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 of Flavescence dorée phytoplasma by direct universal PCR and nested 16SrV-group specific PCR
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)http://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) - 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 Press. - Lee, I.-M.; Gundersen, D. E.; Hammond, R. W.; Davis, R. E.; 1994. Phytopathology 84, 559-566.
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 performance 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 phytoplasma. 4 of them were healthy Vitis sp.. The other ones were other phytoplasmas of 16SrV group and phytoplasmas from other groups, mixed with DNA extract of healthy grapevine to reach the volume necessary for the ring-test. 11 samples were positive for the Flavescence dorée

	phytoplasma. They were DNA extracts of Vitis sp. tested positive by PCR for Flavescence dorée phytoplasmas pure or mixed with different quantities of healthy grapevine or mixed with DNA extracts positive for the 16SrXII group phytoplasmas. When it was possible, supernumerary fractions were produced for each sample to validate their status and for testing the homogeneity of the division during the preparation of tubes for the participants. Then, these supernumerary fractions were randomly chosen in the series of tubes. DNA extracts were amplified in real-time triplex PCR (Pelletier et al., 2009). See Appendix	
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	Direct PCR with universal primers P1/P7 Nested PCR with the group specific primers R16(V)F1/R1
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		
<u>Analytical sensitivity (= limit of detection)</u>		
What is smallest amount of target that can be detected reliably?	The analytical sensitivity 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) Two values are provided: The last dilution level with 100% positive results: less than 1/10 (all three samples) The last dilution level with, at least, one positive result for each sample: 1/2700 (all three samples)	

Diagnostic sensitivity	
Proportion of infected/infested samples tested positive compared to results from the standard test , see appendix 2 of PM 7/98	Results obtained by 14 laboratories (one partner was excluded because the protocol was not respected) with a total of 312 results. 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: 91.44% False negative: (16/312) 5.1%
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 and identification of Flavescence dorée phytoplasma by direct and nested PCR followed by RFLP with Taq I (Martini et al., 1999) - 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)	
Diagnostic Specificity	
Proportion of uninfected/uninfested samples (true negatives) testing negative compared to results from a standard test	Results obtained by 14 laboratories (one partner was excluded because the protocol was not respected) with a total of 312 results. 13 non target samples: 4 healthy grapevines and 9 were other phytoplasmas of 16SrV group and phytoplasmas from other groups. Diagnostic specificity: 88.29%
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 and identification of Flavescence dorée phytoplasma by direct and nested PCR followed by RFLP with Taq I (Martini et al., 1999) - 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 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) Reproducibility: 73.80%
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: 81.65%
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	Interlaboratory comparison among 15 laboratories within the 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 test, etc.**	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 following complementary files are available online:	• Samples for determination of performance criteria