Genetic Resources and Crop Evolution **46:** 557–568, 1999.

Resistance to *Meloidogyne javanica* in wild *Arachis* species*

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Received 3 November 1998; accepted in revised form 15 February 1999

Key words: Arachis spp., *Meloidogyne javanica*, resistance, root-knot nematodes

Abstract

The root-knot nematode, *Meloidogyne javanica* Race 3 is an important nematode parasite of groundnut. Greenhouse evaluation of 184 accessions of 33 wild *Arachis* spp. five interspecific derivatives, 18 groundnut cultivars for root damage (galls formed by nematode) and nematode reproduction demonstrated that resistance to the nematode is available in the genepool of wild *Arachis* spp. Seven accessions, ICG 8952 (*Arachis helodes*), ICC 13211 (*A. sylvestris*), ICG 13224 (*A. kretscmeri*), ICG 13231 (*Arachis* sp.), ICG 14862 (*A. kuhlmannii*), ICG 14868 (*A. stenosperma*), and ICG 14915 (*A. sylvestris*) were highly resistant to nematode reproduction and root damage. There was no gall and eggmass formation on any plant of these accessions. Thirty-three accessions were resistant and 14 were moderately resistant. All the tested accessions of *A. monticola, A. benensis, A. ipaensis, A. hoehnei, A. kempff-mercadoi, A. valida, A. chiquitana, A. rigonii, A. vallsii, A. dardani, A. paraguariensis, A. triseminata*, interspecific derivatives, and groundnut cultivars were susceptible. The possible use of resistance sources in the breeding program is discussed.

Introduction

Groundnut (*Arachis hypogaea* L.) has originated in South America and it is presently being cultivated in over 110 countries between 40 N and 40 S for edible oil, high seed protein, and confectionary use. A number of biotic constraints such as insect pests, fungi, viruses, bacteria and nematodes affect groundnut production in different parts of the world. More than 100 species of plant parasitic nematodes have been found associated with groundnut, but only a few species are important as constraints to groundnut production particularly in the tropics. The root-knot nematodes (*Meloidogyne* spp.) are the most important nematode parasites. Four species of *Meloidogyne* (*M. arenaria, M. javanica*, *M. hapla* and *M. incognita*) attack groundnut in different parts of the world; the first two species are widespread in India and they are an important or potentially important constraint to groundnut production in parts of Gujarat, Tamil Nadu, Andhra Pradesh and Punjab.

The nematode-induced annual economic losses to groundnut are estimated at 12% on a worldwide basis, and in monetary terms these losses are over US$ one billion (Sasser & Freckman, 1987). These losses are predicted to be much higher in the tropical developing countries from where many highly damaging populations of plant parasitic nematodes exist and growers do not have enough resources to invest in nematicide-based nematode control. For example, in some areas of Gujarat in India, the losses to groundnut due to the root-knot nematodes are as high as 38–59% (Ali, 1997). There are no practical nematode management options available to the groundnut farmers. Cultivars resistant to these nematode species have not been developed in India or elsewhere.

Nematode surveys conducted during the last 20 years in India have revealed that populations of *M. javanica* that are highly pathogenic to groundnut are widespread in parts of northern, western and southern

* ICRISAT Journal Article No. 2288.

India (Sharma & Ashokkumar, 1991). Some populations are even more virulent than *M. arenaria* Race 1 (Sakhuja & Sethi, 1985). There are reports on *M. javanica* parasitizing groundnut in many other countries such as Zimbabwe (Martin, 1958), USA (Minton et al., 1969), Brazil (Lordello & Gerin, 1981), and Egypt (Ibrahim & El Saedy, 1976). Sharma et al. (1995) described those populations that have the ability to infect groundnut as race 3 of *M. javanica*. At the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), more than 2500 accessions of cultivated groundnut were screened for resistance to *M. javanica* Race 3 but sources with good levels of nematode resistance not yet found.

The wild *Arachis* species are regarded as important sources of genes for resistance to several fungi, viruses, insects, nematodes, and some other desirable traits. The objective of this study was to scan wild *Arachis* genepool for resistance to *M. javanica* Race 3.

Material and methods

Nematode population

A population of *M. javanica* Race 3, originally collected from Pallipalem village in Prakasam district of Andhra Pradesh in southern India was used in all the tests. The nematode population was maintained on groundnut cultivar JL 24 in 30-cm diam. pots in a greenhouse at ICRISAT, Patancheru, Andhra Pradesh, India.

Arachis *species*

Seed of 161 accessions of wild *Arachis* species within seven botanical Sections (*Arachis*, *Procumbentes, Erectoides, Heteranthae, Triseminatae, Extranevosae* and *Caulorrhizae* (Krapovickas & Gregory, 1994), five interspecific groundnut derivatives, and 18 groundnut cultivars were obtained from the Genetic Resources Division of ICRISAT. The details of species and number of accessions (given in parentheses) in each Section are presented here:

Section *Arachis*: *Arachis batizocoi* (5), *A. benensis* (1), *A. cardenasii* (11), *A. correntina* (1), *A. diogoi* (1), *A. duranensis* (54), *A. helodes* (2), *A. hoehnei* (1), *A. hypogaea* (18), *A. kuhlmannii* (10), *A. monticola* (5), *A. stenosperma* (17), *A. villosa* (2), *A. ipaensis* (1), *A. kempff-mercadoi* (1), and *A. valida* (3).

Section *Procumbentes: Arachis appressipila* (5), *A. chiquitana* (2) *A. kretschmeri* (3), *A. rigonii* (2), and *A. vallsii* (1).

Section *Erectoides: Arachis paraguariensis* (4), *A. oteroi* (1), and *A. stenophylla* (1).

Section *Extranervosae: Arachis villosulicarpa* (1).

Section *Heteranthae*: *Arachis dardani* (2), *A. pusilla* (7), and *A. sylvestris* (2).

Section *Triseminatae: Arachis triseminata* (3).

Section Caulorrhizae: *Arachis pintoi* (9).

Other accessions included one accession of *A. batizogaea* (a natural hybrid of *A. batizocoi* and *A. hypogaea*), two accessions of unidentified *Arachis* species, and five advanced interspecific derivatives.

Screening for nematode resistance

Eggs of *M. javanica* Race 3 were extracted from 8-week-old groundnut plants (cultivar JL 24) by treating the roots with sodium hypochlorite (Hussey & Barker, 1973) and 10,000 eggs in water suspension were placed in the same depression in which seed was 15-cm-d pot. The pots contained riverbed sand + black cotton soil (39% sand, 20% silt, 41% clay; pH 8.0) mixture (4:1, v:v). Groundnut cultivar Robut 33-1 was used as a nematode susceptible check. All the pots were irrigated regularly and supplemented with Arnon's nutrient solution and 250 μg g^{-1} nitrogen as ammonium nitrate once a week. After eight weeks of seedling emergence, roots were carefully washed with tap water and evaluated for gall index, gall size, and % galled area of root. Nematode reproduction was measured by counting egg masses. Roots of each plant were treated with 0.25% trypan blue to stain the egg masses blue (Sharma & Mohiuddin, 1993). Roots were rated on a 1–9 scale for gall index (GI): 1 = no galls; 2 = 1–5 galls; 3 = 6–10 galls; 4 = 11–20 galls; 5 = 21–30 galls; 6 = 31–50 galls; 7 = 51–70 galls; 8 = 71–100 galls; and 9 = >100 galls. Gall size (GS) was evaluated on a 1–9 scale (1 = no galls; 3 = very small, about 10% increase in root area at the galled region over non-galled normal root area; 5 = small galls, about 30% increase; 7 = medium, about 31–50% increase; and 9 = big galls, about 51–100% increase). Percent galled area (GA) of root was rated on a 1–9 scale where 1 = no galls; 3 = 1–10% root area galled; 5 = 11–30% root area galled; 7 = 31–50% root area galled; and 9 = >50% root area galled. GI, GS and GA are intrinsic components of damage by the root-knot nematodes. A damage index (DI) was calculated by dividing the sum of GI, GS, and GA by three (GI + GS + GA)/3.

Accessions with DI = 1 were considered as highly resistant to damage, with DI = 2–3 as resistant, with DI = 4–5 as moderately resistant, with DI = 6–7 as susceptible, and with DI = 8–9 as highly susceptible to damage. Numbers of egg masses were rated using the 1–9 scale for gall number (Egg mass index (EI) 1= no egg masses, 9 = >100 egg masses). Accessions with EI = 1 were considered highly resistant to nematode reproduction and with EI = 9 were highly susceptible. Mean and standard error of mean were calculated for GI, GS, %G, El and DI. Accessions were classified as highly resistant (DI and/or EI = 1), resistant (DI and/or EI $\leq$3), moderately resistant (DI and/or EI $\leq$5), susceptible (DI and/or EI $\leq$7), and highly susceptible (DI and/or EI $\leq$9). If the DI and EI scores for an accession differed, the accession was classified based on the higher of the two scores.

The ambient temperature in the greenhouse ranged between 32 °C and 23 °C. The pots, arranged in a completely randomized design, were irrigated daily with 50-ml water pot^{-1} and quarter strength Arnon's nutrient solution was added every week. Accessions identified as resistant to *M. javanica* were evaluated again to confirm the reaction. Germination of some accessions was poor and seedling mortality was common. Data given in tables are generally based on 3 to 25 plants per accession.

Results

Reaction of all the accessions are in Table 1. Seven accessions were highly resistant to nematode reproduction (EI = 1) and root damage (DI = 1), 33 accessions were resistant with EI and/or DI = 3 or less, 16 accessions were moderately resistant with EI and/or DI = 5 or less, 43 accessions were susceptible with EI and/or DI = 7 or less, and 85 accessions were highly susceptible with EI and/or DI = 9 or less. Reactions of different species within different Sections are described here:

Section Arachis

Arachis batizocoi: Out of five accessions, ICG 8210 was the most promising because it had comparatively very few moderate size galls and egg masses, and plant-to-plant variation in terms of formation of galls and egg masses was very low. Other two resistant accessions were ICG 8211 and ICG 8958, the gall and egg mass numbers on the latter were very variable. ICG 8124, a highly susceptible accession was highly suitable for nematode reproduction; however, the gall size was small. ICG 8209 was moderately resistant, it had 5–30 galls but no egg masses, probably the nematode was not able to complete its life cycle or the generation time was enhanced to more than eight weeks.

Arachis cardenasii: Seven (ICGs 8216, 11558, 11562, 11564, 12167, 13164, 13165) of 12 accessions tested were resistant, two (ICGs 11561, 11563) were moderately resistant, and three (ICGs 11559, 11566 and 13166) were susceptible. Among the resistant ones, ICG 11558 was the most promising; out of 16 plants of this accession that were evaluated, only two had a low number of small egg masses and the other 14 plants were free of any galls or egg masses. It was not checked whether or not these egg masses contained viable eggs. Similarly, all the 15 plants of ICG 8216 were without any egg masses, and only five plants had small galls. ICG 11562 was resistant to nematode infection and the reaction of all its 11 plants to root damage (DI) was consistent. ICG 11561 was resistant to root damage and moderately resistant to egg mass production while ICG 11563 was moderately resistant to root damage and resistant to egg mass production. The general trends of DI and EI indicated that galls were produced in greater number than egg masses on accessions of this species.

Arachis benensis, A. correntina, A. decora, A. diogoi and *A. ipaensis*. One accession of each of these species was evaluated. *Arachis benensis* (ICG 11551) was highly susceptible to root damage and it was very suitable for nematode reproduction. The *A. correntina* accession (ICG 8132) was resistant to nematode-caused root damage as well as reproduction. The mean ratings of this accession for gall number, gall size, galled area on root, DI, and EI were below 3. ICG 14894, an accession of *A. decora*, was moderately resistant to root damage and egg mass production was less than the gall formation; the galls were, however, small and covered only about 10% of the root area. ICG 8962 (*A. diogoi*) was susceptible to root damage and moderately resistant to egg mass production. The galls produced on this accession were medium to big, and on some plants more than 30% root area was covered with galls. The accession of *A. ipaensis* (ICG 8206) was highly susceptible.

Arachis duranensis: None of the 52 accessions was highly resistant to root damage and galls were formed on all the accessions. The resistant accessions were ICGs 8200, 11550, 11555, 13182, 13184, and

Table 1. Reaction of accessions of *Arachis* spp. to *Meloidogyne javanica* race 3

ICG No.	Collector ID	*Arachis* species name	Section	Origin	EI Mean	SE ±	DI Mean	SE
		Highly resistant						
8952	GK 30031	*A. helodes* Martius ex Krapov. & Rigoni	*Arachis*	BRA	1.0	0.0	1.0	0.0
13211	VSW 6676	*A. sylvestris* (A. Chev.) A. Chev	*Heteranthae*	BRA	1.0	0.0	1.0	0.0
13224	VRGeSv 7631 Tall MS	*A. kretschmeri* Krapov. & W.C. Gregory	*Procumbentes*	BRA	1.0	0.0	1.0	0.0
13231	9232	*Arachis* sp. –	NA	NA	1.0	0.0	1.0	0.0
14862	VpoBi 9235	*A. kuhlmannii* Krapov. & W.C. Gregory	*Arachis*	BRA	1.0	0.0	1.0	0.0
14868	VSv 10309	*A. stenosperma* Krapov. & W.C. Gregory	*Arachis*	BRA	1.0	0.0	1.0	0.0
14915	VVeSv 6180	*A. sylvestris* (A. Chev.) A. Chev	*Heteranthae*	BRA	1.0	0.0	1.0	0.0
		Resistant						
8125	HLK 408	*A. stenosperma* Krapov. & W.C. Gregory	*Arachis*	BRA	2.4	0.4	3.0	0.5
8132	GKP 9530	*A. correntina* (Burkart) Krapov. & W.C. Gregory	*Arachis*	ARG	1.2	0.2	2.3	0.2
8137	HLK 409	*A. stenosperma* Krapov. & W.C. Gregory	*Arachis*	BRA	1.1	0.1	1.3	0.2
8144	PI 210554	*A. villosa* Benth	*Arachis*	ARG	1.0	0.0	2.0	0.0
8200	GKBSPSc 30067	*A. duranensis* Krapov. & W.C. Gregory	*Arachis*	ARG	1.7	0.4	1.4	0.1
8210	GKBSPSc 30081	*A. batizocoi* -do-	*Arachis*	BOL	1.4	0.0	1.5	0.0
8211	GKBSPSc 30083	*A. batizocoi* -do-	*Arachis*	BOL	1.8	0.1	2.7	0.2
8216	GKP 10017	*A. cardenasii* Krapov. & Rigoni	*Arachis*	BOL	1.0	0.1	1.4	0.0
8906	HLK 410	*A. stenosperma* Krapov. & W.C. Gregory	*Arachis*	BRA	1.3	0.0	1.5	0.1
8958	GKBSPSc 30080	*A. batizocoi* -do-	*Arachis*	BOL	2.5	0.5	2.3	0.0
11550	GKBSPSc 30068	*A. duranensis* -do-	*Arachis*	ARG	1.6	0.2	2.3	0.9
11552	KSBScC 36002-1	*A. duranensis* -do-	*Arachis*	ARG	1.3	0.3	1.3	0.1
11555	KSBScC 36005-1	*A. duranensis* -do-	*Arachis*	ARG	2.0	0.0	2.1	0.0
11558	KSSc 36019-1	*A. cardenasii* Krapov. & Rigoni	*Arachis*	BOL	1.5	0.1	1.0	0.0
11562	KSSc 36033 Y	*A. cardenasii* -do-	*Arachis*	BOL	1.3	0.2	1.3	0.0
11564	KSSc 36034 YF-1	*A. cardenasii* -do-	*Arachis*	BOL	2.0	0.3	2.4	0.2
13164	KSSc36015-4	*A. cardenasii* -do-	*Arachis*	BOL	1.1	0.1	1.2	0.1
13165	KSSc36019 B-1	*A. cardenasii* -do-	*Arachis*	BOL	1.3	0.1	2.6	0.1
13172	VSMoGeSv 7379	*A. stenosperma* Krapov. & W.C. Gregory	*Arachis*	BRA	1.0	0.0	1.7	1.0
13173	VSSv 7384	*A. stenosperma* -do-	*Arachis*	BRA	1.0	0.0	2.6	0.1
13182	KSSc 38901	*A. duranensis* Krapov. & W.C. Gregory	*Arachis*	BOL	2.2	0.1	1.8	0.1
13184	KSSc 38904	*A. duranensis* -do-	*Arachis*	ARG	1.3	0.0	2.2	0.2
13187	VSMoGeSv 7377-4	*A. stenosperma* -do-	*Arachi*	BRA	1.0	0.0	1.4	0.2
13188	VSSv 7382-7	*A. stenosperma* -do-	*Arachis*	BRA	2.0	0.2	2.2	0.1
13195	KSSc38901-2	*A. duranensis* -do-	*Arachis*	BOL	1.3	0.3	2.7	0.1
13210	AViW 2796	*A. stenosperma* -do-	*Arachis*	BRA	1.4	0.2	2.3	0.0
13219	VVeSv 6110 ORFL	*A. pusilla* Benth	*Heteranthae*	BRA	1.5	0.3	2.0	0.0
14860	VPoBi 9130	*A. appressipila* Krapov. & W.C. Gregory	*Procumbentes*	BRA	1.3	0.1	2.1	0.1
14863	VPoBi 9243	*A. kuhlmannii* -do-	*Arachis*	BRA	1.0	0.0	2.2	0.1
14865	VPoBi 9470	*A. kuhlmannii* -do-	*Arachis*	BRA	2.8	0.0	2.6	0.0
14872	VGaRoSv 12488	*A. stenosperma* -do-	*Arachis*	BRA	1.4	0.2	2.5	0.3
14919	VSGr 6352	*A. kuhlmannii* -do-	*Arachis*	BRA	2.0	0.1	1.8	0.0
		Moderately resistant						
8192	GK 30008	*A. oteroi* Krapov. & W.C. Gregory	*Erectoides*	BRA	4.0	0.3	4.9	0.3
8209	GKBSPSc 30079	*A. batizocci* -do-	*Arachis*	BOL	1.0	0.0	3.7	0.4
8959	GKBSPSc.Z 30085-1	*A. kempff-mercadoi* Krapov., W.C. Gregory & C.E. Simpson	*Arachis*	BOL	3.6	1.0	3.4	0.5

(Continued)

Table 1. Continued

ICG No.	Collector ID	*Arachis* species name	Section	Origin	EI Mean	SE ±	DI Mean	SE
11553	KSBScC 36002-2	*A. duranensis* Krapov. & W.C. Gregory	*Arachis*	ARG	1.9	0.2	4.1	0.3
11554	KSBScC 36003-1	*A. duranensis* -do-	*Arachis*	ARG	3.1	0.2	4.3	0.3
11561	KSSc 36033-2	*A. cardenasii* Krapov. & Rigoni	*Arachis*	BOL	3.1	0.3	2.3	0.2
11563	KSSc 36033 YO-1	*A. cardenasii* -do-	*Arachis*	BOL	1.7	0.1	3.1	0.1
12162	GKBSPSc 30067 D	*A. duranensis* Krapov. & W.C. Gregory	*Arachis*	ARG	3.4	0.1	2.7	0.1
13166	36020-1	*A. cardenasii* Krapov. & Rigoni	*Arachis*	BOL	1.4	0.2	3.6	0.2
13183	KSSc 38903	*A. duranensis* Krapov. & W.C. Gregory	*Arachis*	ARG	3.7	0.3	2.5	0.2
14897	WPn 142	*A. pusilla* Benth	*Heteranthae*	BRA	4.0	1.0	4.7	0.4
14913	WBz 224	*A. pintoi* Krapov. & W.C. Gregory	*Caulorrhizae*	BRA	4.5	0.7	4.3	0.1
14918	VSGrCn 6344	*A. kuhlmannii* -do-	*Arachis*	BRA	5.0	0.0	4.8	0.2
14931	VpoBi 9230	*A. kuhlmannii* -do-	*Arachis*	BRA	4.0	0.7	5.0	0.5
		Susceptible						
758		*A. hypogaea* L. (cv. Japlin 220-15)	*Arachis*	NA	5.8	0.1	5.7	0.0
1284		*A. hypogaea* L. (cv. AH 7341)	*Arachis*	CHN	6.8	0.1	6.3	0.0
2856		*A. hypogaea* L. (cv. US 56)	*Arachis*	CHN	6.4	0.1	6.1	0.0
2997		*A. hypogaea* L. (cv. AH 7326)	*Arachis*	CHN	6.4	0.1	6.0	0.1
3164		*A. hypogaea* L. (cv. Ching Roy)	*Arachis*	CHN	7.0	0.1	5.9	0.1
4299		*A. hypogaea* L. (cv. EC 7585)	*Arachis*	AUS	6.2	0.1	6.0	0.1
4746		*A. hypogaea* L. (cv. Line 136)	*Arachis*	ISR	7.0	0.5	5.3	0.2
6429		*A. hypogaea* L. (cv. Nc. 6)	*Arachis*	USA	6.6	0.1	5.9	0.1
6689		*A. hypogaea* L. (cv. MBWA Runner)	*Arachis*	TZA	5.8	0.1	5.3	0.1
7893		*A. hypogaea* L. (cv. Tripp 2636)	*Arachis*	PER	4.6	0.1	5.6	0.0
8130	KC 11462	*A. paraguariensis* Chodat & Hassl.	*Erectoides*	PRY	3.0	1.0	5.1	0.8
8215	GKPSc 30126	*A. stenophylla* Krapov. & W.C. Gregory	*Erectoides*	BRA	6.3	0.5	5.5	0.4
8141	HLKHe 565-66	*A. paraguariensis* Chodat. & Hassl.	*Erectoides*	BRA	5.7	0.3	6.8	0.1
8191	GK 30007	*A. kretschmeri* Krapov. & W.C. Gregory	*Procumbentes*	BRA	5.0	0.5	6.1	0.2
8205	GKBSPSc 30075	*A. duranensis* -do-	*Arachis*	BOL	7.0	0.2	6.4	0.1
8955	GK 30036	*A. helodes* Martius ex Krapov. & Rigoni	*Arachis*	BRA	5.0	1.0	6.5	0.5
8956	GKBSPSc 30065	*A. duranensis* Krapov. & W.C. Gregory	*Arachis*	ARG	6.0	0.0	5.7	0.0
8962	GKPSc 30106	*A. diogoi* Hoehne	*Arachis*	PRY	3.7	0.3	5.9	0.3
11559	KSSc 36020-1	*A. cardenasaii* Krapov. & Rigoni	*Arachis*	BOL	4.7	0.7	5.3	0.2
11566	KSSc 36034 YO-1	*A. cardenasii* -do-	*Arachis*	BOL	5.0	0.2	5.4	0.1
13186	KSSc 38906	*A. duranensis* Krapov. & W.C. Gregory	*Arachis*	ARG	5.3	1.0	5.0	0.0
13201	KSSc 38903-3	*A. duranensis* -do-	*Arachis*	ARG	7.0	0.9	6.3	1.0
13204	KSSc 38904-3	*A. duranensis* -do-	*Arachis*	ARG	2.0	0.0	5.7	0.0
13205	KSSc 38904-4	*A. duranensis* -do-	*Arachis*	ARG	1.5	0.0	5.7	0.1
13207	KSSc 38905-2	*A. duranensis* -do-	*Arachis*	ARG	6.2	0.6	5.3	0.3

(Continued)

Table 1. Continued

ICG No.	Collector ID	*Arachis* species name	Section	Origin	EI Mean	SE ±	DI Mean	SE
13213	VSW 6785	*A. pusilla* Benth	*Heteranthae*	BRA	6.7	0.3	6.0	0.3
13220	VSW 6709	*A. pusilla* Benth	*Heteranthae*	BRA	6.4	0.5	4.6	0.1
13241	KSSc 36031	*A. chiquitana* Krapov., W.C. Gregory & C.E. Simpson	*Procumbentes*	BOL	1.7	0.1	5.1	0.0
13244	VSMoGeSv 7379-4	*A. stenosperma* Krapov. & W.C. Gregory	*Arachis*	BRA	5.8	0.3	4.9	0.1
11554	KSBScC 36003-1	*A. duranensis* -do-	*Arachis*	ARG	5.8	0.4	5.1	0.0
13257	S 861	*A. vilosa* Benth	*Arachis*	NA	5.8	0.6	5.3	0.3
14875	VFaPzSv 13080	*A. triseminata* Krapov. & W.C. Gregory	*Triseminatae*	BRA	4.3	1.0	6.2	1.4
14890	BRA 03328	*Arachis* sp. –	NA	NA	6.3	0.0	6.8	0.1
14891	Jt 2	*A. stenosperma* Krapov. & W.C. Gregory	*Arachis*	BRA	5.5	0.5	5.5	0.2
14907	VPm 189	*A. pintoi* -do-	*Caulorrhizae*	BRA	6.6	0.5	6.0	0.2
14922	VSW 6784	*A. pintoi* -do-	*Caulorrhizae*	BRA	6.3	0.7	5.2	0.1
14924	VKVeSv 7215	*A. dardani* -do-	*Heteranthae*	BRA	6.5	1.0	6.3	0.3
14927	VSStGdW 7762	*A. stenosperma* -do-	*Arachis*	BRA	7.0	0.4	5.9	0.3
14929	VKSSv 8979	*A. kuhlmannii* -do-	*Arachis*	BRA	5.0	1.0	5.7	0.5
14930	VKSSv 9010	*A. stenosperma* -do-	*Arachis*	BRA	4.5	1.5	6.3	0.7
14932	VSW 9912	*A. kuhlmannii* -do-	*Arachis*	BRA	5.5	0.0	5.2	0.1
14937	VRSv 10972	*A. dardani* -do-	*Heteranthae*	BRA	5.0	1.0	5.7	0.3
14948	VSPmPzRsWi 13315	*A. pintoi* -do-	*Caulorrhizae*	BRA	4.7	0.9	5.8	0.6
14957	VSGSv 13404	*A. pusilla* Benth	*Heteranthae*	BRA	5.0	0.0	5.1	0.1
		Highly susceptible						
1710		*A. hypogaea* L. (cv. NCAc 17135)	*Arachis*	PER	8.8	0.2	5.4	0.3
2307		*A. hypogaea* L. (cv. NCAc 2144)	*Arachis*	USA	8.2	0.4	5.7	0.2
2482		*A. hypogaea* L. (cv. AH 7301)	*Arachis*	CHN	8.0	0.5	5.9	0.3
3690		*A. hypogaea* L. (cv. U4-47- 12)	*Arachis*	AUS	9.0	0.0	8.2	0.1
6330		*A. hypogaea* L. (cv. MS 48)	*Arachis*	ZWE	7.4	0.1	6.1	0.1
6446		*A. hypogaea* L. (cv. NC 3033)	*Arachis*	USA	8.4	0.4	6.7	0.2
8123	K 7988	*A. duranensis* Krapov. & W.C. Gregory	*Arachis*	ARG	7.7	0.5	4.5	0.4
8124	K 9484	*A. batizocoi* -do-	*Arachis*	BOL	9.0	0.0	5.2	0.2
8127	GKP 9990	*A. appressipila* -do-	*Procumbentes*	BRA	8.0	0.5	6.6	0.2
8128	GKP 9993	*A. appressipila* Krapov. & W.C. Gregory	*Procumbentes*	BRA	8.5	0.5	7.3	0.4
8129	GKP 1002	*A. appressipila* -do-	*Procumbentes*	BRA	8.3	0.5	6.6	0.3
8135	HLP 7264	*A. monticola* Krapov. & Rigoni	*Arachis*	ARG	9.0	0.0	7.1	0.3
8138	GKP 10038 SL	*A. duranensis* Krapov. & W.C. Gregory	*Arachis*	ARG	9.0	0.0	8.3	0.0
8139	GKP 10038 LL	*A. duranensis* -do-	*Arachis*	ARG	7.5	0.0	6.9	0.3
8142		*A. villosulicarpa* Hoehne	*Extranervosae*	BRA	9.0	0.0	7.0	0.0
8186		*A. rigonii* Krapov. & W.C. Gregory	*Procumbentes*	BOL	9.0	0.9	6.1	0.2

(Continued)

Table 1. Continued

ICG No.	Collector ID	*Arachis* species name	Section	Origin	EI Mean	SE ±	DI Mean	SE
8190	GK 30006	*A. hoehnei* -do-	*Arachis*	BRA	9.0	0.0	8.3	0.0
8193	GK00011	*A. valida* -do-	*Arachis*	BRA	9.0	0.0	7.8	0.1
8195	GKBSPSc 30060	*A. duranensis* -do-	*Arachis*	ARG	8.1	0.2	8.1	0.2
8196	GKBSPSc 30061	*A. duranensis* -do-	*Arachis*	ARG	9.0	0.0	8.0	0.0
8197	GKBSPSc 30062	*A. monticola* Krapov. & Rigoni	*Arachis*	ARG	9.0	0.0	8.1	0.2
8198	GKBSPSc 30063	*A. monticola* -do-	*Arachis*	ARG	9.0	0.0	8.3	0.0
8199	GKBSPSc 30064	*A. duranensis* Krapov. & W.C. Gregory	*Arachis*	ARG	9.0	0.0	8.5	0.2
8201	GKBSPSc 30069	*A. duranensis* -do-	*Arachis*	BOL	7.7	0.5	7.4	0.3
8202	GKBSPSc 30070	*A. duranensis* -do-	*Arachis*	BOL	8.9	0.1	7.9	0.2
8204	GKBSPSc 30073 A	*A. duranensis* -do-	*Arachis*	BOL	7.4	0.0	5.7	0.1
8206	GKBSPSc 30076	*A. ipaensis* -do-	*Arachis*	BOL	9.0	0.0	8.2	0.3
8346		*A. hypogaea* L. (cv. Tainan #9)	*Arachis*	TWN	9.0	0.0	7.4	0.3
8901	Fernandez 316	*A. batizogeae** –	*Arachis*	ARG	9.0	0.0	8.2	0.1
8904	GKP 10034	*A. rigonii* Krapov. & W.C. Gregory	*Procumbentes*	BOL	9.0	0.0	7.7	0.0
8945	GK 30003	*A. appressipila* -do-	*Procumbentes*	BRA	9.0	0.0	7.4	0.2
8954	GK 30035	*A. kuhlmannii* -do-	*Arachis*	BRA	7.8	0.4	5.1	0.4
8957	GKBSPSc 30074	*A. duranensis* -do-	*Arachis*	BOL	9.0	0.0	8.3	0.0
8963	GKPSc 30109	*A. paraguariensis* Chodat & Hassl.	*Erectoides*	PRY	8.0	1.0	6.8	1.5
8970	GKPSc 30124-1	*A. paraguariensis* -do-	*Erectoides*	PRY	7.2	0.5	4.3	0.1
11285		*A. hypogaea* L. (cv. 473 gasp)	*Arachis*	PER	7.6	0.2	5.3	0.2
11312		*A. hypogaea*+ L. (cv. CS 16)	*Arachis*	ICRISAT	9.0	0.0	6.3	0.0
11317		*A. hypogaea*+ L. (cv. CS 22)	*Arachis*	ICRISAT	8.4	0.4	6.7	0.2
11331		*A. hypogaea*+ L. (cv. CS 39)	*Arachis*	ICRISAT	8.6	0.2	5.7	0.6
11341		*A. hypogaea*+ L. (cv. CS 52)	*Arachis*	ICRISAT	9.0	0.0	6.9	0.1
11353		*A. hypogaea*+ L. (cv. CS 709)	*Arachis*	ICRISAT	9.0	0.0	7.1	0.3
11548	GK 30011 G	*A. valida* Krapov. & W.C. Gregory	*Arachis*	BRA	9.0	0.0	8.3	0.0
11549	GKBSPSc 30063 D	*A. monticola* Krapov. & Rigoni	*Arachis*	ARG	9.0	0.0	7.5	0.1
11551	GKSPSc 35005	*A. benensis* Krapov., W.C. Gregory & C.E. Simpson	*Arachis*	BOL	9.0	0.0	7.7	0.0
13174	ScVn 21763	*A. duranensis* Krapov. & W.C. Gregory	*Arachis*	ARG	7.5	0.7	6.3	0.1
13175	ScVn 21764	*A. duranensis* -do-	*Arachis*	ARG	8.0	0.6	6.7	0.3
13176	ScVn 21767	*A. duranensis* -do-	*Arachis*	ARG	7.8	0.8	4.8	0.2
13178	ScVn 21769-1 St-2	*A. monticola* Krapov. & Rigoni	*Arachis*	ARG	9.0	0.0	6.8	0.2

(Continued)

Table 1. Continued

ICG No.	Collector ID	*Arachis* species name	Section	Origin	EI Mean	SE ±	DI Mean	SE
13181	KSSc 36028	*A. chiquitana* Krapov., W.C. Gregory & C.E. Simpson	*Procumbentes*	BOL	9.0	0.0	8.3	0.0
13185	KSSc 38905	*A. duranensis* Krapov. & W.C. Gregory	*Arachis*	ARG	9.0	0.0	8.3	0.0
13189	KSSc 38900-1	*A. duranensis* -do-	*Arachis*	ARG	9.0	0.0	7.9	0.2
13190	KSSc 38900-2	*A. duranensis* -do-	*Arachis*	ARG	9.0	0.0	8.3	0.0
13191	KSSc 38900-3	*A. duranensis* -do-	*Arachis*	ARG	7.0	0.0	8.1	0.2
13192	KSSc 38900-4	*A. duranensis* -do-	*Arachis*	ARG	5.6	0.0	8.7	0.2
13193	KSSc 38900-5	*A. duranensis* -do-	*Arachis*	ARG	9.0	0.0	8.5	0.1
13194	KSSc 38900-6	*A. duranensis* -do-	*Arachis*	ARG	9.0	0.0	8.3	0.0
13196	KSSc-38902-1	*A. duranensis* -do-	*Arachis*	BOL	7.3	0.3	7.7	0.1
13197	KSSc 38902-3	*A. duranensis* -do-	*Arachis*	BOL	8.0	0.8	7.7	0.4
13198	KSSc 38902-4	*A. duranensis* -do-	*Arachis*	BOL	8.4	0.8	7.0	0.2
13199	KSSc 38903-1	*A. duranensis* -do-	*Arachis*	ARG	8.4	0.4	5.0	0.3
13200	KSSc 38903-2	*A. duranensis* -do-	*Arachis*	ARG	7.2	0.4	4.0	1.0
13202	KSSc 38903-4	*A. duranensis* -do-	*Arachis*	ARG	7.6	0.2	4.1	0.1
13206	KSSc 38905-1	*A. duranensis* -do-	*Arachis*	ARG	8.3	0.8	7.6	0.6
13216	KSBScC 36004 Y	*A. duranensis* -do-	*Arachis*	ARG	9.0	0.0	7.0	0.0
13217	KSSc 36036	*A. duranensis* -do-	*Arachis*	ARG	9.0	0.0	8.2	0.2
13218	KSBScC 36006	*A. duranensis* -do-	*Arachis*	ARG	9.0	0.0	8.3	0.0
13222	VSWSa 6791 WFL	*A. pintoi* -do-	*Caulorrhizae*	BRA	9.0	0.0	6.6	0.1
13223	VSSv 7384 YFL	*A. stenosperma* -do-	*Arachis*	BRA	4.0	0.0	7.3	0.0
13234	IRFL 2273	*A. kretschmeri* -do-	*Procumbentes*	BRA	7.3	0.3	6.8	0.1
13236	GKBSPSc 30061 A	*A. duranensis* -do-	*Arachis*	ARG	9.0	0.0	7.9	0.1
13242	KSSc 38900	*A. duranensis* -do-	*Arachis*	ARG	8.0	0.6	6.5	0.1
13243	KSSc 38902	*A. duranensis* -do-	*Arachis*	BOL	9.0	0.0	7.0	0.0
13245	VRGeSv 7635	*A. vallsii* -do-	*Procumbentes*	BOL	9.0	0.0	7.0	0.0
11552	KSBScC 36002-1	*A. duranensis* -do-	*Arachis*	ARG	9.0	0.0	7.0	0.0
13250	KSBScC 36004 OR	*A. duranensis* -do-	*Arachis*	ARG	8.7	0.2	7.0	0.2
13252	VSStGdW 7762	*A. stenosperma* -do-	*Arachis*	BRA	8.0	0.3	6.1	0.1
13255	9017-1 St 1	*A. stenosperma* Krapov. & W.C. Gregory	*Arachis*	BRA	8.0	0.6	6.3	0.4
13256	VPoBi 9153	*A. valida* -do-	*Arachis*	BRA	9.0	0.3	6.1	0.1
14855	WWs 108	*A. pintoi* -do-	*Caulorrhizae*	BRA	8.0	0.5	8.5	0.1
14856	WPn 123	*A. pintoi* -do-	*Caulorrhizae*	BRA	8.0	0.7	5.5	0.2
14861	VPoBi 9214	*A. kuhlmannii* -do-	*Arachis*	BRA	7.3	0.9	6.5	0.3
14888	VPzBmVaDb 13363	*A. pintoi* -do-	*Caulorrhizae*	BRA	8.2	0.5	6.0	0.2
14898	WPn 143	*A. pusila* Benth	*Heteranthae*	BRA	8.8	0.3	4.9	0.3
14899	WPn 144	*A. triseminata* Krapov. & W.C. Gregory	*Triseminatae*	BRA	9.0	0.0	6.7	0.2
14908	WPn 190	*A. pusilla* Benth	*Heteranthae*	BRA	8.3	0.7	5.2	0.1
14910	WPn 195	*A. triseminata* Krapov. & W.C. Gregory	*Triseminatae*	BRA	9.0	0.0	7.0	0.0
14947	VSPmPzRsWi 13312	*A. pintoi* -do-	*Caulorrhizae*	BRA	8.0	0.6	6.3	0.3

NA = Not available.
* *A. batizogaea* = Hybrid derivative from *A. batizocoi* × *A. hypogaea*.
+Advanced breeding interspecific derivatives.

13195. Among these resistant accessions, the number of galls was lowest on ICG 11550 and highest on ICG 13195. Within this species, ICG 11550 and 13182 were considered as better than other accessions in having only a very small portion of the root covered with galls and no or little egg mass production. Four accessions (ICGs 11553, 11554, 12162, 13183) were moderately resistant to root damage (DI) and/or egg mass production (EI). The moderately resistant accessions had variable plant-to-plant reaction and some plant even had 50 small galls while others had less than 10. All other accessions were susceptible (Table 1). The mode of reaction of different accessions of this species indicated a trend towards susceptibility.

Arachis helodes: The two accessions of this species were very different from each other in their reaction to nematode infection. ICG 8952 was highly resistant and no egg mass and gall were observed on any of the plants of this accession. Another accession, ICG 8955 was susceptible; egg masses and moderate sized galls, which covered about 50% of the root area were observed.

Arachis hoehnei: ICG 8190 was among the most susceptible accessions of *Arachis* spp. Gall size was very big and more than 50% root area was covered with galls.

Arachis hypogaea: All the 18 accessions of *A. hypogaea* were susceptible to nematode infection (Table 1). The plants of all the accessions were normally heavily galled. Among the 18 accessions, two accessions, ICG 6689 which originated in Tanzania, and ICG 7893 from Peru, were 'less susceptible'. ICG 3690, an accession collected from Australia, was most susceptible.

Arachis kempff-mercadoi: Moderate levels of egg masses and galls were produced on ICG 8959. The egg masses were usually produced in greater number than the galls on all the plants of this accession. There was, nevertheless, large plant-to-plant variation in number of egg masses and one of the 10 plants even had more than 80 egg masses.

Arachis kuhlmannii: Of the 10 accessions that were tested, ICG 14862 was highly resistant. There was no gall or egg mass formed on any of the 19 plants examined of this accession. Three other accessions (ICGs 14863, 14865, 14919) were resistant; ICG 14863 had no egg mass on roots. ICGs 14918 and 14931 had only moderate levels of resistance and large intra-accession variation. Two accessions were susceptible (ICGs 8954, 14861) and two others were highly susceptible (ICGs 14929, 14932) to root damage or nematode reproduction or both.

Arachis stenosperma: Most of the 18 accessions tended to resist egg mass and gall formation on roots, and 12 out of 18 accessions were highly resistant or resistant. One accession (ICG 14868) was highly resistant; none of the 21 plants of this accession had any galls or egg masses on the roots. ICGs 8137, 13172, 13173, and 13187 had a few small galls but no egg masses. ICGs 8125, 8906, 13188, 13210, and 14872 had less than 3 ratings for EI as well as DI. Some plants of ICG 8125 had even 35 galls but root area covered with galls was less than 10%. Four accessions (ICGs 13244, 14891, 14927, 14930) were susceptible and three (ICGs 13223, 13252, 13255) were highly susceptible.

Arachis monticola: All the five accessions of *A. monticola* (ICGs 8135, 8197, 8198, 11549, and 13178) were highly susceptible. The gall and egg mass numbers on some plants were greater than even the highly susceptible groundnut cultivars.

Arachis valida: All the three accessions (ICGs 8193, 11548, 13256) of *A. valida* were suceptible. ICG 11548 was the most susceptible accession for nematode damage and nematode reproduction. The root galling was profuse and galls were big.

Arachis villosa: ICG 8144 had no egg masses on the roots of any of the 12 plants and a few very small galls were formed. Another accession ICG 13257 was susceptible.

Arachis spp.: ICG 13231, an accession of an unidentified species, was highly resistant to nematode infection. All the 25 plants of this accession were without any gall or egg mass. Another accession (ICG 14890) was susceptible.

Section Procumbentes

Arachis appressipila: Out of five accessions of this species, ICG 14860 was resistant and four (ICGs 8127, 8128, 8129, 8945) were highly susceptible for nematode reproduction and root damage. The gall size was much bigger on ICG 8945 than on the other three susceptible accessions. This accession also had a higher number of egg masses.

Arachis chiquitana: Two accessions of this species were tested and one (ICG 13181) was highly susceptible and another accession (ICG 13241) was susceptible to root damage but it resisted reproduction of nematode (EI = 1.7).

Arachis kretschmeri: One accession, ICG 13224, was highly resistant and all the 17 plants that were evaluated had no galls or egg masses. ICG 8191 was susceptible to root damage (DI = 6.1) and on average had more than 50 galls per root. ICG 13234 was highly susceptible.

Arachis rigonii: The two accessions of *A. rigonii* (ICGs 8186 and 8904) were highly susceptible. ICG 8904 was more susceptible than ICG 8186, particularly for nematode reproduction as well as for number of galls. More than 50% of the root area of ICG 8904 was covered with galls.

Arachis vallsii: The accession (ICG 13245) of this species was susceptible. It had more than 100 medium size galls which covered about 50% of the root area. The number of egg masses also exceeded 100.

Section Heteranthae

Arachis dardani: Both the accessions (ICGs 14924 and 14937) were susceptible. ICG 14924 supported a greater number of egg masses. The number of galls on both the accessions was similar but the root area covered with galls was greater on ICG 14924.

Arachis pusilla: The accessions of this species also facilitated egg mass and gall production by the nematode. Three accessions (ICGs 13213, 13220, and 14957) were susceptible, two (ICGs 14898 and 14908) were highly susceptible, one (ICG 13219) was resistant and another (ICG 14897) was moderately resistant. All the plants of ICG 14897 had between 30 and 60 galls but less than 10% root area was covered by galls as the gall size was small. ICG 14898 was highly suitable for egg mass production.

Arachis sylvestris: Both the accessions, ICG 13211 and ICG 14915, were highly resistant. There was no incidence of gall and egg mass formation on all the nine plants of ICG 13211 and 10 plants of ICG 14915.

Section Erectoides

Arachis oteroi: ICG 8192, the only accession of *A. oteroi* that was screened, showed moderate levels of resistance to nematode. However, plant-to-plant variation for gall number was evident and one plant had even more than 80 galls. The size of galls was generally small.

Arachis paraguariensis: One accession (ICG 8130) of this species was tested and it was susceptible. The reaction of the four plants that were screened ranged between moderate levels of resistance and susceptibility. The plants varied in number of galls and egg masses.

Arachis stenophylla: ICG 8215 was tested and it was susceptible. Plants of this accession had small to large galls and on some plants up to 50% of root area was covered with galls.

Section Caulorrhizae

Arachis pintoi: Nine accessions (ICGs 13222, 14855, 14856, 14888, 14913, 14922, 14942, 14947 and 14948) of this species were tested and all except ICG 14913 were either susceptible or highly susceptible. ICG 14913 was moderately resistant; however, some plants of this accession have ratings of DI and EI greater than 5.

Section Triseminatae

Arachis triseminata: Three accessions of this species were evaluated; all were susceptible. ICG 14899 and 14910 were highly susceptible while ICG 14875 was susceptible. All the three accessions had medium to large galls. The highly susceptible accessions were very suitable for egg mass production.

Section Extranevosae

Arachis villosulicarpa: The accession (ICG 8142) of this species was highly susceptible. The number of galls on all plants were greater than 100 and about 50% of the root area was covered with galls. This accession was also highly suitable for egg mass production.

Natural hybrid

Arachis batizogaea: The accession (ICG 8901) of this hybrid was highly susceptible to nematode reproduction and root damage. The roots were full of nematode-caused medium to big galls and egg masses.

Interspecific derivatives

All the six accessions (ICGs 11285, 11312, 11317, 11331, 11341, 11353) were highly susceptible. These accessions had profuse galling on roots and were covered with egg masses.

Table 2. List of accessions of *Arachis* spp with resistance to more than one species of *Meloidogyne*

ICG number	Collectors' ID	Species	*M. arenaria*[1] Race 1	*M. hapla*[1]	*M. javanica* Race 3
8216	GKP 10017	*A. cardenasii*	R	R	R
8211	GKPBSSc 30083	*A. batizocoi*	R	–	R
8124	K 9484	*A. batizocoi*	R	R	S
13172	VSGeMoSv 7379	*A. stenosperma*	R	–	R
11554	KSPBScC 36003-1	*A. duranensis*	R	–	MR
13210	AViW 2796	*A. stenosperma*	R	–	R
14865	V 9470	*A. kuhlmannii*	MR	–	R
13211	VSW 6676	*A. sylvestris*	R		HR
13213	VSW 6785	*A. pusilla*	R	–	S
13220	VSW 6709	*A. pusilla*	R	–	S
8906	HLK 410	*A. stenosperma*	R	R	R

[1]Data for *M. arenaria* Race 1 and *M. hapla* taken from Nelson et al. (1989). For collectors' identification details see Nelson et al. (1989). – = Not known.

Discussion

Resistance to *M. javanica* is available in the genepool of *Arachis* wild species. It is interesting and may be a coincidence that all the highly resistant accessions (except ICG 13231 whose origin is not known) originated in Brazil. We are inclined to speculate that even some landraces of cultivated groundnut in Brazil may have resistance to the nematode. Resistance to a *Meloidogyne* sp. in *A. correntina*, *A. helodes*, *A. kretschmeri*, and *A. appressipila* is being reported for the first time. There is not enough information on the geographical origin of *M. javanica* and it is difficult to conjecture the centers of diversity of this highly polyphagus nematode species. It is also hard to comment whether or not the centers of diversity of this nematode species and wild *Arachis* species coincide; nonetheless, good sources of resistance have been located. Many of the tested species such as *A. batizocoi*, *A. duranensis* and *A. stenosperma* are in the same Section *Arachis* as the cultivated groundnut (*A. hypogaea*) and can be directly used in resistance breeding programs for annexation of genes conferring nematode resistance. Some accessions (e.g. ICG 13224) of a species (e.g. *A. kretschmeri*) were highly resistant to nematode damage and reproduction, while some others (e.g. ICG 13234) were highly susceptible. It suggests that while stating results on identification of resistance in wild species, revealing the accession identity is essential to assist in selection of a suitable parent for use in breeding programs.

Large variation in reaction of accessions within a species was observed. Polymorphism in gall number, gall size, root area covered with galls, and egg mass number was observed even within accessions of a species. The field collections of *Arachis* spp. are stored as populations at ICRISAT and are not purified for nematode reaction, hence polymorphism seems to be inevitable.

The nematode resistant accessions that were found during this investigation may be tested against other species of the root-knot nematodes (*M. arenaria* and *M. hapla* in particular) to assess whether or not the resistance is species-specific. Nelson et al. (1989) reported resistance to *M. arenaria* race 1 and *M. hapla*. Comparison of our results with that of Nelson et al. (1989) indicated that some of the accessions that were identified as resistant to *M arenaria* and (or) *M. hapla* are even resistant to *M. javanica* race 3 (Table 2). One of the most promising accessions is ICG 8216 (*A. cardenasii*) which has resistance to all three species. This resistance to *M. arenaria* has been transferred to a complex hybrid TP 135 (Nelson et al., 1989; Starr et al., 1995). However, it is evident from Table 2 that it is not necessary that all accessions that have resistance to *M. arenaria* will have resistance to *M. javanica*. Resistance in *A. cardenasii* (ICG 8216) to *M. arenaria* is expressed as complete inhibition of development of invading juvenile (Nelson et al., 1990). We also did not find any gall or egg mass formation by *M. javanica* on this accession. The mechanisms of resistance and genetics of resistance in the identified accessions need to be studied. ICG 8216 also has a high level of resistance (immune) to rust *Puccinia arachidicola* (Subrahmanyam et al., 1980), and late leaf spot caused by *Phaeoisariopsis personata* (Abdou et al., 1974; Subrabmanyam et al., 1980). Two other accessions of *A. cardenasii*, ICGs 11558 and 11562, that are moderately resistant to the nematode have resistance to peanut stripe virus (Prasada Rao et al., 1993).

Arachis cardenasii and *A. stenosperma* are cross compatible with groundnut and it is possible to transfer the broad spectrum of resistance in these accessions to the cultivated groundnut. The use of nematode resistant germplasm in genetic improvement of cultivated groundnut should have a priority for non-availability of options to manage the root-knot nematode-caused damage particularly in the developing countries. We suggest that the complex hybrid TP 135 should be tested for resistance to *M. javanica* populations. Recently, Abdel-Momen et al. (1998) indicated that interspecific *Arachis* hybrids that have developed resistance to *M. arenaria* may have developed resistance to *M. javanica*. A systematic screening of the accessions within the Section *Arachis* for various biotic stresses may result in identification of accessions with multiple resistance for harvest of useful genes.

Acknowledgement

Assistance provided by Mr J. Shankaraiah and Mr V. Rama Krishna in evaluating the accessions is gratefully acknowledged.

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