

PROJECT FULL TITLE:
**DEVELOPMENT OF A NEW DIAGNOSTIC TOOL USING DNA BARCODING TO IDENTIFY
 QUARANTINE ORGANISMS IN SUPPORT OF PLANT HEALTH**

GRANT AGREEMENT NO.: (226482)

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List of selected nematode Q-organisms

The species have been divided into three priority groups, with the first priority group being divided into three subgroups. The first subgroup will be screened with all candidate barcode regions and used to establish protocols for the amplification of these barcode regions. The second subgroup (containing a subset of subgroup 1 species and one species of another genus) will thoroughly be screened for the amount of intra-species variation within these barcode regions. Subgroup 3 (the remaining species of priority group 1) will then be screened with all barcode regions for which a robust PCR protocol could be established and which displayed no more than an acceptable amount of intra-species variation. Based on the results acquired in priority group 1, the 2-3 most promising barcoding regions will be selected. These will then be used to screen priority group 2 and, if time permits, priority group 3. Priority group 2 contains all remaining Q-organisms not included in priority group 1. Priority group 3 contains close relatives of Q-organisms and other agronomically relevant species. All species on the list are available from at least one of the partners in the QBOL-project with the exception of a few quarantine species. These will have to be acquired through other sources (see footnotes).

Priority group	Subgroup			Species	quarantaine/ alert list ¹	available from ² :
	1	2	3			
1	x			Meloidogyne arenaria		ACW, WUR
1	x			Meloidogyne incognita		ACW, WUR
1	x			Meloidogyne javanica		ACW, WUR, ILVO
1	x	x		Meloidogyne enterolobii ³	alert	ACW, WUR
1	x	x		Meloidogyne mayaguensis ³	alert	ACW, WUR
1	x	x		Meloidogyne chitwoodi	A2/227	ACW, WUR, ILVO
1	x	x		Meloidogyne fallax	A2/295	ACW, WUR, ILVO
1			x	Meloidogyne hapla – race A		ACW, WUR, ILVO
1			x	Meloidogyne minor		ACW, WUR
1			x	Meloidogyne naasi		ACW, WUR
1		x		Bursaphelenchus xylophilus ⁴	A1/158	ILVO
1		x		Bursaphelenchus mucronatus ⁴		ILVO, WUR
1		x		Bursaphelenchus chengi		ILVO
1		x		Bursaphelenchus doui		ILVO
1		x		Bursaphelenchus thailandae		ILVO
1		x		Xiphinema americanum sensu lato	A1/150	ILVO
1		x		Xiphinema diversicaudatum		CSL, ACW
1		x		Xiphinema rivesi	A2/262	ACW
2				Aphelenchoides besseyi	A2/122	CSL, INRA
2				Ditylenchus destructor		ILVO, WUR
2				Ditylenchus dipsaci	A2/174	ILVO, WUR

Priority group	Subgroup			Species	quarantaine/ alert list ¹	available from ² :
	1	2	3			
2				<i>Globodera pallida</i>	A2/124	WUR
2				<i>Globodera rostochiensis</i>	A2/125	WUR
2				<i>Heterodera glycines</i>	A2/167	ILVO
2				<i>Hirschmaniella</i> spp.	EU_SI	WUR
2				<i>Longidorus diadecturus</i>	EU_SI	other sources ⁵
2				<i>Meloidogyne ardenensis</i>		WUR
2				<i>Meloidogyne maritima</i>		WUR, ACW
2				<i>Nacobbus aberrans</i>	A1/144	other sources ⁵
2				<i>Radopholus similis</i> (attacking citrus, formerly <i>R. citrophilus</i>)	A1/161	WUR (1 ind.), other sources ⁵
2				<i>Radopholus similis</i> (not attacking citrus)	A2/126	WUR
2				<i>Xiphinema bricolense</i>	A1/260	other sources ⁵
2				<i>Xiphinema californicum</i>	A1/261	other sources ⁵
3				<i>Anguina tritici</i>		WUR (1 ind.)
3				<i>Aphelenchoides ritzemabosi</i>		other sources ⁵
3				<i>Aphelenchoides bicaudatus</i>		WUR (1 ind.)
3				<i>Aphelenchoides saprophilus</i>		WUR (1 ind.)
3				<i>Bursaphelenchus conicaudatus</i>		other sources ⁵
3				<i>Bursaphelenchus fraudulentus</i>		other sources ⁵
3				<i>Ditylenchus adasi</i>		WUR (1 ind.)
3				<i>Globodera achilleae</i>		CSL, WUR
3				<i>Globodera tabacum</i>		WUR
3				<i>Heterodera avenae</i>		ILVO, WUR
3				<i>Heterodera filipjevi</i>		ILVO
3				<i>Heterodera latipons</i>		ILVO
3				<i>Heterodera schachtii</i>		ILVO, WUR
3				<i>Helicotylenchus dihystra</i>		CSL
3				<i>Helicotylenchus pseudorobustus</i>		CSL, WUR
3				<i>Helicotylenchus varicaudatus</i>		CSL
3				<i>Helicotylenchus vulgaris</i>		CSL, WUR
3				<i>Hirschmaniella gracilis</i>		WUR
3				<i>Laimaphelenchus penardi</i>		WUR
3				<i>Longidorus arthensis</i>		ACW
3				<i>Longidorus dunensis</i>		WUR
3				<i>Longidorus elongatus</i>		ACW
3				<i>Longidorus macrosoma</i>		ACW
3				<i>Meloidogyne exigua</i>		other sources ⁵
3				<i>Paratrichodorus porosus</i>		CSL
3				<i>Paratrichodorus anemones</i>		CSL
3				<i>Paratrichodorus pachydermus</i>		CSL, WUR
3				<i>Pratylenchus loosi</i>		CSL
3				<i>Pratylenchus mediterraneus</i>		CSL
3				<i>Pratylenchus crenatus</i>		CSL, WUR
3				<i>Pratylenchus neglectus</i>		CSL, WUR
3				<i>Pratylenchus penetrans</i>		CSL, WUR
3				<i>Pratylenchus thornei</i>		CSL, WUR
3				<i>Pratylenchus vulnus</i>		ACW
3				<i>Radopholus arabocoffeae</i>		ILVO
3				<i>Radopholus duriophilus</i>		ILVO
3				<i>Subanguina radiculicola</i>		WUR (1 ind.)
3				<i>Trichodorus cedarus</i>		CSL

Priority group	Subgroup			Species	quarantaine/ alert list ¹	available from ² :
	1	2	3			
3				Trichodorus cylindricus		CSL, WUR
3				Trichodorus primitivus		CSL, WUR
3				Xiphinema incognitum		CSL
3				Xiphinema index		WUR (1 ind.)
3				Xiphinema simile		other sources ⁵

¹: A1/A2 numbers indicate that the species is on the A1 or A2 EPPO quarantine list and give the species number; alert indicates the species is on the EPPO alert list; EU_SI indicates the species is not on the EPPO quarantine list but is regulated by EU legislation.

²: WUR = WUR nematology (partner 1), CSL = Central Science Laboratory (partner 2), ILVO = Institute for Agricultural and Fisheries research (partner 3), ACW = Agroscope Changins/Wädenswil (partner 5)

³: Considered putative identical species as via the EPPO alert list.

⁴: Very closely related, possibly identical species.

⁵: *Radopholus similis*. According to the EPPO protocol reference material should be available from the Dutch Plant Protection Service.

Longidorus diadecturus, *Xiphinema bricolense*, *Xiphinema californicum*. These are North American species not occurring in Europe. American colleagues (UC Riverside) will be contacted to help acquire these. The nematology group of the university of Gent, Belgium may also have specimens/DNA available. *L. diadecturus* has only ever been found in the location it has originally been described from. In case complete specimens can not be obtained, DNA will be acquired from reference labs.

Nacobbus aberrans. Material is be available from INRA.

Aphelenchoides ritzemabosi. The SSU gene of this species has been sequenced by three research groups, we will contact them for material.

Bursaphelenchus conicaudatus, *Bursaphelenchus fraudulentus*. Research groups from Germany and the USA which have sequenced these species will be contacted for material.

Meloidogyne exigua. American colleagues (UC Riverside) will be contacted for this species.

Xiphinema simile. This species has been sequenced by three different European research groups who will be contacted for material.