

## 1. Content of the 'Topic Description' document

### 1.1. Topic area

Diagnostics, field detection, surveillance

### 1.2. Links to the Euphresco Strategic Research Agenda

The topic addresses the following objective(s) of the 2017-2022 Euphresco Strategic Research Agenda (*Please keep only relevant objectives*).

Objective 2017-R-1.1: to improve knowledge on the biology, epidemiology and ecology of priority invasive and (re)emerging pests

Objective 2017-R-7.3: to identify and validate strategies for control of pests resistant to pesticides and understand the genetics and epidemiological behaviour of resistant forms

### 1.3. Topic title

Resistance breaking strains of *Tomato spotted wilt tospovirus*: distribution and evaluation of their impact on tomato and pepper production

### 1.4. Description of the problem the research should solve

*Tomato spotted wilt tospovirus* (TSWV) is considered as one of the economically most important plant viruses. Significant damages even up to 100% were recorded to be caused by the emergence of resistance-breaking (RB) isolates of TSWV. RB isolates of TSWV are reported from Spain, Italy, Hungary, Turkey, USA, Brazil, Argentina, Australia and South Africa in peppers and/ or tomatoes overcoming their resistance genes: Tsw in pepper and Sw-5 gene in tomato. The analyses of TSWV isolates overcoming the resistance indicate that mutations in the NSm gene leading to single amino acid changes at positions Y118 or N120 are responsible for resistance breakdown in tomatoes. Mutations in the NSs gene with leading to various single amino acid substitutions are responsible of resistance breakdown in peppers. Selection pressure and permanent growing of resistant cultivars leads to the development of resistance breaking relatively easily (Turina *et al.*, 2016). There is also evidence of RB strains of Tsw-gene present in weed hosts in Australia without selection pressure (unpublished).

For the majority of tomato and pepper growing countries in the EPPO region, data is not available on the presence and distribution of RB TSWV isolates. Identification of RB TSWV isolates can be performed by artificial inoculation of resistant and susceptible tomato and/ or pepper cultivars. RB isolates of TSWV can be identified by sequencing of PCR product of NSm gene. In addition, the specific test for identification of RB isolate with the change at Y118 was developed (di Rienzo *et al.*, 2018).

### 1.5. Description of the expected results

The aim of this project is to determine the distribution of TSWV RB isolates in participating countries and to estimate the potential impact of the RB TSWV isolates on tomato and pepper production. Different diagnostic tests for the identification of RB isolated will be evaluated and a protocol for the identification of RB TSWV isolates will be agreed and used in the participating countries. For the development of the protocol, full genome sequence data of a range of TSWV isolates will be generated and analysed. This includes RB isolates known to overcome the Tsw-gene in pepper and those which overcome the Sw-5 gene in tomato. Generating full genome data of the virus isolates will assist in confirming the putative single amino acid changes in either the NSm or NSs and is predictive of the RB phenotype in field collected isolates. The pathogenicity of all isolates included in the study will be tested against both the Tsw and Sw-5 genes.

### 1.6. Beneficiaries of this research product

Beneficiaries of the research product are listed below.

Stakeholder/user	Perceived benefit	Time-frame for adoption
Farmers	Improved productivity through enhanced understanding of risk. This could be regional within country or national level by knowledge of what RB isolates are likely to be present	Short-term, immediate for areas where study isolates were sourced; medium-term through access to a diagnostic for identification of RB phenotypes from disease outbreaks or testing of weed reservoirs
Agronomists/ inspectors/ crop monitors	Improved advice for growers on varietal selection and/or virus disease management	Short-term, immediate for areas where study isolates were sourced; medium-term through access to a diagnostic for identification of RB phenotypes from disease outbreaks or testing of weed reservoirs
Seed companies	Improved product delivery through better understanding of virus-plant interactions, leading to either improved resistant lines or management advice to better protect existing resistant genes	Short-term, immediate to know RB phenotypes for areas where study isolates were sourced thus allowing better targeted variety selection; long-term for improvements to breeding programs
Scientists	Improved knowledge on <i>Tospovirus</i> -plant interactions	Short-term, immediate to focus research on other <i>Tospovirus</i> species; implementation of diagnostic tests for specific RB phenotypes

### 1.7. Research funders and research contribution/ distribution

Funding organisation	Research activity and researchers involved
<p>1. Department of Agriculture and Fisheries, Queensland, Australia</p> <p>Con Goletsos ACPPPO@agriculture.gov.au</p>	<p>-Project coordination and lead for the Australian component; -RB phenotypes in pepper in Australia: full genome sequences of known RB and non-RB isolates; -Selected tomato TSWV isolates may also be sequenced, although, RB phenotypes of tomato are not known to be present in Australia;</p> <p>Research activities are mostly in collaboration with Dr Monica Kehoe from the Department of Primary Industries and Regional Development, Western Australia and also includes other Australian research groups.</p> <p>Contact person: Cherie Gambley E-mail address: <a href="mailto:Cherie.gambley@daf.qld.gov.au">Cherie.gambley@daf.qld.gov.au</a></p>



	Contact person: Monica Kehoe E-mail address: <a href="mailto:monica.kehoe@dpird.wa.gov.au">monica.kehoe@dpird.wa.gov.au</a>
2. Mediterranean Agronomic Institute of Chania, Greece  Ioannis Livieratos <a href="mailto:livieratos@maich.gr">livieratos@maich.gr</a>	-Sample collection and determination of the nucleotide sequence of specific TSWV genes (N, NSm, NSs, POL) for comparison purposes; -Inoculation of specific indicator species for symptoms observation;  Contact person: Ioannis Livieratos E-mail address: <a href="mailto:livieratos@maich.gr">livieratos@maich.gr</a>
3. Council for Agricultural Research and Economics, Italy  Luca Riccioni <a href="mailto:luca.riccioni@crea.gov.it">luca.riccioni@crea.gov.it</a>	-Pathogenicity testing for the evaluation of TSWV RB phenotype, using several tomato and pepper resistant hybrids and official lines; -Full genome sequencing of Italian TSWV RB strain that will be eventually retrieved for evaluation of specific molecular tests generated by other partners;  Contact person: Andrea Gentili E-mail address: <a href="mailto:andrea.gentili@crea.gov.it">andrea.gentili@crea.gov.it</a>  Contact person: Antonio Tiberini E-mail address: <a href="mailto:antonio.tiberini@crea.gov.it">antonio.tiberini@crea.gov.it</a>
4. Ministry of Agriculture Forestry and Food, Slovenia  Erika Orešek <a href="mailto:erika.oresek@gov.si">erika.oresek@gov.si</a>	-Full genome sequence data of a range of Slovenian TSWV isolates of tomato and pepper will be generated and analysed; - specific molecular test/s for identification of RB isolates will be evaluated  Contact person: Nataša Mehle E-mail address: <a href="mailto:natasa.mehle@nib.si">natasa.mehle@nib.si</a>  Contact person: Denis Kutnjak E-mail address: <a href="mailto:denis.kutnjak@nib.si">denis.kutnjak@nib.si</a>

### 1.8. Research project partnership outside Euphresco

Euphresco funding ensures a certain level of transnational collaboration among Euphresco member countries. It is possible, if the funding consortium is interested, to contact funding organisations or research groups outside the geographical area covered by Euphresco members. The Euphresco coordinator could advertise the research topic in order to have an enlarged collaboration. If funders are interested in this possibility, please check the case below:

The funding consortium of the topic mentioned in section 1.2 requires that the topic is advertised outside the Euphresco network

Information to define the profile of sought partners could be useful (but not mandatory): country/region (if there are preferences), skills/expertise required, etc.

### **1.9. Any other relevant information on content**

Research activities led by the Queensland Department of Agriculture and Fisheries are funded through Hort Innovation Australia using vegetable industry levies and contributions from the Australian Government with co-investment from the Queensland Department of Agriculture and Fisheries; Victorian Department of Economic Development, Jobs, Transport and Resources; The Northern Territory Department of Primary Industry and Resources; the Western Australia Department of Primary Industries and Regional Development and the University of Tasmania.

## 2. Euphresco management aspects of the project

### 2.1. Indication of the topic budget

Funding organisation <sup>a</sup>	Mechanism <sup>b</sup>	Total Budget <sup>c</sup>
1. DAF (AU)	NC	€ 25 000 (in-kind) € 12 000 (cash)
2. CIHEAM Chania (GR)	NC	€ 4 000 exclusively in kind
3. CREA (IT)	NC	€ 4 000 (in kind)
4. MAFF (SI)	NC	TBD
total		€

### 2.2. Expected duration of the project (only for non-competitive topics)

24 months

### 2.3. Identification of project coordinator

Has the research project coordinator been identified?

Yes

No

### 2.4. Any other relevant information on topic organisation and management

<sup>a</sup> First member is project coordinator. A minimum of two partners are necessary for each proposal. Add lines as needed.

<sup>b</sup> Please indicate the preferred mechanism (e.g. real pot RP; virtual pot VP; non-competitive NC), or several mechanisms if there is flexibility.

<sup>c</sup> Optional, as this amount can still change in the next phase. In-kind contribution should also be indicated in this column.