar to that of M. sativa , and in a triploid hybrid between diploid M. sativa and autotetraploid M. rhodopea, trivalent pairing was observed, confirming some homology between chromosomes of the two species. The M. sativa group and M. rhodopea group may have diverged only relatively recently."In pachytene cells of M. rhodopea and two of the M. rhodopea X M. rupestris hybrids , a large darkly staining body was observed in the nucleoplasm. This was shown by pyronine/methyl green staining to contain RNA, and in behaviour resembled an accessory nucleolus".

Language

English

L11 ANSWER 25 OF 29 CABA COPYRIGHT 2007 CABI on STN

Title

Pachytene chromosomes of perennial Medicago species. I. Species closely related to M. sativa

Source

Hereditas, (1972) Vol. 72, No. 2, pp. 277-287. 26 ref.

Abstract

Pachytene chromosome complements of three diploid and one tetraploid species of perennial Medicago are illustrated. Caryotypic data and pachytene idiograms are presented for the diploids Medicago coerulea, M. glandulosa and M. prostrata. The chromosome-arm ratios and proportional lengths of the diploids are similar to published data for diploid M. sativa. Absolute length differences of pachytene chromosomes which occur between these species may be the result of differences in chromosome contraction. Tetraploid M. glutinosa has pachytene chromosomes similar in morphology to those of M. sativa. The presence of quadrivalents at pachytene suggested that M. glutinosa might be of autotetraploid origin."It is suggested that the standard pachytene idiogram for diploid M. sativa can be extended in use to cover all diploid species included in the M. sativa -falcata-glutinosa complex. Published genetic and hybridization data to support this suggestion are mentioned.

Language

English

L11 ANSWER 26 OF 29 CABA COPYRIGHT 2007 CABI on STN

Title

Taxonomy and cytogenetics of Medicago

Source

Agronomy, (1972) No. 15, pp. 53-86. 58 ref. Meeting Info.: Alfalfa science and technology. ISSN: 0065-4663

Abstract

A taxonomic key comprising 62 Medicago taxa is given with photographs of pods and other characteristic plant parts. Special consideration is given to the M. sativa -falcata-glutinosa complex. Based on morphological characters of diploid M. sativa and M.

falcata an attempt is made to distinguish basic taxa from those which are of hybrid origin. Chromosome numbers are listed for 60 of the taxa considered in the key. Idiograms and caryotype data based on somatic chromosome studies are given for 22 annual and two perennial species and idiograms based on pachytene chromosome studies are shown for eight perennial and five annual species. A key is given for the identification of chromosomes of an n set of diploid M. sativa. Pachytene chromosomes corresponding to this M. sativa complement can be recognized in species related to M. sativa.

Language

English

L11 ANSWER 27 OF 29 BIOSIS COPYRIGHT (c) 2007 The Thomson Corporation on STN

Title

Trisomics in diploid alfalfa : L Production, fertility and transmission.

Source

CHROMOSOMA, (1967) Vol. 21, No. 3, pp. 232-242.

Abstract

Eight triploids were produced by pollinating male sterile alfalfa tetraploids with diploid lines of closely related "species " involving Medicago sativa , M. falcata and M. coerulea. Seeds were produced on all but one of the triploids by crossing them with diploid and tetraploid lines. Primary trisomic plants were obtained from the crosses with diploid lines and studies on their fertility and trisomic transmission are reported A brief review of the cytogenetic evidence indicates that the closely related "species " involved in these trisomics appear to be forms of a single polymorphic species and that cultivated tetraploid alfalfa behaves essentially as an autotetraploid. Thus, it is proposed that linkage groups established with these diploid trisomics will also represent the linkage groups of cultivated alfalfa. ABSTRACT AUTHORS: Authors

Language

Unavailable

L11 ANSWER 28 OF 29 BIOSIS COPYRIGHT (c) 2007 The Thomson Corporation on STN

Title

Cytological studies in alfalfa polyploids.

Source

CANADIAN JOUR BOT, (1954) Vol. 32, No. 4, pp. 531-542.

Abstract

Normal tetraploid alfalfa , Medicago sativa L., is characterized by meiotic irregularities consisting of a low percentage of univalents, trivalents, and quadrivalents. While these irregularities might suggest an autoploid origin, their frequency is too low to be conclusive. Cytological studies of the induced octoploid and of the hexaploid, obtained from crossing tetraploid and octoploid, indicate that the two genomes in the tetraploid are only partially homologous. The partial homology is established by the meiotic behavior in the hexaploid in which a low univalent frequency indicates a correspondingly low chiasma frequency at pachytene. Nevertheless this quadrivalent frequency in the

octoploid is more than three times as high as in the tetraploid which suggests a lack of complete homology between the two genomes. The theory is advanced that tetraploid species of Medicago originated from crosses between a series of diploid species fairly similar cytologically out differing in well marked, morphological characters. This affords an explanation for the inheritance of some characters in a disomic and others in a tetrasomic manner. Cytological and genetic evidence thus points to tetraploid alfalfa as originating as an alloploid from closely related diploid species. ABSTRACT AUTHORS: Auth. abst

Language

Unavailable

L11 ANSWER 29 OF 29 HCAPLUS COPYRIGHT 2007 ACS on STN

Title

The production of tyrosinase among species of Rhizobium and related organisms

Source

Zentr. Bakt. Parasitenk (1933), II Abt. 88, 302-4

Abstract

Of the root-nodule bacteria, some cross inoculation groups, notably the bean, alfalfa and soy-bean groups, showed a higher percentage of cultures producing tyrosinase than did others.

Language

Unavailable

2.0 Interspecific, Hybrid, & Alfalfa Terms in English – Title Only

L29 ANSWER 1 OF 157 AGRICOLA Compiled and distributed by the National Agricultural Library of the Department of Agriculture of the United States

Title

Interspecific hybrids between Medicago sativa L. and annual Medicago containing Alfafa weevil resistance.

L29 ANSWER 2 OF 157 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 1

Title

Interspecific hybrids between Medicago sativa L. and annual Medicago containing Alfalfa weevil resistance.

L29 ANSWER 3 OF 157 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 2

Title

Potential to increase yield in lucerne (Medicago sativa subsp. sativa) through introgression of Medicago sativa subsp. falcata into Australian adapted material.

L29 ANSWER 4 OF 157 AGRICOLA Compiled and distributed by the National Agricultural Library of the Department of Agriculture of the United States

Title

White clover (Trifolium repens) and associated viruses in the subalpine region of south-eastern Australia: implications for GMO risk assessment.

L29 ANSWER 5 OF 157 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 3

Title

New mitochondrial genome organization in three interspecific somatic hybrids of Medicago sativa including the parent-specific amplification of substoichiometric mitochondrial DNA units.

L29 ANSWER 6 OF 157 CABA COPYRIGHT 2007 CABI on STN

Title

Compounds and genes for enhanced protein assimilation and digestibility in forage legumes: altering condensed tannins content in the leaves of forage legumes.

L29 ANSWER 7 OF 157 CABA COPYRIGHT 2007 CABI on STN

Title

A study of the mitochondrial DNA rearrangements in three interspecific somatic hybrids of Medicago sativa.

L29 ANSWER 8 OF 157 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 4

Title

Molecular analysis of genetic variation among alfalfa (Medicago sativa L.) and Medicago ruthenica clones.

L29 ANSWER 9 OF 157 CABA COPYRIGHT 2007 CABI on STN

Title

Inheritance and mapping of 2n-egg production in diploid alfalfa.

L29 ANSWER 10 OF 157 CABA COPYRIGHT 2007 CABI on STN

Title

Molecular tagging of the Am gene from Lycopersicon hirsutum f. glabratum PI 134417 using AFLP markers.

L29 ANSWER 11 OF 157 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 5
Title

Estimation of host-strain compatibility for symbiotic N-fixation between Rhizobium meliloti, several annual species of Medicago and Medicago sativa.

L29 ANSWER 12 OF 157 AGRICOLA Compiled and distributed by the National Agricultural Library of the Department of Agriculture of the United States
Title

AFLP fingerprinting in Medicago spp.: its development and application in linkage mapping.

L29 ANSWER 13 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title

Chloroplast-transgenic plants are not a gene flow panacea.

L29 ANSWER 14 OF 157 BIOSIS COPYRIGHT (c) 2007 The Thomson Corporation on STN
Title

Breeding methods for forage legumes.

L29 ANSWER 15 OF 157 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 6
Title

Chromosomal and molecular rearrangements in somatic hybrids between tetraploid Medicago sativa and diploid Medicago falcata.

L29 ANSWER 16 OF 157 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 7
Title

A repetitive and species-specific sequence as a tool for detecting the genome contribution in somatic hybrids of the genus Medicago.

L29 ANSWER 17 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title

Karyotypic analysis of C-banded chromosomes of diploid alfalfa : Medicago sativa ssp. caerulea and ssp. falcata and their hybrid.

L29 ANSWER 18 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title

The incidence of alfalfa mosaic virus in breeding material of Medicago ssp. and its transmission by seeds.

L29 ANSWER 19 OF 157 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 8
Title

Quantitative comparison of volatile compounds among seven Medicago spp. accessions.

L29 ANSWER 20 OF 157 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 9
Title

The fate of ribosomal genes in three interspecific somatic hybrids of Medicago sativa : three different outcomes including the rapid amplification of new spacer-length variants.

L29 ANSWER 21 OF 157 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 10
Title

Transgenic plantlets of 'Chancellor' grapevine (Vitis sp.) from biolistic transformation of embryogenic cell suspensions.

L29 ANSWER 22 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title

Cytogeography of Medicago falcata L. and M. sativa L. in Switzerland.

L29 ANSWER 23 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title

Ten years of research on Medicago at 'Instituto di Ricerche sul Miglioramento Genetico delle Painte Foraggere del CNR di Perguia'.

L29 ANSWER 24 OF 157 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 11
Title

A chromosome atlas and interspecific-intergenic index for Lotus and Tetragonolobus (Fabaceae).

L29 ANSWER 25 OF 157 AGRICOLA Compiled and distributed by the National Agricultural Library of the Department of Agriculture of the United States
Title

Cytological, morphological and molecular analysis of controlled progenies from meiotic mutants of alfalfa producing unreduced gametes.

L29 ANSWER 26 OF 157 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 12
Title

Molecular, cytological and morpho-agronomical characterization of hexaploid somatic hybrids in Medicago.

L29 ANSWER 27 OF 157 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 13
Title
Registration of C-25, C-26, and C-27 alfalfa germplasms.

L29 ANSWER 28 OF 157 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 14
Title
Registration of C-28, C-29, C-30, and C-31 alfalfa germplasms.

L29 ANSWER 29 OF 157 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 15
Title
Unreduced gametes in ball clover and its relevance in white clover breeding.

L29 ANSWER 30 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Forage variety performance tests 1992-1993.

L29 ANSWER 31 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
ENOD12 gene expression as a molecular marker for comparing Rhizobium-dependent and -independent nodulation in alfalfa.

L29 ANSWER 32 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Registration of KS224 glandular-haired alfalfa germplasm with multiple pest resistance.

L29 ANSWER 33 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Identification of meiotic mutants producing 2n pollen in the Medicago sativa complex.

L29 ANSWER 34 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Evaluation of perennial pasture legumes for a central Victorian hill environment.

L29 ANSWER 35 OF 157 AGRICOLA Compiled and distributed by the National Agricultural Library of the Department of Agriculture of the United States

Title

Diapause dynamics and host plant utilization of Colias philodice, Colias interior and their hybrids (Lepidoptera: Pieridae).

L29 ANSWER 36 OF 157 CABA COPYRIGHT 2007 CABI on STN

Title

Forage variety performance tests 1991-1992.

L29 ANSWER 37 OF 157 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 16

Title

Potential of trispecies bridge crosses and random amplified polymorphic DNA markers for introgression of Medicago daghestanica and M. pironae germplasm into alfalfa (M. sativa).

L29 ANSWER 38 OF 157 CABA COPYRIGHT 2007 CABI on STN

Title

Pollen morphology as a tool for determining interspecific relationships in the genus Medicago.

L29 ANSWER 39 OF 157 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 17

Title

Karyotype and C-banding in Medicago noeana Boiss., Leguminosae.

L29 ANSWER 40 OF 157 CABA COPYRIGHT 2007 CABI on STN

Title

New interspecific hybrids in the genus Medicago through in vitro culture of fertilized ovules.

L29 ANSWER 41 OF 157 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 18

Title

Production of interspecific somatic hybrid plants in the genus Medicago through protoplast fusion.

L29 ANSWER 42 OF 157 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 19

Title

Accumulation of potato virus Y is enhanced in Solanum brevidens also infected with tobacco mosaic virus or potato spindle tuber viroid.

L29 ANSWER 43 OF 157 MEDLINE on STN
Title
A PCR-based method of identifying species-specific repeated DNAs.

L29 ANSWER 44 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Production of interspecific hybrid plants in the genus Medicago through embryo rescue.

L29 ANSWER 45 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
The possibility of hybridization [between] Medicago varia Mart. and annual species of lucerne.

L29 ANSWER 46 OF 157 BIOSIS COPYRIGHT (c) 2007 The Thomson Corporation on STN
Title
Chromosome manipulations and genetic analysis in Medicago.

L29 ANSWER 47 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Performance of induced polyploids in North American forages.

L29 ANSWER 48 OF 157 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 20
Title
The importance of endosperm balance number in potato breeding and the evolution of tuber-bearing Solanum species.

L29 ANSWER 49 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Genome manipulation and molecular genetic analysis of alfalfa (Medicago sativa L.).

L29 ANSWER 50 OF 157 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 21
Title
Somatic hybrids of the forage legumes Medicago sativa L. and M. falcata L.

L29 ANSWER 51 OF 157 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 22
Title
Segregation of molecular markers supports an allotetraploid structure for Medicago sativa X Medicago papillosa interspecific hybrid.

L29 ANSWER 52 OF 157 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 23
Title

Protoplast fusion in the genus Medicago and isoenzyme analysis of parental and somatic hybrid cell lines.

L29 ANSWER 53 OF 157 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 24
Title

Use of northern alfalfa as donor of valuable properties.

L29 ANSWER 54 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title

Interspecific somatic hybrid plants in the genus Medicago developed through protoplast fusion.

L29 ANSWER 55 OF 157 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 25
Title

Comparison of pod-wall characteristics with seed damage and resistance to the alfalfa seed chalcid (Hymenoptera: Eurytomidae) in Medicago species.

L29 ANSWER 56 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title

Backcrossing tetraploidy into diploid Medicago falcata L. using 2n eggs.

L29 ANSWER 57 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title

Paternal inheritance of plastids in the genus Daucus.

L29 ANSWER 58 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title

Survival and growth of globemallow [Sphaeralcea] species in dryland spaced-plant nurseries.

L29 ANSWER 59 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title

Forage breeding in Taiwan.

L29 ANSWER 60 OF 157 CABA COPYRIGHT 2007 CABI on STN

Title

Recurrent phenotypic selection for low grasshopper food preference in rangeland alfalfa.

L29 ANSWER 61 OF 157 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 26

Title

Selection of interspecific somatic hybrids of Medicago by using Agrobacterium-transformed tissues.

L29 ANSWER 62 OF 157 CABA COPYRIGHT 2007 CABI on STN

Title

Field resistance of perennial glandular-haired Medicago strains and alfalfa cultivars to the alfalfa weevil.

L29 ANSWER 63 OF 157 CABA COPYRIGHT 2007 CABI on STN

Title

Identification of 2n and 4n gamete producers in an experimental population of diploid Medicago.

L29 ANSWER 64 OF 157 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 27

Title

Resistance to viruses in Trifolium interspecific hybrids related to white clover.

L29 ANSWER 65 OF 157 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 28

Title

A potential solution to the chromosome instability problem in hexaploid alfalfa , Medicago sativa L.

L29 ANSWER 66 OF 157 CABA COPYRIGHT 2007 CABI on STN

Title

Transfer of genes for aphid resistance from Medicago truncatula (barrel medic) via M. littoralis (strand medic) to M. tornata (disc medic).

L29 ANSWER 67 OF 157 CABA COPYRIGHT 2007 CABI on STN

Title

Potential uses of embryo culture derived interspecific hybrids of alfalfa (Medicago sativa L.).

L29 ANSWER 68 OF 157 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 29

Title

Allotetraploid behavior of hybrids of Medicago sativa L. and M. papillosa Boiss.

L29 ANSWER 69 OF 157 CABA COPYRIGHT 2007 CABI on STN

Title

Cytology and cytogenetics of alfalfa.

L29 ANSWER 70 OF 157 CABA COPYRIGHT 2007 CABI on STN

Title

Alfalfa and alfalfa improvement.

L29 ANSWER 71 OF 157 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 30

Title

Tissue culture selection for disease resistant plants.

L29 ANSWER 72 OF 157 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 31

Title

Electric field mediated fusion of protoplasts of Medicago sativa L. and Medicago arborea L.

L29 ANSWER 73 OF 157 AGRICOLA Compiled and distributed by the National Agricultural Library of the Department of Agriculture of the United States

Title

Interspecific hybrid lines of M. sativa and M. arborea by protoplast electrofusion.

L29 ANSWER 74 OF 157 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 32

Title

Dominant expression of a gene amplification-related herbicide resistance in medicago cell hybrids.

L29 ANSWER 75 OF 157 CABA COPYRIGHT 2007 CABI on STN

Title

Electrofusion of protoplasts and heterokaryon survival in the genus Medicago.

L29 ANSWER 76 OF 157 CABA COPYRIGHT 2007 CABI on STN

Title

Methods for the selection of interspecific somatic hybrids in the genus Medicago.

L29 ANSWER 77 OF 157 LIFESCI COPYRIGHT 2007 CSA on STN
Title
Cytology and cytogenetics of alfalfa. ALFALFA AND ALFALFA IMPROVEMENT.

L29 ANSWER 78 OF 157 AGRICOLA Compiled and distributed by the National Agricultural Library of the Department of Agriculture of the United States
Title
Forage breeding to improve yield and quality.

L29 ANSWER 79 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Preliminary analysis of chromosome stability in hexaploid hybrids of Medicago sativa X M. papillosa.

L29 ANSWER 80 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Independent inheritance of genes conditioning resistance to Phytophthora root rot from diploid and tetraploid alfalfa.

L29 ANSWER 81 OF 157 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 33
Title
Cytogenetic analysis of interspecific hybrids between alfalfa (Medicago sativa L.) and M. rhodopea Velen.

L29 ANSWER 82 OF 157 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 34
Title
Mitochondrial and chloroplast DNA analysis of interspecific somatic hybrids of a Leguminosae: Medicago (alfalfa).

L29 ANSWER 83 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Plant regeneration from cotyledon protoplasts of wild Medicago species.

L29 ANSWER 84 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Xerophytism in Medicago.

L29 ANSWER 85 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Selection for improved nutritional quality of alfalfa forage.

L29 ANSWER 86 OF 157 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 35
Title
Interspecific hybridization of perennial Medicago species using ovule-embryo culture.

L29 ANSWER 87 OF 157 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 36
Title
Interspecific relations and the breeding of pasture plants for semiarid regions.

L29 ANSWER 88 OF 157 BIOSIS COPYRIGHT (c) 2007 The Thomson Corporation on STN
Title
FORAGE DRY MATTER ACCUMULATION AND QUALITY OF TURNIP BRASSICA-RAPA SWEDE RAPE BRASSICA-NAPUS CHINESE CABBAGE BRASSICA-CAMPESTRIS HYBRIDS AND KALE BRASSICA-OLERACEA IN THE EASTERN USA.

L29 ANSWER 89 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Registration of 81IND-2 glandular-haired alfalfa germplasm.

L29 ANSWER 90 OF 157 AGRICOLA Compiled and distributed by the National Agricultural Library of the Department of Agriculture of the United States
Title
Hybrids between Medicago taxa in lucerne breeding.

L29 ANSWER 91 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Unreduced gametes in diploid Medicago and their importance in alfalfa breeding.

L29 ANSWER 92 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Unreduced gametes production in Medicago spp.: analysis of morphological and cytological behaviour of F1 hybrids from 2x.4x and 4x.2x crosses.

L29 ANSWER 93 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Inheritance of density of erect glandular trichomes in the genus Medicago.

L29 ANSWER 94 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Alfalfa seed chalcid (Hymenoptera: Eurytomidae) infestation trials in annual Medicago.

L29 ANSWER 95 OF 157 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 37
Title
Interspecific hybridization of Medicago sativa L. and M. rupestris M. B. using ovule-embryo culture.

L29 ANSWER 96 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Verticillium wilt of alfalfa , background and current research.

L29 ANSWER 97 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Analytic breeding of alfalfa for resistance to Phytophthora root rot.

L29 ANSWER 98 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Registration of A169, A224, A603, A604, N.S. 31, N.S. 33, N.S. 46, and N.S. 47 broad-crowned or creeping-rooted alfalfa germplasms.

L29 ANSWER 99 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Use of meiotic analysis to describe genomic affinities in Medicago.

L29 ANSWER 100 OF 157 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 38
Title
Uneven ploidy levels and a reproductive mutant required for interspecific hybridization of Medicago sativa L. X Medicago dzhawakhetica Bordz.

L29 ANSWER 101 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Influence of drought stress on genetic variances of alfalfa and wheatgrass seedlings.

L29 ANSWER 102 OF 157 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 39
Title
Laboratory evaluation of medics for resistance to lucerne weevil.

L29 ANSWER 103 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Screening of Medicago species for resistance to alfalfa weevil.

L29 ANSWER 104 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Reproductive characteristics of hexaploid alfalfa derived from 3x X 6x crosses.

L29 ANSWER 105 OF 157 BIOSIS COPYRIGHT (c) 2007 The Thomson Corporation on STN
Title
IN-VITRO CULTURE OF PODS FROM ANNUAL AND PERENNIAL MEDICAGO SPECIES.

L29 ANSWER 106 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Interspecific hybrids of perennial Medicago species produced via ovule-embryo culture.

L29 ANSWER 107 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Analytic breeding of alfalfa : selection and breeding at the diploid level for resistance to Phytophthora megasperma f. sp. medicaginis.

L29 ANSWER 108 OF 157 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 40
Title
Sources of resistance to spotted alfalfa aphid (Therioaphis maculata Buckton) in medics.

L29 ANSWER 109 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Genetic variances of alfalfa and wheatgrass populations grown under water application gradients.

L29 ANSWER 110 OF 157 CABA COPYRIGHT 2007 CABI on STN

Title

Interspecific hybridization of alfalfa (Medicago sativa) and M. rupestris.

L29 ANSWER 111 OF 157 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 41

Title

Light and electron microscopy of embryo development in an annual X perennial Medicago species cross.

L29 ANSWER 112 OF 157 AGRICOLA Compiled and distributed by the National Agricultural Library of the Department of Agriculture of the United States

Title

Pollen germination and pollen tube growth following self-pollination and intra-and interspecific pollination of Medicago species [Includes Medicago sativa , alfalfa , fertilization, interspecific crosses].

L29 ANSWER 113 OF 157 BIOSIS COPYRIGHT (c) 2007 The Thomson Corporation on STN DUPLICATE 42

Title

GENETICS CYTOLOGY AND CROSSING BEHAVIOR OF AN ALFALFA MEDICAGO -SATIVA MUTANT RESULTING IN FAILURE OF THE POST MEIOTIC CYTOKINESIS.

L29 ANSWER 114 OF 157 CABA COPYRIGHT 2007 CABI on STN

Title

Breeding alfalfa for tolerance to multiple cutting.

L29 ANSWER 115 OF 157 CABA COPYRIGHT 2007 CABI on STN

Title

Description of several variants observed in plant introductions being increased at Reno, Nevada.

L29 ANSWER 116 OF 157 CABA COPYRIGHT 2007 CABI on STN

Title

Efficient hybridization of Medicago dzhawakhetica and M. sativa using a M. sativa mutant lacking post-meiotic cytokinesis.

L29 ANSWER 117 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Hexaploid alfalfa derived from 3x X 6x crosses: a status report.

L29 ANSWER 118 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Testing a heterozygous block concept in advanced generations of Medicago sativa - M. falcata hybrids.

L29 ANSWER 119 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Hybrids from diploid X tetraploid crosses in Medicago studied at two ploidy levels.

L29 ANSWER 120 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Studies on the breeding behavior of alfalfa , Medicago sativa L.: I. Selection in two allele populations of tetraploid alfalfa. II. Mechanism of 2n egg production. III. Test of a heterozygous block hypothesis in M. sativa - M. falcata hybrids.

L29 ANSWER 121 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Heinrichs alfalfa.

L29 ANSWER 122 OF 157 LIFESCI COPYRIGHT 2007 CSA on STN
Title
A perennnial x annual Medicago cross.

L29 ANSWER 123 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
The inheritance of 2n pollen formation in diploid alfalfa Medicago sativa.

L29 ANSWER 124 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Tetrasomic segregation for multiple alleles in alfalfa.

L29 ANSWER 125 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Transfer of glandular hairs from diploid Medicago prostrata to tetraploid M. sativa.

L29 ANSWER 126 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Hybridization of crop plants.

L29 ANSWER 127 OF 157 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 43
Title
Production of two species and two interspecific hybrids of phalaris under irrigation in south-west New South Wales.

L29 ANSWER 128 OF 157 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 44
Title
Mating between Pratylenchus penetrans and P. fallax in sterile culture.

L29 ANSWER 129 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Genus Medicago (Leguminosae): a taxogenetic study.

L29 ANSWER 130 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Cytology and breeding of hexaploid alfalfa. I. Stability of chromosome number.

L29 ANSWER 131 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Influence of genetical and non-genetical sources of variability on number of eggs in lucerne ovaries.

L29 ANSWER 132 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Cultivated alfalfa at the diploid level: origin, reproductive stability, and yield of seed and forage.

L29 ANSWER 133 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Disease and insect resistance in cultivated grapes.

L29 ANSWER 134 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Saponins of the genus Medicago.

L29 ANSWER 135 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Classified list of herbage varieties England and Wales 1977/78.

L29 ANSWER 136 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Cytological analysis and electrophoretic patterns of seed proteins in Medicago sativa , Medicago glutinosa and their hybrids.

L29 ANSWER 137 OF 157 AGRICOLA Compiled and distributed by the National Agricultural Library of the Department of Agriculture of the United States
Title
Interspecific crosses between Rhizobium leguminosarum and Rhizobium meliolti: Formation of haploid recombinants and of R-primes [Nodule bacteria, inoculation tests with peas and lucerne]

L29 ANSWER 138 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Attempted interspecific hybridization of Medicago scutellata and M. sativa.

L29 ANSWER 139 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Alfalfa germplasm in the United States: genetic vulnerability, use, improvement, and maintenance.

L29 ANSWER 140 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Classified list of herbage varieties in England and Wales 1976/77.

L29 ANSWER 141 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Medicago falcata L. X M. sativa L. (lucerne) Cv. Walkabout (Reg. Number B-8b-2).

L29 ANSWER 142 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Some factors affecting production of two species and two interspecific hybrids of Phalaris under irrigation.

L29 ANSWER 143 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Registration of alfalfa germplasm from cultivated X wild hybrids.

L29 ANSWER 144 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Fodder improvement in Pennisetums.

L29 ANSWER 145 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Polyploidy in alfalfa breeding.

L29 ANSWER 146 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Breeding lucerne (Medicago sativa L.) with higher tolerance to water logging.

L29 ANSWER 147 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Reduction of chromosome number in root tip cells of Medicago.

L29 ANSWER 148 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Lucerne.

L29 ANSWER 149 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Inheritance of the level of substances inhibiting Trichoderma viridis development in local populations of alfalfa.

L29 ANSWER 150 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title
Chromosome homology at pachytene in diploid Medicago sativa , M. falcata and their hybrids.

L29 ANSWER 151 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title

Interspecific crosses involving alfalfa. VII. Medicago sativa X M. rhodopea.

L29 ANSWER 152 OF 157 CABA COPYRIGHT 2007 CABI on STN
Title

Cytology and evolution of the Medicago sativa -falcata complex.

L29 ANSWER 153 OF 157 AGRICOLA Compiled and distributed by the National Agricultural Library of the Department of Agriculture of the United States
Title

Interspecific crosses involving alfalfa. VII. Medicago sativa X Medicago rhodopea

L29 ANSWER 154 OF 157 AGRICOLA Compiled and distributed by the National Agricultural Library of the Department of Agriculture of the United States
Title

Interspecific hybrids involving alfalfa. VI. Ineffectiveness of alloploidy in induction fertility in Medicago pironae x Medicago daghestanica hybrids

L29 ANSWER 155 OF 157 AGRICOLA Compiled and distributed by the National Agricultural Library of the Department of Agriculture of the United States
Title

Interspecific crosses involving alfalfa. V. Medicago saxatilis x Medicago sativa with reference to Medicago cancellata and Medicago rhodopaea

L29 ANSWER 156 OF 157 AGRICOLA Compiled and distributed by the National Agricultural Library of the Department of Agriculture of the United States
Title

First generation crosses between two alfalfa species.

L29 ANSWER 157 OF 157 BIOSIS COPYRIGHT (c) 2007 The Thomson Corporation on STN
Title

Pollen morphology as a tool for determining interspecific relationships in the genus Medicago.

3.0 Interspecific, Hybrid, & Alfalfa Terms not in English – Title Only

L48 ANSWER 1 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
[Genome analysis by molecular markers: III. Analysis of gene expression]. Analisi del genoma mediante marcatori molecolari: III. Studio dell'espressione genica.

L48 ANSWER 2 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
[Forage crops: 1998 varietal list]. Colture foraggere: liste varietali 1998.

L48 ANSWER 3 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
Inter-species hybridization of alfalfa as the means to develop new species for the conditions of Ukranian Polissya News of agrarian science.

L48 ANSWER 4 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
[National catalogue of varieties]. Catalogo nacional de variedades.

L48 ANSWER 5 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
Kinetics of cell polyploidization in primary callus of different lucerne genotypes.

L48 ANSWER 6 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
[Resistance of interspecific hybrids of Medicago spp. and Trifolium spp. to some virus pathogens]. Rezistence mezidruhovych hybridu Medicago spp. a Trifolium spp. k nekterym virovym patogenum.

L48 ANSWER 7 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
[Trials of herbage plants, root crops, maize, green fodder plants and potatoes 1994]. Afpr<o>vning af graesmarks- og baelgplanter, rodfrugter, majs, gr<o>nfoderplanter og kartofler 1994.

L48 ANSWER 8 OF 95 CABA COPYRIGHT 2007 CABI on STN

Title

Cytokaryological characterization of the lucerne species Medicago lupulina L., Medicago borealis Grossch. and their somatic hybrid, as an evaluation of source material for breeding for fodder value.

L48 ANSWER 9 OF 95 CABA COPYRIGHT 2007 CABI on STN

Title

[Varieties of herbage plants, root crops, maize, green fodder plants and potatoes 1993]. Sorter af graesmarksplanter, rodfrugter, majs, gr<o>nfoderplanter og kartofler 1993.

L48 ANSWER 10 OF 95 CABA COPYRIGHT 2007 CABI on STN

Title

[Interspecific crossing in lucerne]. Krzyzowanie miedzygatunkowe lucerny.

L48 ANSWER 11 OF 95 CABA COPYRIGHT 2007 CABI on STN

Title

Production of lucerne breeding material of the cutting type by means of distant hybridization.

L48 ANSWER 12 OF 95 CABA COPYRIGHT 2007 CABI on STN

Title

[Annual report, July 1988 - end 1990]. Rapport d'activite scientifique, juillet 1988 - fin 1990.

L48 ANSWER 13 OF 95 BIOSIS COPYRIGHT (c) 2007 The Thomson Corporation on STN

Title

OBTAINING ASYMMETRICAL SOMATIC HYBRIDS IN THE GENUS MEDICAGO.

L48 ANSWER 14 OF 95 CABA COPYRIGHT 2007 CABI on STN

Title

Use of Medicago borealis as a donor of useful traits.

L48 ANSWER 15 OF 95 CABA COPYRIGHT 2007 CABI on STN

Title

[New lucerne variety NS-Novosaanka H11]. Nova sorta lucerke NS-Novosaanka H11.

L48 ANSWER 16 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
New varieties of perennial herbage crops.

L48 ANSWER 17 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
Ecological and genetic parameters of survival and shoot production in lucerne plants.

L48 ANSWER 18 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
Biotechnological methods of producing valuable forms of perennial fodder legumes.

L48 ANSWER 19 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
Results of using interspecific and intergeneric hybridization in breeding perennial herbage crops.

L48 ANSWER 20 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
Sources of disease resistance in lucerne.

L48 ANSWER 21 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
Evaluation of the combining ability of varieties and heterosis effects in lucerne hybrids produced using cytoplasmic male sterility (CMS).

L48 ANSWER 22 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
Patterns in the expression of heterosis and the gene pool of fodder crops.

L48 ANSWER 23 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
[Prerequisites for the use of heterosis and synthetic populations in fodder crops]. Predpoklady vyuzivani heteroze a syntetickych populaci u picnin.

L48 ANSWER 24 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
Comparative evaluation of hybrid lucerne varieties.

L48 ANSWER 25 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
Heritability and variation in content of amino acids and protein in lucerne hybrids.

L48 ANSWER 26 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
Tests with promising lucerne cultivars on solonetzic soils.

L48 ANSWER 27 OF 95 BIOSIS COPYRIGHT (c) 2007 The Thomson Corporation on STN
Title
POLLEN FERTILITY IN ALFALFA PARENTS AND INTERSPECIFIC HYBRIDS.

L48 ANSWER 28 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
Promising source material of perennial leguminous crops for breeding in the steppe zone of northern Kazakhstan.

L48 ANSWER 29 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
Using induced polyploidy in breeding lucerne species of different chromosome numbers.

L48 ANSWER 30 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
Primary problems in studying and utilizing the gene pool of fodder crops.

L48 ANSWER 31 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
Producing single and complex lucerne hybrids.

L48 ANSWER 32 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
Root rot pathogens in lucerne and crop resistance to them.

L48 ANSWER 33 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
Breeding lucerne for resistance to diseases and high yield.

L48 ANSWER 34 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
Polyploidy and interspecific hybrids of lucerne.

L48 ANSWER 35 OF 95 BIOSIS COPYRIGHT (c) 2007 The Thomson Corporation on STN
Title
USE OF IN-VITRO METHODS IN BREEDING PROGRAMS FOR DISEASE RESISTANCE IN PLANTS.

L48 ANSWER 36 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
Results and methods of breeding lucerne for increased seed production.

L48 ANSWER 37 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
Breeding perennial herbage crops in the Ukraine.

L48 ANSWER 38 OF 95 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 1
Title
Use of induced polyploidy and interspecific hybridization in producing lucerne breeding material.

L48 ANSWER 39 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
Evaluation of lucerne species and varieties for pod and seed set using the topcross method.

L48 ANSWER 40 OF 95 LIFESCI COPYRIGHT 2007 CSA on STN
Title
Somatic hybridization between Medicago sativa L. and Medicago falcata L.

L48 ANSWER 41 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
Main results and prospects in genetical studies with perennial herbage crops.

L48 ANSWER 42 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
Breeding lucerne for yield and quality. Methods of producing and evaluating hybrids for pastures.

L48 ANSWER 43 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
Polyploidy and distant hybridization in breeding lucerne.

L48 ANSWER 44 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
Breeding lucerne for quality.

L48 ANSWER 45 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
Lucerne Donskaya 1.

L48 ANSWER 46 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
Results of breeding perennial leguminous herbage crops for flood plains.

L48 ANSWER 47 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
Fodder yield of synthetic lucerne populations.

L48 ANSWER 48 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
Culture of cells, tissues and reproductive organs in breeding herbage crops.

L48 ANSWER 49 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
Mobilization of fodder plant resources in Kazakhstan.

L48 ANSWER 50 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
Evaluation of pasture-type lucerne hybrids in pasturage and simulated grazing.

L48 ANSWER 51 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
[Morphological and biological features of lucerne in relation to seed yield]. Morfologicko-biologicka charakteristika vojtesky ve vztahu k vynosu semene.

L48 ANSWER 52 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
Initial material for producing heterotic lucerne hybrids.

L48 ANSWER 53 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
Pod and seed set in top crosses of different varieties and hybrids of lucerne.

L48 ANSWER 54 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
Some characteristics of seed set following intervarietal crosses of lucerne.

L48 ANSWER 55 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
Production and evaluation of lucerne hybrids of the pasture type.

L48 ANSWER 56 OF 95 AGRICOLA Compiled and distributed by the National Agricultural Library of the Department of Agriculture of the United States
Title
Results of studies of interspecific hybrids of alfalfa.

L48 ANSWER 57 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
Polyploidy in interspecific crosses of lucerne species differing in ploidy.

L48 ANSWER 58 OF 95 AGRICOLA Compiled and distributed by the National Agricultural Library of the Department of Agriculture of the United States
Title
Polyploidy in interspecific crossings of alfalfa species of different ploidy.

L48 ANSWER 59 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
Content and composition of aminoacids in the protein of hybrid lucerne.

L48 ANSWER 60 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
Breeding lucerne for resistance to frequent cutting during early stages of development.

L48 ANSWER 61 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
Breeding lucerne for the Nonchernozem Zone.

L48 ANSWER 62 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
Production of lucerne with branched inflorescence and intermediate falcate pods following the interspecific hybridization of Medicago sativa with M. falcata.

L48 ANSWER 63 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
Interspecific crosses of lucerne.

L48 ANSWER 64 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
Results of the collection and study of genetic resources of fodder plants.

L48 ANSWER 65 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
Main results of work in the field of genetics at the Institute of Cytology and Genetics of the Siberian Branch of the Soviet Academy of Sciences during 1971-75.

L48 ANSWER 66 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
Breeding lucerne for increased protein yield.

L48 ANSWER 67 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
New initial material of lucerne.

L48 ANSWER 68 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title

Features of the use of pollen-sterile lucerne plants in back crosses.

L48 ANSWER 69 OF 95 BIOSIS COPYRIGHT (c) 2007 The Thomson Corporation on STN
Title

INVESTIGATIONS ON FACTORS INFLUENCING SEED SET IN MEDICAGO-FALCATA AND INTERSPECIFIC HYBRIDS OF MEDICAGO-FALCATA X MEDICAGO -SATIVA.

L48 ANSWER 70 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title

Genetic resources of wild Medicago falcata in the USSR and their importance for breeding and production.

L48 ANSWER 71 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title

Some results of breeding and seed-production work with lucerne in Azerbaijan.

L48 ANSWER 72 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title

Initial material for the production of high-yielding varieties and heterotic hybrids of lucerne.

L48 ANSWER 73 OF 95 AGRICOLA Compiled and distributed by the National Agricultural Library of the Department of Agriculture of the United States
Title

Investigations on factors influencing seed set in Medicago falcata and interspecific hybrids of Medicago falcata X Medicago sativa [Alfalfa] Untersuchungen uber den samenansatz beeinflussende faktoren bei Medicago falcata und artbastarden M. falcata X M. Sativa

L48 ANSWER 74 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title

[Experiments in lucerne breeding in the USSR]. Erfahrungen bei der Luzernezuchtung in der UdSSR.

L48 ANSWER 75 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
Importance for breeding of wild species of lucerne. (Brief review).

L48 ANSWER 76 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
Resources of perennial forage plants in eastern Kazakhstan.

L48 ANSWER 77 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
[Species crosses in lucerne breeding at the Swedish Seed Association's Ultuna branch station]. Artkorsningar i lusernforadlingen vid Sveriges Utsadesforenings Ultanafilial.

L48 ANSWER 78 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
Lucerne hybrids displaying heterosis.

L48 ANSWER 79 OF 95 BIOSIS COPYRIGHT (c) 2007 The Thomson Corporation on STN
Title
INTERSPECIFIC CROSSES INVOLVING ALFALFA PART 7 MEDICAGO - SATIVA MEDICAGO-RHODOPEA HYBRID.

L48 ANSWER 80 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
Breeding and seed production of perennial herbage crops for the Far East.

L48 ANSWER 81 OF 95 CABA COPYRIGHT 2007 CABI on STN DUPLICATE 2
Title
Agronomic evaluation of interspecific crosses of Medicago spp.

L48 ANSWER 82 OF 95 CABA COPYRIGHT 2007 CABI on STN
Title
Initial material for breeding lucerne for frost resistance.

L48 ANSWER 83 OF 95 BIOSIS COPYRIGHT (c) 2007 The Thomson Corporation on STN
Title

INTERSPECIFIC HYBRIDS INVOLVING ALFALFA -D PART 6 INEFFECTIVENESS OF ALLO PLOIDY IN INDUCTION FERTILITY IN MEDICAGO-PIRONAE-D MEDICAGO DAGHESTANICA-D HYBRIDS.

L48 ANSWER 84 OF 95 BIOSIS COPYRIGHT (c) 2007 The Thomson Corporation on STN
Title

INTERSPECIFIC CROSSES INVOLVING ALFALFA -D PART 5 MEDICAGO-SAXATILIS-D X MEDICAGO -SATIVA -D WITH REFERENCE TO MEDICAGO-CANCELLATA-D AND MEDICAGO-RHODOPAEA-D.

L48 ANSWER 85 OF 95 BIOSIS COPYRIGHT (c) 2007 The Thomson Corporation on STN
Title

INTERSPECIFIC CROSSES INVOLVING ALFALFA -D IV MEDICAGO-GLOMERATA-D MEDICAGO -SATIVA -D WITH REFERENCE TO MEDICAGO-PROSTRATA-D.

L48 ANSWER 86 OF 95 BIOSIS COPYRIGHT (c) 2007 The Thomson Corporation on STN
Title

Intra- and intervariety crosses of Medicago sativa L. and Medicago falcata L.

L48 ANSWER 87 OF 95 BIOSIS COPYRIGHT (c) 2007 The Thomson Corporation on STN
Title

INTERSPECIFIC CROSSES FOR THE IMPROVEMENT OF LUCERNE -D MEDICAGO -SATIVA -D.

L48 ANSWER 88 OF 95 BIOSIS COPYRIGHT (c) 2007 The Thomson Corporation on STN
Title

Interspecific crosses involving alfalfa. III. Medicago sativa L. x M. prostrata Jacq.

L48 ANSWER 89 OF 95 BIOSIS COPYRIGHT (c) 2007 The Thomson Corporation on STN
Title

Interspecific crosses involving alfalfa. II. Medicago cancellata M. B. X Medicago sativa L.

L48 ANSWER 90 OF 95 BIOSIS COPYRIGHT (c) 2007 The Thomson Corporation on STN
Title

Interspecific crosses involving alfalfa. I. Medicago dzhawakhetica (Bordz.) Vass. X M. sativa L. and its peculiarities.

L48 ANSWER 91 OF 95 BIOSIS COPYRIGHT (c) 2007 The Thomson Corporation on STN
Title

Uchet entomofil'nosti pri vyvedenii sortov lyutsern Use of insect attraction in breeding lucerne varieties Number 80881. (Translation).

L48 ANSWER 92 OF 95 BIOSIS COPYRIGHT (c) 2007 The Thomson Corporation on STN
Title

Important wild forage plants of the northern Caucasus. Original Title: Vazheishie dikorastushchie kormovye rasteniya severnoge Kavkaza.

L48 ANSWER 93 OF 95 BIOSIS COPYRIGHT (c) 2007 The Thomson Corporation on STN
Title

Cytogenetics of forage crops.

L48 ANSWER 94 OF 95 BIOSIS COPYRIGHT (c) 2007 The Thomson Corporation on STN
Title

Interspecific hybridization in Medicago.

L48 ANSWER 95 OF 95 BIOSIS COPYRIGHT (c) 2007 The Thomson Corporation on STN
Title

Flower colour inheritance in diploid and tetraploid alfalfa.

Appendix I-4. Communication

1.0 Communication from E. Charles Brummer, Iowa State University, on Potential Natural Hybridization between Annual and Perennial Medics

From: ecbrummer@gmail.com [mailto:ecbrummer@gmail.com] **On Behalf Of** Charles Brummer
Sent: Tuesday, November 27, 2007 4:27 PM
To: Fitzpatrick, Sharie
Subject: Re: Annual medic X alfalfa, contd.

Hi Sharie,

You have my permission to use this letter as personal communication.

I have reviewed the Skalska et al. manuscript regarding hybridization of alfalfa with annual Medicago species. The limitations of the paper are significant as you describe below. I concur with all your statements below.

The major reservations I have about the paper, reiterating many that you have, are as follows:

1. Control self fertilization of the male sterile alfalfa plant to assess the potential for selfed seed production was not done--that is, the male sterility may not be complete.

2. Control hybridizations to other alfalfa (i.e., tetraploid Medicago sativa) plants was not done, so the potential hybridization efficiency is not noted.

3. No evidence is presented that the putative hybrids are actually hybrids and not selfs.

4. No evidence is presented that the putative hybrid seeds were viable and could germinate.

Therefore, I see no evidence in this paper that producing viable hybrids between tetraploid M. sativa and the annual species is possible, congruent with all previously published results that hybridization is not successful (with the exception of the Sangduen et al. paper, in which one sativa x scutellata plant was allegedly produced, but it was sterile and never replicated).

Let me know if you have other questions regarding this paper.

Best regards,

Charlie

On 11/28/07, **Fitzpatrick, Sharie** <SFitzpatrick@foragegenetics.com> wrote:

Dear Dr. Brummer:

Attached for your review are the original Skalska et al. paper and the Polish to English translation of the main text. Please review in detail.
With your permission, I would intend to use your reply letter to me as a "personal communication" citation as an expert's review of this publication.

My review of the data lead me to the conclusions stated below. Please reply with your agreement, edits or other comments regarding whether or not you view the data sufficient to determine whether or not there is evidence that Medicago sativa produced viable hybrid progeny with any of the annual species listed and whether in your view, any other data in the literature would support these findings or discount them.

There is no evidence that seeds were viable or an attempt to germinate them; in fact "most were of dark color" and "most embryos died out" which indicate that the developed seeds were non-viable seeds. All of the data are only measurements of seed development, count, size and color.

There is no genetic evidence that putative hybrid seeds were interspecific hybrids.

There was no proper negative control (i.e., no attempt to self pollinate the M. sativa seed-parent plants to determine if they were fully pollen-sterile; it is known that most male sterile plants leak some viable pollen that can result in a low frequency of selfed seed of low vigor). The putative hybrid seeds may have been the result of M. sativa self pollination; there is no proof that they were cross-pollinated.

For all annual species, this would be the only account of interspecific hybridization between annual medics and M. sativa by hand pollination,with the exception of those already noted in table II-1 from the 2004 Roundup Ready® alfalfa Petition (see excerpt attached for your convenience; table summarized from published data).

Inferring from the author's closing statement that, 'the results indicate the usefulness of future research into tissue culture and cytological and biochemical methods to eliminate embryo lethality, the author's do not use their data to state that hand-crossing or natural crossing is a viable method of M. sativa X annual species hybridization.

Authors specifically state that hand crosses to M. lupulina were unsuccessful. This data supports that M. sativa and M. lupulina do not form hybrids. This supports statements made in Petition appendix 4: " Expert Testimony of M. sativa with M. lupulina".

For perennial "species": All successful crosses were to other members of the M. sativa complex which is in agreement with Petition statements: i.e., M. hemicycla; M. coerula; M. falcata; M. glutinosa are synonyms for members of subspecies grouped within the M. sativa complex.

For the annual species listed below, this is the only account (except as noted for M. scutellata). Based on lack of evidence of viable hybrids, these putative hybridizations are unproven, in direct conflict with other literature, and should be discounted until proven.

M. aculeata
M. aculeata intermis
M. blancheana
M. coronata
M. hispida
M. intertexta
M. lacininata

M. murex
M. nigra
M. orbicularus
M. rotata
M. scutellata-- previously noted by Sangduen et al., 1982; single hybrid not fertile, died out
M. truncatula

Thank you for your time.

Sharie Fitzpatrick

Sharie Fitzpatrick, Forage Genetics International
Regulatory Affairs and Seed Quality Assurance for Biotech Traits
N5292 South Gills Coulee Road, West Salem, WI 54669
Telephone: 608-786-2121, Fax: 608-786-2193; Cell: 608-317-9810
sfitzpatrick@foragegenetics.com

--
E. Charles Brummer
Professor, Forage and Biomass Crop Breeding
Center for Applied Genetic Technologies
Crop and Soil Science Department
University of Georgia
111 Riverbend Rd.
Athens, GA 30602

706.542.8847 phone
706.583.8120 fax
brummer@uga.edu
http://www.cropsoil.uga.edu/brummer