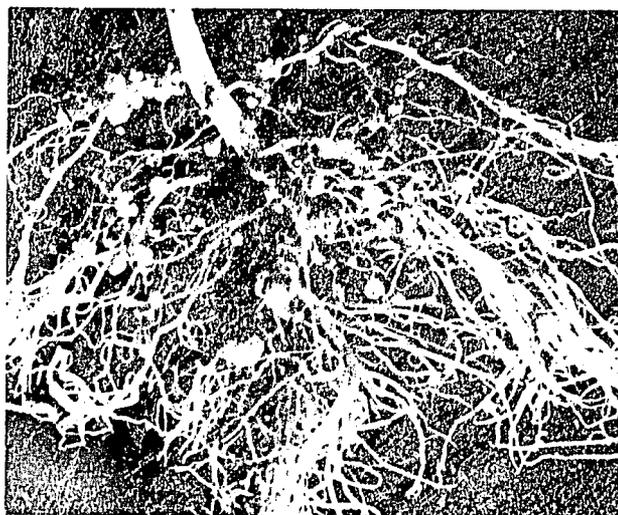


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# CIAT RHIZOBIUM COLLECTION



**1980**

## Section 2

Strains for *P. vulgaris*  
and other grain legumes



## TABLE OF CONTENTS

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	Page #
	<hr/>
About the collection	1
About the catalogue	2
Strains of <u>Rhizobium</u> for grain legumes	
Species : <u>R. japonicum</u>	3 -6
Species : <u>R. leguminosarum</u>	7
Species : <u>R. phaseoli</u>	8 -24
Species : <u>Rhizobium</u> sp.	25-27
Characterisation of selected strains of <u>R. phaseoli</u>	28
Appendix 1. Reconstitution of strains from ampoules.	29

## ABOUT THE COLLECTION

The Centro Internacional de Agricultura Tropical (CIAT) in Cali, Colombia was the fourth international research centre established, its mandate including three major commodity thrusts: pasture improvement for the acid infertile soils of tropical america; improved yield and quality in Phaseolus beans, and cassava improvement. The Rhizobium collection at CIAT reflects these interests, principally containing and emphasising rhizobia from forage legumes adapted to allic soils and strains for Phaseolus vulgaris and related species. Many other strains including those recommended for agriculturally important legumes in Australia and the USA are, however, held in the collection and are available to interested scientists.

All strains are maintained in the freeze dried (lyophilised) form, and will normally be supplied in glass vials. Details for the regeneration of cultures are included in the appendix. Cultures can also be supplied as peat base inoculant for specific experimental purposes.

To ensure better service and greater familiarity with cultures, responsibility for the collection has been divided between the staff microbiologists in the forage legume and bean programs. For information relating to the grain legume section of the collection, enquiries should be addressed to :

P.H. GRAHAM  
Soil Microbiologist  
Bean Program  
CIAT, Apartado Aereo 67-13  
Cali, Colombia

## ABOUT THE CATALOGUE

This catalogue emphasises rhizobia isolated from Phaseolus sp , but principally P. vulgaris. In addition it lists Rhizobium strains from other grain legumes. The collection of rhizobia for pasture legumes has been published separately.

In characterising the symbiotic performance of strains "infective" is used to describe isolates nodulating their appropriate host when tested by the pouch method (Weaver, R.W. & Frederick, L.R., Plant Soil (1972) 36, 219-222). Many, but not all isolates, have also been tested for nitrogen fixation in Leonard Jar assemblies (Vincent, J.M. (1970) IBP Handbook No 15, Blackwell London). Those strains described as "effective" showed excellent nodule development, high  $N_2$  ( $C_2H_2$ ) fixation and active plant growth relative to -N controls in these tests. As the glasshouse used in this study was not airconditioned, some strains listed here as "ineffective" could have been affected by the high ambient temperatures.

Strains of Rhizobium for grain legumes

Species : R. japonicum

- CIAT 1     Glycine max. Obtained from the Marandellas Research Station, Rhodesia as isolate 1130 in 1971. Last tested for infectivity, 1978. Infective.
- CIAT 2     Glycine max. Obtained from the Marandellas Research Station, Rhodesia as isolate 1127 in 1971. Last tested for infectivity, 1978. Infective.
- CIAT 3     Glycine max. Obtained from the Marandellas Research Station, Rhodesia as isolate 846 in 1971. Last tested for infectivity, 1978. Infective.
- CIAT 4     Glycine max. Obtained from the Marandellas Research Station, Rhodesia as isolate 492 in 1971, originally Beltsville isolate 3 li b 38. Last tested for infectivity, 1972. Recommended strain for soybean inoculation in Colombia, 1972-1979. See also:  
Graham, P.H. (1973) in "Genes, Enzymes and Populations A.M. Srb Editor, Plenum press pp 321-330.  
Varela, R. (1978). Revista ICA 13, 249-255.
- CIAT 5     Glycine max. Obtained from the Marandellas Research Station, Rhodesia as isolate 493 in 1971, originally Beltsville isolate 3 li b 42.

R. japonicum cont.

- CIAT 51 Glycine max. Obtained from J. Dobereiner, Brazil as isolate 5006 in 1971. Last tested for infectivity in 1972. Highly effective.
- See also:
- Graham, P.H. (1973) in "Genes, Enzymes and Populations" A. M. Srb, Editor, Plenum Press. pp. 321-330.
- Varela, R.(1978) Revista ICA 13, 249-255
- CIAT 58 Glycine max. Obtained from J. Dobereiner, Brazil, as isolate SB 16 in 1973. Has not been plant tested at CIAT.
- CIAT 90 Glycine max. Obtained from University of Sydney as SU 697 in 1971, originally CB 1809. Last tested for infectivity in 1972. Highly effective. Recommended Australian inoculant strain for soya
- See also:
- Dobereiner, J. et.al.(1970) Pesq. Agropec. Brasil. 5, 155-161.
- CIAT 196 Glycine max. Isolated as Z23 near El Bolo, Palmira, Colombia in 1972. Last tested for infectivity in 1978. Infective.
- CIAT 199 Glycine max. Isolated as Z250 near Balboa, Buga, Colombia in 1972. Last tested for infectivity in 1978 .Infective.
- CIAT 200 Glycine max. Isolated as Z251 near Balboa, Buga, Colombia in 1972. Last tested for infectivity in 1978 .Infective.
- CIAT 201 Glycine max. Isolated as Z252, Balboa, Buga, Colombia in 1972. Presumptive Rhizobium only.
- CIAT 202 Glycine max. Isolated as Z254, Buga, Colombia in 1972. Presumptive Rhizobium only.
- CIAT 204 Glycine max. Isolated as Z256 Buga, Colombia in 1972. Presumptive Rhizobium only.
- CIAT 205 Glycine max. Isolated as Z257 Buga, Colombia in 1972.

R. japonicum cont.Presumptive Rhizobium only.CIAT 206 Glycine max. Isolated as Z258 Buga, Colombia in 1972Presumptive Rhizobium only.CIAT 207 Glycine max. Isolated as Z259 Buga, Colombia in 1972.Presumptive Rhizobium only.CIAT 208 Glycine max. Isolated as Z260 Buga, Colombia in 1972.Presumptive Rhizobium only.CIAT 209 Glycine max. Isolated as Z261 Buga, Colombia in 1972.Presumptive Rhizobium only.CIAT 210 Glycine max. Isolated as Z1 Pradera, Colombia in 1972.Presumptive Rhizobium only.CIAT 211 Glycine max. Isolated as Z2 Pradera, Colombia in 1972.Presumptive Rhizobium only.CIAT 212 Glycine max. Isolated as Z3 Pradera, Colombia in 1972.Presumptive Rhizobium only.CIAT 213 Glycine max. Isolated as Z4 Pradera, Colombia in 1972.Presumptive Rhizobium only.CIAT 214 Glycine max. Isolated as Z6 Pradera, Colombia in 1972.Presumptive Rhizobium only.CIAT 215 Glycine max. Isolated as Z8 Pradera, Colombia in 1972.Presumptive Rhizobium only.CIAT 216 Glycine max. Isolated as Z10, Pradera, Colombia in 1972.Presumptive Rhizobium only.CIAT 217 Glycine max. Isolated as Z12, Pradera, Colombia in 1972.Presumptive Rhizobium only.CIAT 218 Glycine max. Isolated as Z13, Pradera, Colombia in 1972.

R. japonicum cont.

- Presumptive Rhizobium only.
- CIAT 219 Glycine max. Isolated as Z14, Pradera, Colombia in 1972.
- Presumptive Rhizobium only.
- CIAT 380 Glycine max. Isolated from variety Americana, Boliche, Ecuador in 1973. Presumptive Rhizobium only.
- CIAT 403 Glycine max. Isolated from nodules on plants inoculated with Nitragin soybean inoculant. Presumptive Rhizobium only.
- CIAT 656 Glycine max. Isolated as Z637, La Buitrera, Colombia in 1974. Presumptive Rhizobium only.
- CIAT 658 Glycine max. Isolated as Z638, La Buitrera, Colombia in 1974. Presumptive Rhizobium only.

Strains of Rhizobium for grain legumes.

Species : R. leguminosarum

- CIAT 17 Pisum sativum. Obtained from Sydney University as SU 391 in 1971.  
Last tested for infectivity in 1975. Effective.
- CIAT 27 Pisum sativum. Obtained from Sydney University as SU 567  
(= TA 101) in 1971. Last tested for infectivity in 1975. Effective.
- CIAT 333 Pisum sativum. Isolated as Z131, Tenerife, Colombia in 1972.  
Presumptive Rhizobium only.
- CIAT 334 Pisum sativum. Isolated as Z132, Rio Negro, Colombia in 1972.  
Presumptive Rhizobium only.
- CIAT 345 Pisum sativum. Isolated as Z156 near Buga, Colombia in 1972.  
Presumptive Rhizobium only.
- CIAT 448 Lathyrus odoratus. Isolated as Z448, Chia, Colombia in 1974.  
Presumptive Rhizobium only.
- CIAT 459 Vicia sp. (silvestral). Isolated as Z657 Obonuco, Colombia in 1975.  
Presumptive Rhizobium only.
- CIAT 467 Vicia andicola. Isolated as Z462, Bogota, Colombia in 1974.  
Presumptive Rhizobium only.

Strains of Rhizobium for grain legumes

Species : R. phaseoli

- CIAT 15 P. coccineus. Obtained from the Marandallas Research Station, Rhodesia as strain 787 in 1971. Last tested for infectivity in 1979. Infective.
- CIAT 16 P. coccineus. Obtained from the Marandallas Research Station, Rhodesia as strain 787 in 1971. Last tested for infectivity in 1976. Infective.
- CIAT 40 P. vulgaris. Obtained from J.C. Burton, Milwaukee as strain 127 K 26 in 1971. Last tested for infectivity in 1978. Ineffective at the temperature prevailing.
- CIAT 45 P. vulgaris. Obtained from J. Dobereiner, Brazil as strain F310 in 1971. Last tested for infectivity in 1972.
- CIAT 57 P. vulgaris. Obtained from Sydney University as CC511 in 1971. Repeatedly tested for symbiotic response between 1972 and 1979. Australian bean inoculant culture 1971-present. CIAT recommended inoculant culture 1972-1979. Included in the International Bean Inoculation Trial (IBIT) 1979 and 1980. See also: Graham, P.H. and Halliday, J. Inoculation and nitrogen fixation in the genus Phaseolus in "Exploiting the legume-Rhizobium symbiosis in tropical agriculture" J.M. Vincent Ed. Univ. of Hawaii Misc. Public. 145, 313-334.

R. phaseoli cont.

Graham, P.H. and Rosas, J.C. 1977. J. Agric. Sci. Camb. 88, 503-508.

Graham, P.H. and Rosas, J.C. 1978a. J. Agric. Sci. Camb. 90, 19-29.

Graham, P.H. and Rosas, J.C. 1978b. J. Agric. Sci. Camb. 90, 311-317.

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|------|-----|---|--|
| CIAT | 68  | <u>P. vulgaris.</u>                                 | Obtained from J. Dobereiner as strain F310 in 1973. Last tested for infectivity in 1979. ineffective at the temperature prevailing.                |
| CIAT | 73  | <u>P. vulgaris.</u>                                 | Isolated as Z1016 Candelaria, Colombia in 1972. Last tested for infectivity in 1979. Highly effective, though response erratic in field plantings. |
| CIAT | 75  | <u>P. vulgaris.</u>                                 | Isolated from variety Algarrobo, Pradera, Colombia in 1972. Last tested for infectivity in 1979. Highly effective.                                 |
| CIAT | 83  | <u>P. multiflorus.</u> (Syn. <u>P. coccineus</u> ). | Obtained from B. Strijdom, South Africa as strain UD2. Not plant tested at CIAT.   |
| CIAT | 95  | <u>P. vulgaris.</u>                                 | Isolated as Z37, Palmira, Colombia, 1972. Last tested for infectivity in 1979. Ineffective.  |
| CIAT | 96  | <u>P. vulgaris.</u>                                 | Isolated as Z34, Florida, Colombia in 1972. Last tested for infectivity in 1979. Highly effective.   |
| CIAT | 112 | <u>P. vulgaris.</u>                                 | Isolated as Z28, Pradera, Colombia in 1972. Last tested for infectivity in 1975.   |
| CIAT | 113 | <u>P. vulgaris.</u>                                 | Isolated as Z29, Pradera, Colombia in 1972. Last tested for infectivity in 1979. Ineffective.  |

R. phaseoli cont.

- CIAT 115 P. vulgaris. Isolated as Z35, Palmira, Colombia, 1972. Last tested for infectivity in 1972.
- CIAT 116 P. vulgaris. Isolated as Z36, Palmira, Colombia in 1972. Last tested for infectivity in 1972.
- CIAT 117 P. vulgaris. Isolated as Z47, Tenerife, Colombia in 1972. Last tested for infectivity in 1979. Ineffective.
- CIAT 118 P. vulgaris. Isolated as Z31, Pradera, Colombia in 1972. Presumptive Rhizobium only.
- CIAT 119 P. vulgaris. Isolated as Z55, Tenerife, Colombia in 1972. Last tested for infectivity in 1972.
- CIAT 121 P. vulgaris. Isolated as Z57, Tenerife, Colombia in 1972. Last tested for infectivity in 1979. Ineffective.
- CIAT 123 P. vulgaris. Isolated as Z61, Tenerife, Colombia in 1972. Repeatedly tested for symbiotic response in glasshouse and field, 1972-79. Highly effective.
- CIAT 124 P. vulgaris. Isolated as Z62, Tenerife, Colombia in 1972. Last tested for infectivity in 1979. Moderately effective.
- CIAT 125 P. vulgaris. Isolated as Z63, Tenerife, Colombia in 1972. Last tested for infectivity in 1979. Highly effective.
- CIAT 126 P. vulgaris. Isolated as Z64, Tenerife, Colombia in 1972. Last tested for infectivity in 1979. Effective.

R. phaseoli cont.

- CIAT 127 P. vulgaris. Isolated as Z65, Tenerife, Colombia, in 1972. Last tested for infectivity in 1979. Highly effective. Included in the 1980 IBIT.
- CIAT 128 P. vulgaris. Isolated as Z66, Tenerife, Colombia in 1972. Last tested for infectivity in 1979. Highly effective.
- CIAT 129 P. vulgaris. Isolated as Z67, Tenerife, Colombia in 1972. Last tested for infectivity in 1979. Ineffective.
- CIAT 130 P. vulgaris. Isolated as Z100, San José, Guarne, Colombia in 1972. Last tested for infectivity in 1979. Effective.
- CIAT 131 P. vulgaris. Isolated as Z101, San José, Guarne, Colombia in 1972. Last tested for infectivity in 1979. Effective.
- CIAT 132 P. vulgaris. Isolated as Z102, San José, Guarne, Colombia in 1972. Last tested for infectivity in 1979. Effective.
- CIAT 133 P. vulgaris. Isolated as Z103, San José, Guarne, Colombia in 1972. Last tested for infectivity in 1979. Ineffective.
- CIAT 134 P. vulgaris. Isolated as Z104, San Jose, Guarne, Colombia in 1972. Last tested for infectivity in 1979. Effective.
- CIAT 135 P. vulgaris. Isolated as Z110, San José, Guarne, Colombia in 1972. Last tested for infectivity in 1979. Ineffective.
- CIAT 137 P. vulgaris. Isolated as Z112, San José, Guarne, Colombia in 1972. Last tested for infectivity in 1979. Ineffective.

R. phaseoli cont.

- CIAT 139 P. aborigeneus. Isolated from germplasm accessions at CIAT in 1977. Presumptive Rhizobium only.
- CIAT 141 P. vulgaris. Isolated as Z116, San José, Guarne, Colombia in 1972. Last tested for infectivity in 1979. Ineffective.
- CIAT 142 P. vulgaris. Isolated as Z117, San José, Guarne, Colombia in 1972. Last tested for infectivity in 1979. Highly effective.
- CIAT 143 P. vulgaris. Isolated as Z118, San José, Guarne, Colombia in 1972. Last tested for infectivity in 1979. Effective.
- CIAT 144 P. vulgaris. Isolated as Z119, Antioquia, Colombia in 1972. Last tested for infectivity in 1979. Highly effective.
- CIAT 146 P. vulgaris. Isolated as Z122, San José, Guarne, Colombia in 1972. Last tested for infectivity in 1979. Ineffective.
- CIAT 147 P. vulgaris. Isolated as Z123 near Medellín, Colombia in 1972. Last tested for infectivity in 1979. Effective.
- CIAT 149 P. vulgaris. Isolated as Z125 near Medellín, Colombia in 1972. Last tested for infectivity in 1979. Ineffective.
- CIAT 150 P. vulgaris. Isolated as Z126 near Medellín, Colombia in 1972. Last tested for infectivity in 1979. Ineffective.
- CIAT 151 P. vulgaris. Isolated as Z127 near Medellín, Colombia in 1972. Last tested for infectivity in 1979. Effective.
- CIAT 153 P. vulgaris. Isolated as Z129, San José, Antioquia, Colombia in 1972. Last tested for infectivity in 1979. Effective.

R. phaseoli cont.

- CIAT 155 P. vulgaris. Isolated as Z140, San José, Antioquia, Colombia in 1972. Presumptive Rhizobium only.
- CIAT 156 P. vulgaris. Isolated as Z141, San José, Antioquia, Colombia in 1972. Presumptive Rhizobium only.
- CIAT 157 P. vulgaris. Isolated as Z142, San José, Antioquia, Colombia in 1972. Last tested for infectivity in 1979. Moderately effective.
- CIAT 158 P. vulgaris. Isolated as Z143, San José, Antioquia, Colombia in 1972. Last tested for infectivity in 1979. Moderately effective.
- CIAT 159 P. vulgaris. Isolated as Z144, San José, Antioquia, Colombia in 1972. Last tested for infectivity in 1979. Ineffective.
- CIAT 160 P. vulgaris. Isolated as Z145, San José, Antioquia, Colombia in 1972. Last tested for infectivity in 1979. Effective.
- CIAT 161 P. vulgaris. Isolated as Z146, Buga, Colombia in 1972. Repeatedly tested for symbiotic response 1972-79. Highly effective. Included in the 1980 IBIT. Also available as spec<sup>r</sup> strep<sup>r</sup> mutant.
- See also :
- Graham, P. H. (1979). J. Agric. Sci. Camb. 93, 365-370.
- CIAT 163 P. vulgaris. Isolated as Z148, Buga, Colombia in 1972. Last tested for infectivity in 1979. Ineffective.
- CIAT 165 P. vulgaris. Isolated as Z150, Buga, Colombia in 1972. Last tested for infectivity in 1979. Moderately effective.

R. phaseoli cont.

- CIAT 166 P. vulgaris. Isolated as Z151, Buga, Colombia in 1972. Last tested for infectivity in 1979. Highly effective. Included in the 1980 IBIT. Also available as spec<sup>r</sup> strep<sup>r</sup> mutant.
- CIAT 167 P. vulgaris. Isolated as Z152, Buga, Colombia in 1972. Last tested for infectivity in 1979. Highly effective.
- CIAT 250 P. vulgaris. Isolated as Z267, Santa Cruz, Nicaragua in 1972. Last tested for infectivity in 1979. Ineffective.
- CIAT 251 P. vulgaris. Isolated as Z726, Palmira, Colombia in 1976. Presumptive Rhizobium only.
- CIAT 252 P. vulgaris. Isolated as Z269, Santa Cruz, Nicaragua in 1972. Last tested for infectivity in 1979. Effective.
- CIAT 253 P. vulgaris. Isolated as Z270, Danli, Honduras in 1972. Last tested for infectivity in 1979. Ineffective.
- CIAT 255 P. vulgaris. Isolated as Z272, Danli, Honduras, in 1972. Repeatedly tested for symbiotic response 1972-79. Highly effective, though response erratic in fields plantings. Included in 1979 and 1980 IBITs.
- CIAT 256 P. vulgaris. Isolated as Z273, Danli, Honduras, in 1972. Last tested for infectivity in 1979. Ineffective.
- CIAT 281 P. vulgaris. Isolated as Z727, Palmira, Colombia in 1976. Last tested for infectivity in 1979. Effective.
- CIAT 300 P. vulgaris. Obtained from A. Franco, Brazil as strain 3610 in 1975. Not plant tested at CIAT.

R. phaseoli cont.

- CIAT 303 P. vulgaris. Isolated as Z719, Popayan, Colombia in 1975. Last tested for infectivity in 1979. Effective.
- CIAT 305 P. vulgaris. Isolated as Z728, Palmira, Colombia in 1976. Last tested for infectivity in 1979. Weakly effective.
- CIAT 306 P. vulgaris. Isolated as Z729, Palmira, Colombia in 1976. Presumptive Rhizobium only.
- CIAT 309 P. vulgaris. Obtained from the Marandellas Research Institute in Rhodesia in 1976 as strain 1276. Last tested for infectivity in 1979. Ineffective.
- CIAT 312 P. vulgaris. Isolated as Z720, Popayan, Colombia in 1975. Presumptive Rhizobium only.
- CIAT 321 P. vulgaris. Isolated as Z721, Popayan, Colombia in 1975. Last tested for infectivity in 1979. Highly effective.
- CIAT 323 P. vulgaris. Obtained from E.B. Roslycky, Canada as strain 95/RIO. Not plant tested at CIAT.
- CIAT 323 P. vulgaris. Isolated as Z716, Popayan, Colombia in 1975. Last tested for infectivity in 1979. Highly effective.
- CIAT 348 P. vulgaris. Isolated as Z305, CIAT, Cali, Colombia, in 1973. Last tested for infectivity in 1979. Ineffective.
- CIAT 349 P. vulgaris. Isolated as Z306, CIAT, Cali, Colombia, in 1973. Last tested for infectivity in 1979. Ineffective.

R. phaseoli cont.

- CIAT 351 P. vulgaris. Isolated as Z308, CIAT, Cali, Colombia, in 1973.  
Last tested for infectivity in 1979. Ineffective.
- CIAT 352 P. vulgaris. Isolated as Z309, CIAT, Cali, Colombia, in 1973.  
Last tested for infectivity in 1979. Moderately effective.
- CIAT 364 P. vulgaris. Obtained from the Marandellas Research Institute,  
Rhodesia as strain 1279 in 1976. Not plant tested at CIAT.
- CIAT 381 P. vulgaris. Obtained as mutant isolate from strain CIAT 57. on  
exposure to 500 ppm streptomycin. Last tested for infectivity in 1979.
- CIAT 385 P. vulgaris. Isolated as Z722, Popayán, Colombia, in 1975. Last  
tested for infectivity in 1979. Highly effective.
- CIAT 390 P. vulgaris. Isolated as Z723, Popayan, Colombia in 1975. Last  
tested for infectivity in 1979. Highly effective. Included in the  
1980 IBIT.
- CIAT 404 P. vulgaris. Isolated from CIAT fields, Cali, Colombia in 1974.  
Last tested for infectivity in 1979. Effective.
- CIAT 406 P. vulgaris. Isolated from CIAT fields, Cali, Colombia in 1974.  
Last tested for infectivity in 1979. Ineffective.
- CIAT 407 P. vulgaris. Isolated from CIAT fields, Cali, Colombia in 1974.  
Last tested for infectivity in 1979. Highly effective. Included in  
the 1980 IBIT.
- CIAT 460 P. vulgaris. Obtained from G. Bayment, Belgium as strain 9.59 B.  
Last tested for infectivity in 1979. Effective.

R. phaseoli cont.

- CIAT 515 P. vulgaris. Obtained from G. Bayment, Belgium as strain 9.2.1.  
Last tested for infectivity in 1978. Effective.
- CIAT 579 P. vulgaris. Isolated as Z717, Popayan, Colombia in 1975. Presumptive Rhizobium only.
- CIAT 580 P. vulgaris. Isolated as Z715, Popayan, Colombia in 1975. Presumptive Rhizobium only.
- CIAT 608 P. vulgaris. Isolated as Z616, Chinchiná, Colombia in 1974. Last tested for infectivity in 1979. Ineffective.
- CIAT 609 P. vulgaris. Isolated as Z617, Chinchiná, Colombia in 1974. Presumptive Rhizobium only.
- CIAT 610 P. vulgaris. Isolated as Z618, Chinchiná, Colombia in 1974. Presumptive Rhizobium only.
- CIAT 611 P. vulgaris. Isolated as Z619. Chinchiná, Colombia in 1974. Presumptive Rhizobium only.
- CIAT 612 P. vulgaris. Isolated as Z610, Chinchiná, Colombia in 1974. Last tested for infectivity in 1979. Moderately effective.
- CIAT 613 P. vulgaris. Isolated as Z621, Chinchiná, Colombia in 1974. Last tested for infectivity in 1979. Moderately effective.
- CIAT 614 P. vulgaris. Isolated as Z622, Chinchiná, Colombia in 1974. Last tested for infectivity in 1979. Ineffective

R. phaseoli cont.

- CIAT 615 P. vulgaris. Isolated as Z623, Chinchiná, Colombia in 1974. Last tested for infectivity in 1979. Ineffective.
- CIAT 620 P. vulgaris. Obtained from R. Aguilera, Guatemala, as strain 23 in 1974. Last tested for infectivity in 1979. Ineffective.
- CIAT 621 P. vulgaris. Obtained from R. Aguilera, Guatemala, as strain 38 in 1974. Last tested for infectivity in 1979. Effective.
- CIAT 622 P. vulgaris. Obtained from R. Aguilera, Guatemala, as strain 37 in 1974. Last tested for infectivity in 1979. Effective.
- CIAT 623 P. vulgaris. Obtained from R. Aguilera, Guatemala, as strain 35 in 1974. Last tested for infectivity in 1979. Moderately effective.
- CIAT 624 P. vulgaris. Obtained from R. Aguilera, Guatemala, as strain 43 in 1974. Not plant tested at CIAT.
- CIAT 625 P. vulgaris. Obtained from R. Aguilera, Guatemala, as strain 22 in 1974. Repeatedly tested for symbiotic response 1974-79. Highly effective in most trials, though suspect at higher temperatures.  
Included in some sets of the 1979 IBIT.
- CIAT 626 P. vulgaris. Obtained from R. Aguilera, Guatemala, as strain 25 in 1974. Last tested for infectivity in 1976. Weakly effective.
- CIAT 627 P. vulgaris. Obtained from R. Aguilera, Guatemala, as strain 39 in 1974. Last tested for infectivity in 1979. Weakly effective.
- CIAT 628 P. vulgaris. Obtained from R. Aguilera, Guatemala, as strain 27 in 1974. Not plant tested at CIAT.

R. phaseoli cont.

- CIAT 629 P. vulgaris. Obtained from R. Aguilera, Guatemala, as strain 26 in 1974. Not plant tested at CIAT.
- CIAT 630 P. vulgaris. Obtained from R. Aguilera, Guatemala, as strain 28 in 1974. Not plant tested at CIAT.
- CIAT 631 P. vulgaris. Obtained from R. Aguilera, Guatemala, as strain 24 in 1974. Not plant tested at CIAT.
- CIAT 632 P. vulgaris. Obtained from R. Aguilera, Guatemala, as strain 21 in 1974. Repeatedly tested for symbiotic response 1974-79. Highly effective. Included in the 1979 IBIT.
- CIAT 633 P. vulgaris. Obtained from R. Aguilera, Guatemala, as strain 41 in 1974. Not plant tested at CIAT.
- CIAT 634 P. vulgaris. Obtained from R. Aguilera, Guatemala, as strain 42 in 1974. Not plant tested at CIAT.
- CIAT 635 P. vulgaris. Obtained from R. Aguilera, Guatemala, as strain 33 in 1974. Not plant tested at CIAT.
- CIAT 636 P. vulgaris. Obtained from R. Aguilera, Guatemala, as strain 44 in 1974. Not plant tested at CIAT.
- CIAT 637 P. vulgaris. Obtained from R. Aguilera, Guatemala, as strain 40 in 1974. Not plant tested at CIAT.
- CIAT 638 P. vulgaris. Isolated as Z643, La Buitrera, Colombia in 1974.  
Presumptive Rhizobium only.

R. phaseoli cont.

- CIAT 639 P. vulgaris. Isolated as Z644, La Buitrera, Colombia in 1974.  
Presumptive Rhizobium only.
- CIAT 640 P. vulgaris. Isolated as Z632, La Buitrera, Colombia in 1974.  
Repeatedly tested for symbiotic response 1974-79. Highly effective. Included in the 1979 IBIT.
- CIAT 641 P. vulgaris. Isolated as Z631, Palmira, Colombia in 1974. Last tested for infectivity in 1976. Ineffective.
- CIAT 644 P. vulgaris. Isolated as Z641, La Buitrera, Colombia in 1974.  
Presumptive Rhizobium only.
- CIAT 645 P. vulgaris. Isolated as Z635, La Buitrera, Colombia in 1974.  
Presumptive Rhizobium only.
- CIAT 646 P. vulgaris. Isolated as Z630, Palmira, Colombia in 1974.  
Presumptive Rhizobium only.
- CIAT 647 P. vulgaris. Isolated as Z648, La Buitrera, Colombia in 1974.  
Presumptive Rhizobium only.
- CIAT 648 P. vulgaris. Isolated as Z642, La Buitrera, Colombia in 1974.  
Presumptive Rhizobium only.
- CIAT 649 P. vulgaris. Isolated as Z647, La Buitrera, Colombia in 1974.  
Presumptive Rhizobium only.
- CIAT 650 P. vulgaris. Isolated as Z639, La Buitrera, Colombia in 1974.  
Presumptive Rhizobium only.

R. phaseoli cont.

- CIAT 651 P. vulgaris. Isolated as Z634, La Buitrera, Colombia in 1974.  
Presumptive Rhizobium only.
- CIAT 652 P. vulgaris. Isolated as Z629, Palmira, Colombia in 1974.  
Presumptive Rhizobium only.
- CIAT 653 P. vulgaris. Isolated as Z649, La Buitrera, Colombia in 1974.  
Presumptive Rhizobium only.
- CIAT 654 P. vulgaris. Isolated as Z650, La Buitrera, Colombia in 1974.  
Presumptive Rhizobium only.
- CIAT 655 P. vulgaris. Isolated as Z636, La Buitrera, Colombia in 1974.  
Presumptive Rhizobium only.
- CIAT 657 P. vulgaris. Isolated as Z633. La Buitrera, Colombia in 1974.  
Presumptive Rhizobium only.
- CIAT 659 P. vulgaris. Isolated as Z640, La Buitrera, Colombia in 1974.  
Presumptive Rhizobium only.
- CIAT 661 P. vulgaris. Obtained from P.E. Davis, England as strain 3627,  
in 1974. Last tested for infectivity in 1976. Moderately effective.
- CIAT 663 P. vulgaris. Obtained from P.E. Davis, England as strain 3627,  
in 1974. Last tested for infectivity in 1976. Ineffective under  
the temperature conditions prevailing.
- CIAT 664 P. vulgaris. Obtained from P.E. Davis, England as strain 3637,  
in 1974. Last tested for infectivity in 1976. Effective.

R. phaseoli cont.

- CIAT 666 P. vulgaris. Obtained from P. E. Davis, England as strain 3605 = CC 511. See also CIAT 57. Last tested for infectivity in 1976. Effective.
- CIAT 668 P. vulgaris. Obtained from P. E. Davis, England as strain 3635, in 1974. Last tested for infectivity in 1976. Moderately effective.
- CIAT 671 P. vulgaris. Obtained from P. E. Davis, England as strain 3644, in 1974. Last tested for infectivity in 1976. Ineffective.
- CIAT 672 P. vulgaris. Obtained from P. E. Davis, England as strain 3619, in 1974. Last tested for infectivity in 1976. Ineffective.
- CIAT 673 P. vulgaris. Obtained from P. E. Davis, England as strain 3633, in 1974. Last tested for infectivity in 1976. Ineffective.
- CIAT 674 P. vulgaris. Obtained from P. E. Davis, England as strain 3634, in 1974. Last test for infectivity in 1976. Ineffective.
- CIAT 676 P. vulgaris. Obtained from P. E. Davis, England as strain 3620, in 1974. Last tested for infectivity in 1979. Moderately effective. Included in 1979 IBIT.
- CIAT 686 P. vulgaris. Isolated as strain Z653, Popayán, Colombia in 1974. Last tested for infectivity in 1976.
- CIAT 688 P. vulgaris. Isolated as strain Z651, Popayán, Colombia in 1974. Presumptive Rhizobium only.
- CIAT 872 P. vulgaris. Isolated from nodules, San Vicente, Colombia in 1978. Presumptive Rhizobium only.

R. phaseoli cont.

- CIAT 873 P. vulgaris. Isolated from nodules, San Vicente, Colombia in 1978.  
Presumptive Rhizobium only.
- CIAT 874 P. vulgaris. Isolated from nodules, El Guarne, Colombia in 1978.  
Presumptive Rhizobium only.
- CIAT 875 P. vulgaris. Isolated from nodules, El Guarne, Colombia in 1978.  
Presumptive Rhizobium only.
- CIAT 876 P. vulgaris. Isolated from nodules, El Guarne, Colombia in 1978.  
Presumptive Rhizobium only.
- CIAT 877 P. vulgaris. Isolated from nodules, Marinilla, Colombia in 1978.  
Presumptive Rhizobium only.
- CIAT 878 P. vulgaris. Isolated from nodules, Marinilla, Colombia in 1978.  
Presumptive Rhizobium only.
- CIAT 893 P. vulgaris. Isolated as M-20, Carmen de Viboral, Colombia in 1978.  
Repeatedly plant tested in 1978 & 1979. Highly effective. Included  
in 1979. IBIT.
- CIAT 894 P. vulgaris. Isolated as M-83, Carmen de Viboral, Colombia in 1978.  
Last tested for infectivity in 1978. Effective.
- CIAT 895 P. vulgaris. Isolated as M-46, Carmen de Viboral, Colombia in 1978.  
Last tested for infectivity in 1978. Effective.
- CIAT 896 P. vulgaris. Isolated as M-113, Carmen de Viboral, Colombia in 1978.  
Last tested for infectivity in 1978. Effective.

R. phaseoli cont.

- CIAT 897 P. vulgaris. Isolated as M-24, Carmen de Viboral, Colombia in 1978.  
Last tested for infectivity in 1978. Effective.
- CIAT 898 P. vulgaris. Isolated as M-73, Carmen de Viboral, Colombia in 1978.  
Last tested for infectivity in 1978. Effective.
- CIAT 899 P. vulgaris. Isolated as M-188, Carmen de Viboral, Colombia in 1978.  
Last tested for infectivity in 1978. Effective.
- CIAT 900 P. coccineus. Isolated as CBI, Popayan, Colombia in 1979.  
Last tested for infectivity in 1979.
- CIAT 901 P. coccineus. Isolated as CB4, Popayan, Colombia in 1979.  
Last tested for infectivity in 1979.
- CIAT 902 P. coccineus. Isolated as CRI, Popayan, Colombia in 1979.  
Last tested for infectivity in 1979.
- CIAT 903 P. vulgaris. Obtained from J. Halliday, USA as Tal 182 in 1979.  
Last tested for infectivity in 1979. Effective. Included in 1979 IBIT.
- CIAT 904 P. vulgaris. Obtained from S.M.T. Saito, Brazil as C88 in 1979.  
= 487 RGS Porto Alegre. Last tested for infectivity in 1979.  
Effective. Included in 1979 and 1980 IBITs.
- CIAT 905 P. vulgaris. Obtained from S.M.T. Saito, Brazil as C29 in 1979.  
Last tested for infectivity in 1979. Effective. Included in 1979.  
IBIT.
- CIAT 906 P. vulgaris. Obtained from S.M.T.Saito, Brazil as C34 in 1979.  
Last tested for infectivity in 1979. Effective.

Strains of Rhizobium for grain legumes.

Species : Rhizobium sp. (strains in this group are divided according to host plant.)

Arachis hypogea

- |      |     |   |
|------|-----|---|
| CIAT | 6   | Isolated in 1976 near Bogotá, Colombia. Presumptive <u>Rhizobium</u> only.  |
| CIAT | 14  | Obtained from the Marandellas Research Institute, Rhodesia as strain 411 in 1971. Last tested for infectivity in 1972. Effective. |
| CIAT | 47  | Obtained from Sydney University as SU 649 = CB 746 in 1972. Not plant tested at CIAT.   |
| CIAT | 79  | Obtained from Sydney University as CB756 in 1971. Last tested for infectivity in 1972. Effective. Wide spectrum strain.           |
| CIAT | 396 | Obtained from the Instituto Nacional de Ciencias Agrícolas in Colombia in 1973. Originally from Japan. Not plant tested at CIAT.  |

Cajanus cajan

- |      |     |  |
|------|-----|--|
| CIAT | 397 | Obtained from University of West Indies as strain UW 1 0001 in 1973. Not plant tested at CIAT. |
| CIAT | 398 | Obtained from the University of West Indies as UWI 0004 in 1973. Not plant tested at CIAT.     |
| CIAT | 399 | Obtained from the University of West Indies as UWI 0005 in 1973. Not plant tested at CIAT.     |

Cajanus cajan cont.

CIAT 400 Obtained from P. Dart as Voand Barn I und originally isolated in Nigeria. Not plant tested at CIAT.

Phaseolus sp.

CIAT 79 See Arachis hypogea.

CIAT 257 Phaseolus acutifolius. Obtained from E.B. Roslycky as strain 94/RIO in 1976. Not plant tested at CIAT.

CIAT 518 Phaseolus lunatus. Obtained from E.B. Roslycky as strain 96/RIO in 1976. Not plant tested at CIAT.

CIAT 718 Phaseolus lunatus. Isolated from nodules, Tunia, Colombia in 1977. Presumptive Rhizobium only.

CIAT 719 Phaseolus lunatus. Isolated from nodules Restrepo, Colombia in 1977. Presumptive Rhizobium only.

CIAT 720 Phaseolus lunatus. Isolated from nodules, CIAT Colombia in 1977. Presumptive Rhizobium only.

CIAT 721 Phaseolus lunatus. Isolated from nodules, Pradera, Colombia in 1977. Presumptive Rhizobium only.

CIAT 722 Phaseolus lunatus. Isolated from nodules, Florida, Colombia in 1977. Presumptive Rhizobium only.

CIAT 723 Phaseolus lunatus. Isolated from nodules, Dagua, Colombia in 1977. Presumptive Rhizobium only.

Phaseolus sp. cont.

- CIAT 725 Phaseolus lunatus. Isolated from nodules, Carimagua, Colombia in 1977. Presumptive Rhizobium only.
- CIAT 879 Phaseolus lunatus. Obtained from J.C.Burton as strain 127E 12 in 1978. Not plant tested at CIAT.
- CIAT 880 Phaseolus penduratus. Obtained from J.C.Burton as strain 127N in 1978. Tested for infectivity with P. acutifolius in 1979. Effective.

Vigna unguiculata

- CIAT 79 See Arachis hypogea
- CIAT 239 Isolated as Z243, Galapa, Colombia in 1972. Presumptive Rhizobium only.
- CIAT 292 Isolated as Z337, Carimagua, Colombia in 1973. Presumptive Rhizobium only.

Characterisation of selected strains of Rhizobium phaseoli\*

Table 1: Lists some biochemical, serological and nutritional data for 52 strains of R. phaseoli. The methods used were derived from the following publications :

Tests	1, 3, 10, 11 :	Graham, P.H. Plant Soil (1964) <u>20</u> , 383-396.
Test	2	Bernaerts, M.J. and DeLey, J. (1963) Nature <u>197</u> , 406-407.
Test	4	Maier, R.J. <u>et al.</u> (1978) Proc. Nat Acad Sci. USA <u>75</u> , 3258-3262.
Tests	5, 6, 7, 8,9:	Keyser, H.H. and Munns, D.N. (1979) Soil Sci. Soc. Amer. J. <u>43</u> , 519-523.
Tests	12-19	Graham, P.H. (1963). Aust. J. Biol. Sci <u>16</u> , 557-559.
Tests	20-25	Graham, P.H. (1964). Ant van Leeuwenhoek <u>30</u> , 68-72.
Tests	26-27	Vincent, J.M. (1970). IBP Handbook No. 15.
Tests	28-30	Graham, P.H. (1971). Arch. Mikrobiol. <u>78</u> , 70-75.

\* Work undertaken by Arturo Palacios ( Fertimex, Mexico ) during a postgraduate internship at CIAT.



Characteristic studied	Strain of <i>R. phaseoli</i>																									
	620	622	625	632	634	636	640	641	661	663	664	668	671	673	676	693	804	895	896	898	899	903	904	905	906	
1. Gram reaction	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2. Ketolactose production	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3. Isolated colonies on BYMA in 2-3 days	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
4. Reduction of Tetrazolium HCl	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5. Growth in Keyser medium, pH 4.6	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
6. Growth in Keyser medium, pH 5.0	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
7. Growth in pH 6.0 medium + 50 uM Mn	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
8. As 5, plus 2 ppm Al	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
9. As 5, plus 4 ppm Al	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10. Growth in medium, pH 9.0	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
11. Growth in BYMA + 2% NaCl	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12. Tolerance of Streptomycin (10 ug/disc)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13. Tolerance of Erythromycin (15 ug/disc)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14. Tolerance of Bacitracin (10 units/Disc)	-	-	+	+	-	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-
15. Tolerance of Terramycin (5 ug/disc)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16. Tolerance of Ampicillin (10 ug/disc)	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
17. Tolerance of Oleandomycin (15 ug/disc)	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
18. Tolerance of chloromycetin (30 ug/disc)	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
19. Tolerance of Viomycin (2 ug/disc)	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
20. Growth on glucose medium	-	-	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
21. Growth on sucrose medium	-	-	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
22. Growth on lactose medium	-	-	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
23. Growth on mannitol medium	-	-	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
24. Growth on rhamnose medium	-	-	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
25. Growth on glycerol medium	-	-	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
26. Nodulation with <i>P. vulgaris</i> , P 566	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
27. Efficient in N <sub>2</sub> fixation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
28. Serological reaction with 57 antisera	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29. Serological reaction with 255 antisera	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
30. Serological reaction with 632 antisera	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

06

## Appendix 1

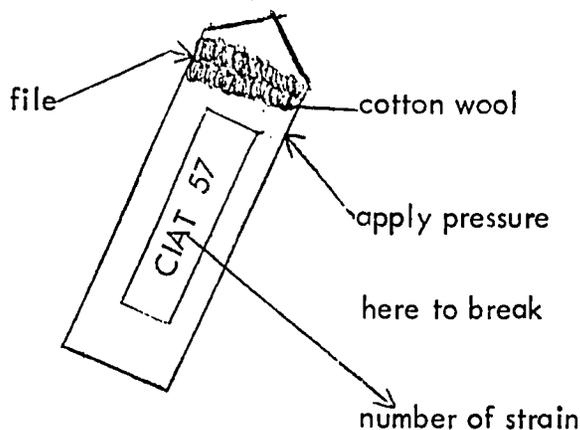
### Reconstitution of strains from Ampoules

#### Requirements :

Sterile pasteur pipette, 3 cornered file, sterile yeast-mannitol broth or physiological saline, Plates of yeast mannitol medium.

#### Procedure :

1. Mark the base of two petri plates containing YM medium with an X close to their outer walls.
2. Score the ampoule deeply with a file so that it will break readily under pressure. Filing mark should traverse the ampoule and be located in the middle of the cotton wool plug. Crack ampoule.



3. Half-fill sterile pasteur pipette with broth or saline, then add several drops to the paper at bottom of ampoule. Suck up and expel liquid several times.
4. Place 1 drop on X position in each of the two petri plates and leave them 2-3 hours to absorb liquid.
5. Subculture normally on the remaining area of the plate.