## EUROPEAN AND MEDITERRANEAN PLANT PROTECTION ORGANIZATION ORGANISATION EUROPEENNE ET MEDITERRANEENNE POUR LA PROTECTION DES PLANTES (11-17239)

## Summary sheet of validation data for a diagnostic test

The EPPO Standard PM 7/98 Specific requirements for laboratories preparing accreditation for a plant pest diagnostic activity describes how validation should be conducted. It also includes definitions of performance criteria.

Target Organism	Grapevine flavescence dorée phytoplasma
Short description	Detection and identification of Flavescence dorée phytoplasma by direct and nested PCR followed by RFLP
Laboratory contact details	EUPHRESCO-GRAFDEPI Via Carlo Giuseppe Bertero, 22, 00156 ROMA, Italy
Date and reference of the validation report	Project EUPHRESCO GRAFDEPI Final Report 2014-07-31 1)h ttp://www.euphresco.net/media/project_reports/grafdepi_final_report.pdf 2)The Euphresco Grafdepi Group, 2015. European interlaboratory comparison of detection methods for "flavescence dorée" phytoplasma: preliminary results. Phytopathogenic Mollicutes doi: 10.5958/2249-4677.2015.00015.8 Vol. 5 (1-Supplement), January 2015, S35-S37
Validation process according to EPPO Standard PM 7/98:	Yes
Reference of the test description	PM 7/079(1) - Martini, M.; Murari, E.; M ori, N.; Bertaccini, A.; 1999. Plant Disease 83, 925-930 Deng, S.; Hiruki, C.; 1991. Journal of Microbiological Methods 14, 53 - 61) - Schneider B., Seemüller E., Smart C. D., Kirkpatrick B. C., 1995. In: Razin S. and Tully J. G. (ed.). Molecular and Diagnostic Procedures in Mycoplasmology 2: 369-380. New York: Academic PressGibb, K. S.; Padovan, A. C.; Mogen, B. D.; 1995. Phytopathology 85, 169-174 Padovan, A. C.; Gibb, K. S.; Bertaccini, A.; Vibio, M.; Bonfiglioli, R. G.; Magarey, P. A.; Sears, B. B.; 1995. Australian Journal of Grape and Wine Research 1, 25-31.
Is the test the same as described in the EPPO DP?	Yes
Is the lab accredited for this test?	No
Plant species tested (if relevant)	The samples had been provided by different partners of Project GRAFDEPI and belonged to different plant host species. The homogenising and preparation were performed by ANSES-LSV (France).  The samples consisted in DNA extracts. The batches' selection was based on methodology proposed in PM7/98 for the evaluation of the erformance criteria of analytical methods. Positive samples were from different parts of Europe in order to have a wide diversity of strains for testing the inclusivity of methods. Phytoplasmas in the same group and/or infecting grapevines were also chosen to test different degrees of specificity/exclusivity of methods.  13 samples were negative for the Flavescence dorée

	were other from other grapevine 11 sample phytoplas positive be mixed with DNA phytoplas When it were rand DNA extra	ma. 4 of them were healthy Vitis sp. The other ones or phytoplasmas of 16SrV group and phytoplasmas or groups, mixed with DNA extract of healthy to reach the volume necessary for the ring-test. Es were positive for the Flavescence dorée ma. They were DNA extracts of Vitis sp. tested by PCR for Flavescence dorée phytoplasmas pure or higherent quantities of healthy grapevine or mixed extracts positive for the 16SrXII group mas. The area of the same of the division during the preparation of tubes of the division during the preparation of tubes of the division during the preparation of tubes of the division that it is supernumerary fractions lomly chosen in the series of tubes. The appendix of the division during the preparation of tubes of the series of tubes. The appendix of the division during the preparation of tubes of the division during the preparation of tubes of tubes. The appendix of tubes appendix of tubes. The appendix of tubes appendix of tubes appendix of tubes appendix of tubes.	
Matrices tested (if relevant)			
List of methods used			
Method for extraction / isolation / baiting of target organism from matrix			
Molecular methods, e.g. hybridization, PCR and real time PCR	X	Detection and identification of Flavescence dorée phytoplasmas by a direct universal PCR with primers P1/P7, followed by a nested universal PCR with primers 16R758f (M1)/M23SR1804r (B6) and RFLP analysis of nested amplicons after digestion with Taql restriction enzyme	
Serological methods: IF, ELISA, Direct Tissue Blot Immuno Assay			
Plating methods: selective isolation			
Bioassay methods: selective enrichment in host plants, baiting, plant test and grafting.			
Pathogenicity test			
Fingerprint methods: protein profiling, fatty acid profiling & DNA profiling			
Morphological and morphometrical methods intended for identification			
Biochemical methods: e.g. enzyme electrophoresis, protein profiling			
Other			
Analytical sensitivity (= limit of detec	ction)		
What is smallest amount of target that can be detected reliably?	The analytical sensitivity was calculated in five laboratories analyzing three samples at five dilution levels (1/10; 1/100; 1/300; 1/900; 1/2700) in five repetitions. Samples (DNA extracts) came from IPEP (Serbia), ACW (Switzerland) and		

Diagnostic sensitivity	ANSES (France). The homogenising and preparation were performed by ANSES-LSV (France) Two values are provided: The last dilution level with 100% positive results: less than 1/10 (for all samples) The last dilution level with, at least, one positive result for each sample: 1/2700 (for all samples)
Proportion of infected/infested	Six laboratories were involved in performing this method
samples tested positive compared	within the ringtest. The results of one Partner have been
to results from the standard test, see appendix 2 of PM 7/98	removed because the RFLP analysis was not possible. A total of 120 results has been analysed.
see appendix 2 of the 1/50	Determined in 11 samples positive for Flavescence dorée
	phytoplasma. They were DNA extracts of Vitis sp. tested positive by PCR for FD pure or mixed with different quantities
	of healthy grapevine or mixed with DNA extracts positive for
	the 16SrXII group phytoplasmas. Within the ringtest 7 diagnostic methods were compared.
	Diagnostic sensitivity: 88.89%
	False negative: (8/120) 6.7%
Specify the standard test	Other protocols included in the ringtest:
	- Simoultaneous detection of FD and BN phytoplasmas by
	multiplex nested-PCR (Dairè et al., 1997; Angelini et al., 2001; Clair et al., 2003)
	- Detection of Flavescence dorée phytoplasma by universal
	direct PCR and nested 16SrV-group specific PCR - Simplex real time PCR for the detection of FD and BN
	phytoplasmas with an internal control for grapevine (Angelini
	et al., 2007) - Simplex real time PCR for the detection of FD and BN
	phytoplasmas with an internal control - (Hren et al., 2007)
	- Triplex real-time PCR for simultaneous FD and BN phytoplasmas detection with an internal control for grapevine.
	(Pelletier et al., 2009)
	- Triplex real time PCR for simultaneous FD and BN phytoplasmas detection with an internal control - (under
	patent IPADLAB)
Analytical specificity	
Specificity value	
Number of strains/populations of	
target organisms tested	
Number of non-target organisms tested	
Cross reacts with (specify the species)	
<b>Diagnostic Specificity</b>	
Proportion of uninfected/uninfested samples (true negatives) testing negative compared to results from a	Six laboratories were involved in performing this method within the ringtest. The results of one Partner have been removed because the RFLP analysis was not possible. A total

standard test	of 120 results has been analysed. 13 non target samples: 4 healthy grapevines and 9 were other phytoplasmas of 16SrV group and phytoplasmas from other groups. Diagnostic specificity: 93.18%
Specify the standard test	Other protocols included in the ringtest:
specify the standard test	- Simoultaneous detection of FD and BN phytoplasmas by multiplex nested-PCR (Dairè et al., 1997; Angelini et al., 2001; Clair et al., 2003) - Detection of Flavescence dorée phytoplasma by universal direct PCR and nested 16SrV-group specific PCR - Simplex real time PCR for the detection of FD and BN phytoplasmas with an internal control for grapevine (Angelini et al., 2007) - Simplex real time PCR for the detection of FD and BN phytoplasmas with an internal control - (Hren et al., 2007) - Triplex real-time PCR for simultaneous FD and BN phytoplasmas detection with an internal control for grapevine. (Pelletier et al., 2009) - Triplex real time PCR for simultaneous FD and BN phytoplasmas detection with an internal control - (under patent IPADLAB)
Reproducibility	
Provide the calculated % of agreement for a given level of the pest (see PM 7/98)	The reproducibility was calculated in five laboratories analyzing three samples at five dilution levels (1/10; 1/100; 1/300; 1/900; 1/2700) in five repetitions. Samples (DNA extracts) came from IPEP (Serbia), ACW (Switzerland) and ANSES (France). The homogenising and preparation were performed by ANSES-LSV (France).  Reproducibility: 67.73%
Repeatability	
Provide the calculated % of agreement for a given level of the pest (see PM 7/98)	The repeatability was calulated in five laboratories analyzing three samples at five dilution levels (1/10; 1/100; 1/300; 1/900; 1/2700) in five repetitions. Samples (DNA extracts) came from IPEP (Serbia), ACW (Switzerland) and ANSES (France). The homogenising and preparation were performed by ANSES-LSV (France) Repeatability: 77.60%
Test performance study	
Test performance study?	Yes
Include brief details of the test performance study and its output.It available, provide a link to published article/report	EUPHRESCO Project GRAFDEPI (CRA-PAV, Italy; AGES, Austria; CRA-W, Belgium, PPRS, Turkey; INIAV, Portugal; ACW, Switzerland; ILVO, Belgium; DIPSA, Bologna Italy; DISAA, Milan Italy; IPEP, Serbia; NIB, Slovenia; IRTA, Spain; ANSES, France; Cra-VIT, Italy)
Other information	
Any other information considered useful e.g. robustness, ease of performing	The ringtest was carried out by 15 laboratories and it is not possible to state if any of them is accredited for this test.

the test, etc.	
The following complementary files are available online:	Samples for determination of performance criteria