Legumes of the Koffler Scientific Reserve and Their Rhizobia

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Abstract

In this document, we have consolidated information on the legumes of the Koffler Scientific Reserve (KSR, the University of Toronto's biological research station, 44° 01' N, 79° 31' W; King Township, ON, Canada) and their associated rhizobia. The list of associated rhizobia was originally compiled in 2020 by J. Wang under the supervision of J.R. Stinchcombe, J.A. Boyle, and T.L. Harrison, and previously has been distributed via the field station website.

The structure of the document is as follows. For each of 17 legume species found at KSR, as determined by the KSR plant species list (193), we provide: Latin binomial, common name, links to the Global Biodiversity Information Facility (GBIF), and then to any online collections of the species at the Royal Ontario Museum (ROM). Photographs, native or invasive status, annual or perennial habit, and flowering times are also provided. Photographic images were obtained from iNaturalist images with CC0 licenses (copyright restrictions removed). Images of species should not be considered definitive and are provided only for aid in identification.

The legume species described in this document are all capable of forming symbiotic relationships with rhizobia, a group of nitrogen-fixing soil bacteria. Rhizobia colonize plant roots and induce the formation of nodules within which they convert atmospheric nitrogen into a plant usable form, receiving nutrients from the host plant in return.

For each plant species, we searched the literature to determine their symbiotic rhizobial partners and a qualitative evaluation of rhizobia strain effectiveness. Strain effectiveness was qualitatively scored based on the description of rhizobia activity in root nodule formation and nitrogen fixation. The scoring is as follows: NA = Not described; 0 = Nodulating, fixation not described; 1 = Ineffective (nodulating, fix-); 2 = Partially effective (fix±); 3 = Very effective (fix+). One important thing to note is that these are rhizobial species known to associate with the plant species, as reported in the literature, rather than as documented at KSR

The list is provided to facilitate studies on plant-microbe interactions, mutualism ecology and evolution, plant-microbiome studies, and other areas of evolutionary ecology.

Amphicarpaea bracteata

Common name: Hog-peanut

- GBIF
- ROM


Native status: Native

Duration: Annual to perennial (short-lived)

Flowering: July to September

Growth habit: Forb/herb, Vine

Rhizobia:

Genus	Species	Strain	Effectiveness	Source
Bradyrhizobium	*B. amphicarpaeae*	39S1MB^{T}	1	1
	B. diazoefficiens	USDA110	1	2, 10
	B. elkanii	USDA76^{T}	3	3
	B. japonicum	USDA123	2	3
	B. ottawaense	OO99^{T}	1	2, 4
	B. sp. 323s2	1S5 323S2	1 1	10 10
	B. sp. 41S5	41S5	1	10
	B. sp. 6	1S3	1	10
	B. sp. 1S1	1S1	1	10

	B. sp. 2S1	2S1	1	10
	Bradyrhizobium sp.	abs7	NA	5
		abw9	NA	5
		ApB2	2	24
		ApB5	2	24
		ApT2	2	24
		bfs1b	3	6
		DesB1	3	24
		DesB3	3	24
		DesT1	2	24
		DesT10	3	24
		fcdes1	NA	5
		HM155	0	2
		jwc91-2	3	6
		jws91-2	3	6
		ky14	3	6
		ky6	3	6
		lds88-6	3	6
		onl92.10	NA	7
		onl92.6 (onl92-6)	3	6–7
		th.b2 (th-b2)	3	6–9
		th17	3	6, 24

Desmodium canadense

Common name: Showy tick-trefoil

- GBIF
- ROM


Native status: Native

Duration: Perennial

Flowering: June to September

Growth habit: Forb/herb

Rhizobia:

Genus	Species	Strain	Effectiveness	Source
Bradyrhizobium	*B. diazoefficiens*	USDA110	2	2, 10
	B. ottawaense	OO99^{T}	2	2, 4
	B. sp. 323s2	1S5 323S2	3 2	10 10
	B. sp. 41S5	41S5	2	10
	B. sp. 6	1S3	2	10
	B. sp. 1S1	1S1	2	10
	B. sp. 2S1	2S1	2	10
	Bradyrhizobium sp.	CIAM 3207 CIAM 3208 CIAM 3209	NA NA NA	11 11 11

		DcE2.8 EDC2.8 EDC3.6 HM155 UMR6437 UMR6617	NA NA NA 0 3 3	7 12 12 2 13–15 13–15
Ensifer (syn. *Sinorhizobium*)	*E. fredii*	B33 HH103 NGR234 (formerly *Rhizobium* sp.) SMH12 SMX11 USDA257	2 3 3 3 3 3	16 17 18–19 20 20 18
Rhizobium	*R. etli*	CFN234 CFN299 CFN42 F16	2 3 1 2	21–22 21 21 21
	R. tropici	CIAT 899^{T}	3	21
	Rhizobium sp.	BR816	1	21
Unidentified	Unidentified	UMN6439 UMR6404	0 0	23 23

Gleditsia triacanthos

Common name: Honey locust

- GBIF
- No online collections available at the ROM


Native status: Invasive

Duration: Perennial

Flowering: May to June

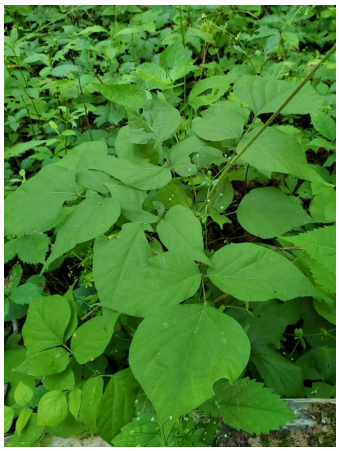
Growth habit: Shrub, Tree

Rhizobia:

Gleditsia triacanthos is a non-nodulating, nitrogen-fixing legume. It does not form root nodules (23) but is thought to fix atmospheric nitrogen. Rhizobia have been observed to form infection threads in root hairs, without the formation of nodules (24). An unidentified *Burkholderia* species was previously isolated from *G. triacanthos* but lacks nodA (25).

Hylodesmum glutinosum (syn. *Desmodium glutinosum*)
Common name: Glutinous tick-trefoil, Pointed-leaved tick-trefoil

- GBIF
- ROM




Native status: Native
Duration: Perennial
Flowering: June to August
Growth habit: Forb/herb

Rhizobia:

Genus	Species	Strain	Effectiveness	Source
Bradyrhizobium	*B.* sp. 323s2	1S5	1	10
	B. sp. 41S5	41S5	1	10
	B. sp. 6	1S3	1	10
	B. sp. 1S1	1S1	1	10
	B. sp. 2S1	2S1	1	10
	Bradyrhizobium sp.	ApB16 ApT2 DesB1–B15 DesT1–T18 fcdes1 jwc91-2 th-b2	NA NA NA NA NA NA 3	27 27 27 7, 27 5 27 9, 27

Lotus corniculatus

Common name: Bird's-foot trefoil

- GBIF
- ROM


Native status: Non-native

Duration: Perennial

Flowering: April to September

Growth habit: Forb/herb

Rhizobia:

Genus	Species	Strain	Effectiveness	Source
Bradyrhizobium	*Bradyrhizobium* sp.	15LBIV CC814s NZP2192 NZP2257	NA NA NA 3	28 29 30 30–31
Ensifer (syn. *Sinorhizobium*)	*E. fredii*	NGR234 (formerly *Rhizobium* sp.) USDA257	3 1	18–19 19
	E. medicae	R46130	NA	28
Mesorhizobium	*M. amorphae*	SEMIA 806	NA	28, 32
	M. erdmanii	USDA 3471^{T} (formerly *M. loti*)	NA	8, 28, 33
	M. gobiense	CCBAU 83330^{T}	0	34
	M. helmanticense	CLSC115N^{T}	0	28, 35

		CSLC19N CSLC37N	0 0	28, 35
	M. japonicum	MAFF 303099^{T} R7A (formerly *M. loti*)	0 0	28, 36 8, 28, 36
	M. jarvisii	ATCC 33669^{T}	NA	28, 33
	M. loti (formerly *Rhizobium loti*)	19BFT3 B816 CIAM 1801–1806 CJ3sym MSDJ 865 NZP2037 NZP2213^{T} NZP2234 (syn. CC811) NZP2388 O8 R5 R88b SU343 (syn. NZP2196) UA5 UA6 UB4 Up4 YB5 YB6	NA NA 3 NA NA 3 3 3 NA NA NA NA 3 NA NA NA NA NA NA	37 29 38 8 39 29, 31 31, 40 31, 39–40 29 28, 41 28, 41 8 28, 41 28, 41 28, 41 28, 41 28, 41 28, 41 28
	M. olivaresii	CPS13^{T}	NA	28, 42
	M. septentrionale	SDW014^{T}	0	43
	M. tarimense	CCBAU 83306^{T}	0	34
	M. temperatum	SDW018^{T}	0	43
	M. tianshanense	CGS10 CGS2	NA NA	44 44

		CPS20	NA	44
	Mesorhizobium sp.	10.1.2 13.1.2 7.2.1 B733 CGS7 CMSS27 CPS12 CSLC14N CSLC22N CSLC30N LCA1 LL32 M75P N141 N3 N33 N362 O4 R2 R3 R46043 S673 S828 SEMIA 816 SEMIA 830 U510	NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA	28 28 28 28, 45 44 28 28 28 28 28 28 28, 45 28 28 28 28 28 28 28 28 28 28 28 28, 46 46 28
Rhizobium	*R. etli*	CFN299 CFN42	3 1	21 21
	R. leguminosarum	10.2.1	NA	28
	R. tropici	CIAT 899^{T}	3	21
	Rhizobium sp.	3F6s1 CC1005 CC809a Lc265Da	3 3 3 3	31 31 31 31

		NZP2260	3	31
Unidentified	Unidentified	LL12 LL33	NA NA	28 28

Medicago lupulina

Common name: Black medick

- GBIF
- ROM


Native status: Invasive

Duration: Annual to perennial (short-lived)

Flowering: April to July

Growth habit: Forb/herb

Rhizobia:

Genus	Species	Strain	Effectiveness	Source
Ensifer (syn. *Sinorhizobium*)	*E. fredii*	CCBAU 81348 CCBAU 81353	NA NA	47 47
	E. medicae	CC169 1054	3 3	48 48

	E. meliloti	1021	3	48
		102F34 (syn. ORS620)	NA	37
		1827	3	48
		CCBAU 15531	NA	49
		CCBAU 15532	NA	49
		CCBAU 15533	NA	49
		CCBAU 15534	NA	49
		CCBAU 81205	NA	47
		CCBAU 81356	NA	47
		CCBAU 81379	NA	47
		CCBAU 81407	NA	47
		CCBAU 85201	NA	47
		CCNWGS0037	NA	50
		CCNWSX0020	3	50–51
		CIAM1755	NA	8
		RCR2011	0	52
	E. sesbaniae	CCBAU 65688	NA	53
		CCBAU 65690	NA	53
	Ensifer sp.	T173	1	65
Rhizobium	*R. mongolense*	CCBAU 85033	NA	54
		CCBAU 85041	NA	54
	R. tibeticum	CCBAU 85027	0	55
		CCBAU 85039^{T}	0	55
	Rhizobium sp.	CCBAU 85016	NA	54
		CCBAU 85024	NA	54
		CCNWTB 701	NA	56

Medicago sativa
Common name: Alfalfa

- GBIF
- ROM


Native status: Non-native
Duration: Annual to perennial
Flowering: May to September
Growth habit: Forb/herb

Rhizobia:

Genus	Species	Strain	Effectiveness	Source
Ensifer (syn. *Sinorhizobium*)	*E. adhaerens*	R-7457	NA	57
	E. fredii	USDA 201 USDA 205 USDA 208 USDA 209 USDA 214	3 2 3 3 3	58 58 58 58 58
	E. garamanticus	STM 354	3	59
	E. kummerowiae	CCBAU 71714^{T}	0	60
	E. medicae	CC169 HAMBI 1808 (m75) HAMBI 1809 (m102)	3 NA NA	61 62–63 62–63

		L12	NA	64
		L24	NA	64
		L28	NA	64
		M-7AH	3	185
		T10	3	65
		T2	3	65
		WSM157	NA	66
	E. meliloti	1021	3	48, 67–68
		102F28	NA	60
		102F34 (syn. ORS620)	NA	62
		11	NA	69
		13	NA	69
		1827	3	48
		30-1	NA	68
		43G2	NA	70
		7G2	NA	70
		AK 631	3	61
		ARC 1	3	58
		ATCC 9930^{T} (syn. NZP4027^{T}, 3DOa2^{T})	3	27, 62, 65, 70
		CC2013	NA	71
		CCBAU 01199	3	72
		CCBAU 01290	3	72
		CCBAU 01314	3	72
		CCBAU 03041	NA	72
		CCBAU 81180	NA	47
		CCBAU 81401	NA	47
		CCBAU 83060	0	73
		CCBAU 83062	NA	73
		CCBAU 83065–83066	NA	72
		CCBAU 83068	NA	72
		CCBAU 83071	NA	73
		CCBAU 83085	NA	72
		CCBAU 83092	NA	73

		CCBAU 83097	NA	73
		CCBAU 83103	NA	73
		CCBAU 83164	3	72
		CCBAU 83168	NA	72
		CCBAU 83179	NA	72
		CCBAU 83408	0	73
		CCBAU 83483	NA	73
		CCBAU 83489	NA	73
		CCBAU 83552	NA	73
		CCBAU 85109	NA	48
		CCBAU 85111	NA	48
		CCBAU 85130	NA	48
		CCMA ALF-3	3	185
		CE31	3	74
		CIAM 1723	NA	38
		CIAM 1732	NA	38
		GR4	3	74
		HAMBI 1167	3	75
		HAMBI 470	3	75
		IAM12611	NA	76
		L17	NA	64
		L19	NA	64
		L23	0	64
		L35	NA	64
		L36	NA	64
		L5-30 (syn. ORS621)	NA	62, 69
		L54	NA	69
		LMG6133	NA	76
		MPI 4001	NA	67
		MVII-I	NA	8
		NZP4009 (syn. SU47)	3	30–31, 62, 65
		NZP4015	NA	30
		NZP4017	NA	30
		R.me 1	NA	77
		RCAM04491	3	78
		RCR2011 (syn.	3	62, 70

		ORS634)		
		SEMIA 134	NA	46
		SEMIA 135	NA	46
		Sm1021	3	66
		Sm 2011	3	61
		T15	3	65
		T1580	3	65
		T1607	3	65
		U45 (syn. HAMBI 1150)	3	31, 67, 75
		USDA 1002^{T}	NA	48, 71
		USDA 1030 (syn. 3DOa30)	NA	30, 62
		USDA 1936	3	58
		USDA 1954	3	58
		USDA 1969	3	58
		WSM152	NA	66
	E. numidicus	LBi$_2^{T}$	0	68
		ORS 1410	3	59
	Ensifer sp.	25K3	3	70
		1M1	3	70
		USDA 6670 (syn. CC2017)	3	8, 31
Mesorhizobium	*M. alhagi*	CCNWXJ 12-2^{T}	0	79
	M. camelthorni	CCNWXJ 40-4^{T}	0	80
	M. temperatum	SDW018^{T}	0	43
Rhizobium	*R. daejeonense*	L61^{T}	0	81
	R. favelukesii	LPU83^{T}	2	61, 74, 82
		OR191 (formerly *R. tibeticum*)	2	8, 61, 82–83
	R. tibeticum	CCBAU 85027	0	55
		CCBAU 85039^{T}	0	55

	R. tubonense	CCBAU 85046^{T}	0	84
	Rhizobium sp.	3DOa13	3	31
		CB1170	3	31
		LPU63	3	74
		PDDCC 1322	3	31
		T1155	3	65
		T136	3	65
		T1470	3	65
		T1473	3	65
		USDA 1944	NA	85
		USDA 1953	NA	85

Melilotus alba (syn. *Melilotus albus*)
Common name: White sweetclover

- GBIF
- ROM


Native status: Invasive
Duration: Annual to biennial
Flowering: May to September
Growth habit: Forb/herb

Rhizobia:

Genus	Species	Strain	Effectiveness	Source
Ensifer (syn. *Sinorhizobium*)	*E. medicae*	M102 T10 T2	3 3 3	65 65 65
	E. meliloti	1021 ATCC 9930^{T} (syn. NZP4027^{T}, 3DOa2^{T}) CCBAU 83318 CCBAU 85100 CCBAU 85108 CCBAU 85129 CCBAU 85131 CCBAU 85138 Rm1021 T15	3 3 NA NA NA NA NA NA 3 3	88 65 73 54 54 54 54 54 86–87 65

		T1580 T1607	3 3	65 65
Phyllobacterium	*Phyllobacterium* sp.	T1018 T1293	NA NA	65 65
Rhizobium	*Rhizobium* sp.	T136 USDA 1079 USDA 1083	2 NA NA	65 85 85

Melilotus officinalis

Common name: Yellow sweetclover

- GBIF
- ROM


Native status: Invasive

Duration: Annual, biennial to perennial (short-lived)

Flowering: May to August

Growth habit: Forb/herb

Rhizobia:

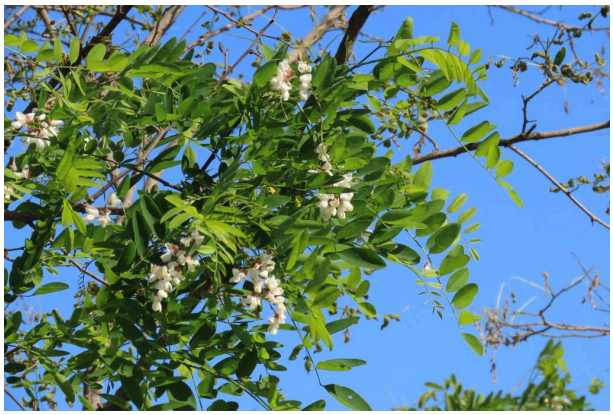
Genus	Species	Strain	Effectiveness	Source
Ensifer (syn. *Sinorhizobium*)	*E. medicae*	D20 D26 D39	NA 0 NA	64 64 64
	E. meliloti	CCBAU 15505–15511 CCBAU 15542–15545 CCBAU 81102 CCBAU 81291 CCBAU 85091 CCBAU 85092 CCBAU 85095 CCBAU 85102 CCBAU 85116 CCBAU 85117	NA NA NA NA NA NA NA NA NA NA	49 49 47 47 54 54 54 54 54 54

		CCBAU 85118 CCBAU 85312 D09 D12 D14 D24 D34 D38 NHBTR71 RCAM04491 SB292	NA NA NA NA NA NA NA NA 3 3 NA	54 54 64 64 64 64 64 64 89 78 90
Rhizobium	*R. leguminosarum*	CCBAU 85412	NA	54
	R. tibeticum	CCBAU 85027 CCBAU 85039^{T}	0 0	55 55
	Rhizobium sp.	USDA 1088	NA	85

Robinia pseudoacacia

Common name: Black locust

- GBIF
- ROM



Native status: Invasive

Duration: Perennial

Flowering: April to June

Growth habit: Tree

Rhizobia:

Genus	Species	Strain	Effectiveness	Source
Bradyrhizobium	*B. japonicum*	USDA 6^{T}	3	91–92
	Bradyrhizobium sp.	USDA 3384 USDA 3456	3 3	91 91
Burkholderia	*Burkholderia* sp.	Ch322	0	93
Ensifer (syn. *Sinorhizobium*)	*E. fredii*	NGR234 (formerly *Rhizobium* sp.) USDA257	3 3	18–19 18
	Ensifer sp.	CCBAU 83279	NA	94
Mesorhizobium	*M. amorphae*	CCNWGS0123 (syn. 186) ICMP15022	3 NA	95–98 68
	M. gobiense	CCBAU 83330^{T}	0	34

	M. huakuii	DSM 6573^{T}	0	99
	M. loti (formerly *Rhizobium loti*)	Ch90 DSM 2626^{T} HZ76 R1	0 0 3 3	93 99 100–101 102–104
	M. robiniae	CCNWYC 115^{T} (syn. HAMBI 3082^{T}) CCNWYC 116 CCNWYC 120 CCNWYC 124 CCNWYC 131 CCNWYC 132 CCNWYC 140 CCNWYC 147	3 0 3 3 0 3 0 3	105–106 106 105–106 105–106 106 105–106 106 105–106
	M. septentrionale	CCBAU 83281 CCBAU 83284	NA NA	34, 94 34, 94
	M. tarimense	CCBAU 83278 CCBAU 83306^{T}	NA 0	34, 94 34
	Mesorhizobium sp.	CCBAU 83282 LMG 4270 Rob23 RPJ16 RPJ3 RPJ5 RPJ6 RPP14 RPP20	NA 0 0 3 3 3 3 3 3	34, 94 99, 106 99, 107 69, 108 69, 108 69, 107–108 69, 108 69, 108 69, 107–108
Rhizobium	*R. multihospitium*	CCBAU 83283 CCBAU 83401^{T}	NA 0	110 110
	R. pisi	DSM 30132^{T}	0	99, 109
	R. tropici	CIAT 899^{T}	0	99

	Rhizobium sp.	3145	3	31
		CB1274	3	31
		CB81	3	31
		CC401	3	31
		GRH11	3	111
		Lc265Da	3	31
		NWYC129	3	112
		NZP5299	3	31
		NZP5302	3	31
		NZP5355	3	31
		R2 (USDA 3112 3F4b4)	NA	102–103
		R3 (USDA 3113 3F4b8)	NA	102–103
		R4 (USDA 3115 3F4b8)	NA	102–103
		R5	NA	102–103
		R6	NA	102–103
		R7	NA	102–103
		RpI1	3	113
		TAL 183 (syn. NIT 137A4)	3	114–115
		TAL 1889 (syn. USDA 3436)	3	114–115
		TAL 1907 (syn. USDA 3112)	3	114–115
		USDA 4280	0	116
Tardiphaga	*T. robiniae*	LMG 26466		117
		LMG 26467^{T}		117
		LMG 26468		117

Trifolium campestre (syn. *Trifolium procumbens*)
Common name: Pinnate-leaved hop clover, Low hop clover, Hop trefoil

- GBIF
- ROM


Native status: Non-native
Duration: Annual to biennial
Flowering: April to August
Growth habit: Forb/herb

Rhizobia:

Genus	Species	Strain	Effectiveness	Source
Rhizobium	*R. leguminosarum*	R-45779 R-45780 R-45791 R-45871 R-45937	NA NA NA NA NA	118 118 118 118 118
	R. leguminosarum bv. *trifolii*	VTc07–VTc11	NA	119

Trifolium hybridum
Common name: Alsike clover

- GBIF
- ROM


Native status: Non-native
Duration: Annual to perennial
Flowering: May to September
Growth habit: Forb/herb

Rhizobia:

Genus	Species	Strain	Effectiveness	Source
Bradyrhizobium	*Bradyrhizobium* sp.	CCBAU 65831	NA	120
Rhizobium	*R. leguminosarum*	R-45791 R-45854 R-45921 R-45923 R-46001 R-46009 R-46084 R-46086 R-46118 R-46161 R-46232	NA NA NA NA NA NA NA NA NA NA NA	121 118 118 118 118 118 118 118 118 118 118
	R. leguminosarum bv. *trifolii*	209 A8 ANU843	NA 3 3	122 123 124

		CIAM 1361 HAMBI 461 OSUT2 R4 TA1 (syn. ANU794) W4	NA 3 NA 3 NA 3	38 123 125 123 126 123
	Rhizobium sp.	USDA 2061	NA	85

Trifolium pratense
Common name: Red clover

- GBIF
- ROM


Native status: Non-native
Duration: Biennial to perennial
Flowering: April to October
Growth habit: Forb/herb

Rhizobia:

Genus	Species	Strain	Effectiveness	Source
Phyllobacterium	*P. trifolii*	PETP02^{T}	0	127
Rhizobium	*R. leguminosarum*	R-45844 SEMIA 2081 SEMIA 222 T.P2-2	NA 3 3 0	121 46, 128 46, 128 129
	R. leguminosarum bv. *trifolii*	162831 (syn. HAMBI 498) 162BB1 162K68 162X68 162P17 162P30 (syn. HAMBI 497) 24.1 24AR5	NA 3 NA NA 3 NA 3 3	67 130 110 160 130 67 131–132 133

		255	3	134
		298	3	135
		299	3	134
		3.6	NA	68, 136
		317	3	137
		60 B (syn. HAMBI 458)	3	67, 75
		61	NA	122
		A8	3	123
		ACCC18002	0	138
		ANU843	3	139–140
		ATCC 14480^{T}	NA	141–142, 173
		CIAM 1326	NA	38
		HAMBI 461	3	123
		KO17	3	143
		LM1	3	130
		MPI 8001	NA	67
		NA 30	0	144
		NGR68	3	152
		R4	3	123
		RCR0403	3	145–146
		RCR5	3	145–146
		RCR59	0	147
		RP113-7	3	130
		RT162P46	NA	37
		Rt24.2	3	148
		T126	3	149
		T143	NA	150
		T224	NA	150
		T266	NA	150
		T352	NA	150
		T453	NA	150
		TA1 (syn. ANU794)	3	126, 130, 151–152
		U204	3	137, 149
		USDA 2046 (syn. ATCC 14479)	NA	77, 153
		USDA 2048 (syn.	NA	153

		ATCC 10328) W4	 3	 123
	R. pisi sv. *trifolii*	K3.22	3	154
	Rhizobium sp.	ARTP01 HETP01 HETP02 HETP03 HETP04 HETP05 HTP01 HTP02 HUTP01 MITP01 MITP02 MITP03 NTP02 NTP04 PETP01 PETP03 PETP05 PETP06 RTP02 RTP05 SU202	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 NA	155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 155 31

Trifolium repens

Common name: White clover

- GBIF
- ROM


Native status: Non-native

Duration: Perennial

Flowering: April to September

Growth habit: Forb/herb

Rhizobia:

Genus	Species	Strain	Effectiveness	Source
Phyllobacterium	*P. trifolii*	PETP02^{T}	0	127
Rhizobium	*R. leguminosarum*	CCBAU 85005 K06 RBL5515 RMCC TR0111 RMCC TR0132 RMCC TR0721 SEMIA 222 SEMIA 235 TS-7C	NA NA 3 NA NA NA 3 3 3	54 64 176 122 122 122 128, 156 156 185
	R. leguminosarum bv. *viciae*	USDA 2370^{T}	0	109, 157
	R. leguminosarum bv. *trifolii*	0403 162 E7	3 NA	125, 158 159

		162X68	3	125
		173	NA	122
		231	NA	122
		24AR5	3	133
		7012	3	161
		A8	3	123
		ABH12-1	3	162
		ANU843	3	140, 163
		ATCC 14480^{T}	0	127
		AZR13-1	3	162
		CC2480a	NA	150
		CC275e (syn. NZP56, HAMBI 1138)	3	30–31, 67, 75, 162, 164
		FYM	3	147
		HAMBI 461	3	123
		ICC105	3	162
		J. 12	NA	165
		JI	3	125
		K16	NA	64
		K24	0	64
		LMG9517	NA	76
		NA 30	0	144
		NGR68	3	152
		NZP1	NA	141
		NZP560 (syn. PDDCC 2153)	3	30, 162
		OSS82	3	162
		OSUT2	3	125
		PDD 2153	0	166
		PDD 2666	0	166
		PDD 2668	0	166
		PDD 4240	0	166
		R4	3	123
		RCR1	3	147
		RCR10	3	147
		RCR212	3	147
		RCR213	3	147

		RCR221	3	147
		RCR226	3	147
		RCR227	3	147
		RCR3	3	147
		RCR32	3	147
		RCR35	3	147
		RCR46	3	147
		RCR49	3	147
		RCR59	3	147
		SU329	NA	76
		SU794	3	125
		T1	3	125
		T126	3	149
		TA1 (syn. ANU794)	3	147, 152–153, 167
		U204	3	137, 149
		USDA 2071	NA	71
		W4	3	123
		WSM1325	3	168
	R. phaseoli	ATCC 14482^{T} (syn. DSM 30137^{T})	0	109
	R. pisi	DSM 30132^{T}	0	109
	R. pisi sv. *trifolii*	K3.22	3	154
	Rhizobium sp.	3DlJ12	NA	31
		ARTP01	0	155
		CC231a	NA	31
		K8	NA	31
		HETP01	0	155
		HETP02	0	155
		HETP03	0	155
		HETP04	0	155
		HETP05	0	155
		HTP01	0	155
		HTP02	0	155
		HUTP01	0	155

		MITP01	0	155
		MITP02	0	155
		MITP03	0	155
		NSP562a	3	31
		NTP02	0	155
		NTP04	0	155
		NU134	3	31
		NZP5279	3	31
		NZP550	3	31
		NZP564	3	31
		NZP565	3	31
		NZP566	3	31
		NZP567	3	31
		PETP01	0	155
		PETP03	0	155
		PETP05	0	155
		PETP06	0	155
		POA3	3	155
		RTP02	0	155
		RTP05	0	155
		USDA 2235	NA	85
		WU351	3	31

Vicia cracca

Common name: Cow vetch, Tufted vetch, Bird vetch

- GBIF
- ROM


Native status: Non-native

Duration: Perennial

Flowering: May to August

Growth habit: Forb/herb, Vine

Rhizobia:

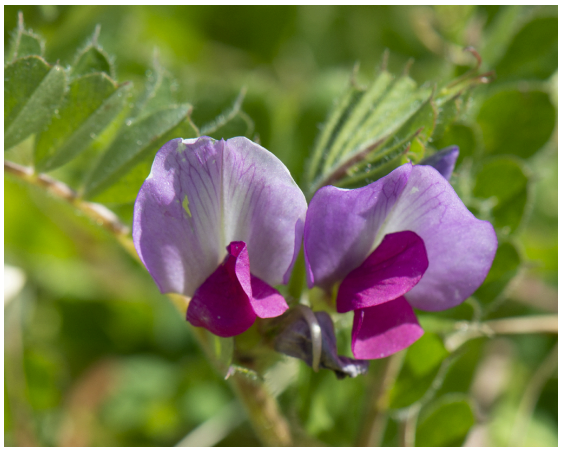
Genus	Species	Strain	Effectiveness	Source
Mesorhizobium	*M. alhagi*	CCNWXJ 12-2^{T}	0	79
Rhizobium	*R. leguminosarum*	CCBAU 85011 PB126 PB129 PB130 PB131 R-45625 R-45639 R-45825 R-45877 R-45916 R-45917 R-46107	NA NA NA NA NA NA NA NA NA NA NA NA	47 169 169 169 169 121 121 121 121 121 121 121
	R. leguminosarum bv. *viciae*	3841 KHDsib 8.11	0 3	170 171

		KHDVB 1030.3	3	171
		KHDVB 1598.3	3	171
		KHDVB 1619.10	3	171
		KHDVB 1680.5	3	171
		KHDVB 1681.2	3	171
		KHDVB 1703.2	3	171
		KHDVB 1707.1	3	171
		KHDVB 1902.3	3	171
		KHDVB 2171.3	3	171
		KHDVB 654.3	3	171
		OYAVB 164.10	3	171
		OYAVB 169.1	3	171
		OYAVB 174.1	3	171
		Vc2	NA	8
	Rhizobium sp.	CCBAU 83415	NA	94
		CCBAU 83416	NA	94
		CCBAU 83452	NA	94
		CCBAU 83455	NA	94
		CCBAU 83456	NA	94
		CCBAU 83457	NA	94
		CCBAU 83485	NA	94
		CCBAU 83487	NA	94
		CCBAU 83488	NA	94
		CCBAU 83489	NA	94
		CCBAU 83490	NA	94
		CCBAU 83491	NA	94

Vicia sativa

Common name: Spring vetch, Common vetch

- GBIF
- No online collections available at the ROM

Native status: Non-native

Duration: Annual

Flowering: March to June

Growth habit: Forb/herb, Vine

Rhizobia:

Genus	Species	Strain	Effectiveness	Source
Rhizobium	*R. etli*	SEMIA 384	NA	46
	R. laguerreae	WYCCWR 11122 WYCCWR 11176 WYCCWR 11187 WYCCWR 11221 WYCCWR 11370 WYCCWR 11385 WYCCWR 11395	3 3 3 3 3 3 3	172 172 172 172 172 172 172
	R. leguminosarum	CCBAU 71124 CCBAU 71205 CCBAU 73064 CCBAU 81188 CCBAU 85018 CCBAU 85025 CCBAU 85211	3 3 3 NA NA NA NA	173 121, 173 173 47 54, 121 54 47

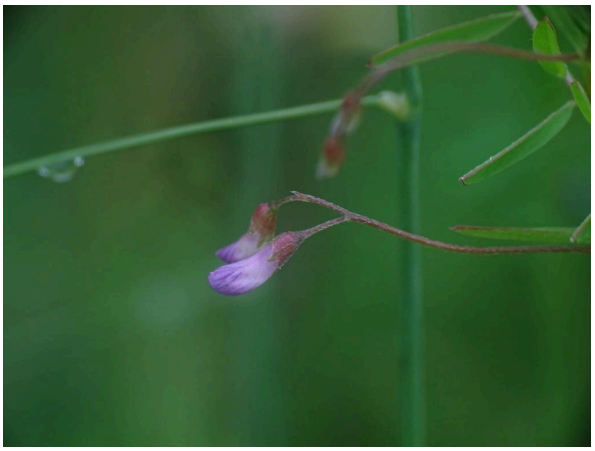
		H-2	NA	121
		PRE	3	174–175
		R-45557	NA	121
		R-45725	NA	121
		R-45855	NA	118, 121
		R-46098	NA	121
		RBL5515	3	176
		RBL5523	3	177–180
		RVS01	3	173
		RVS02	3	173
		RVS03	3	173
		RVS04	3	173
		RVS07	3	173
		RVS08	3	173
		RVS09	3	173
		RVS11	3	173
		V-2	NA	121
		V-3	NA	121
	R. leguminosarum bv. *viciae*	0610	NA	181
		248	3	174–175, 182–183
		KHDVB 1942.14	3	171
		KHDVB 1942.2	3	171
		KHDVB 1942.4	3	171
		KHDVB 1942.9	3	171
		KHDVB 2094.1	3	171
		KHDVB 2098.1	3	171
		KHDVB 2103.2	3	171
		RBL1	3	175
		RBL5601	NA	184
		V7-A	3	185
		V7-C	3	121, 185
		VF39	NA	186
	R. radiobacter (formerly *Agrobacterium tumefaciens*)	V7-Q	1	185

	R. sophorae	WYCCWR 11191	3	172
		WYCCWR 11210	3	172
	Rhizobium sp.	CVIII13	3	173
		CVIII14	3	173
		CVIII16	3	173
		CVIII20	3	173
		CVIII4	3	173
		MVP01	3	173
		MVP03	3	173
		MVP04	3	173
		MVP05	3	173
		MVP07	3	173
		MVP08	3	173
		MVP09	3	173
		MVP10	3	173
		WYCCWR 11128	3	172
		WYCCWR 11146	3	172
		WYCCWR 11152	3	172
		WYCCWR 11279	3	172
		WYCCWR 11290	3	172
		WYCCWR 11317	3	172

Vicia tetrasperma

Common name: Sparrow vetch, Lentil vetch, Smooth tare

- GBIF
- No online collections available at the ROM

Native status: Non-native

Duration: Annual

Flowering: April to June

Growth habit: Forb/herb, Vine

Rhizobia:

Genus	Species	Strain	Effectiveness	Source
Rhizobium	*R. leguminosarum*	CCNWSX1289 JHI24 R-45747 R-45781 R-45986 R-46094 R-46101 R-46109 R-46125 R-46137 RBL1 VT608	NA NA NA NA NA NA NA NA NA NA 0 NA	187 188 118, 121 118, 121 118 118 118 118 118 118 175 189
	R. leguminosarum bv. *viciae*	128C30 KHDVB 2094.1 KHDVB 2098.1	3 3 3	190–192 171 171

		KHDVB 2103.2	3	171
	Rhizobium sp.	CCBAU 83430 CCBAU 83431	NA NA	94 94

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