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:
☒ Objective 2017-R-2.1: to improve knowledge on emerging pathways of entry and means of spread for pests

1.3. Topic title

Seed borne pathogens of conifers

1.4. Description of the problem the research should solve

Traditionally tree seed material has been considered a relatively low risk pathway for the movement of exotic pests and pathogens, although there is a growing awareness that the risks are only poorly understood. Internet trade in seeds and the ongoing search for new tree species as part of adaptation measures to counter climate change impacts may also lead to unregulated trade in seed or the collection of seed from areas where little is known about potential seed-borne pests. In addition, spread through the movement of infected seed may be one of the drivers for the spread of pathogens such *Fusarium circinatum* or for the emergence of diseases such as Diplodia blight of pine, Neonectria canker on fir and Sirococcus blight which affects cedars, fir, hemlocks, pine and spruce. Although digital X-rays are effective at detecting insect or mechanical damage affecting seed, detection of pathogens has mainly come from culturing seed material onto agar media, which is time consuming and often has only a low probability of success. It is likely therefore, that pathogen frequency associated with tree seed and the risk of pest movement via this pathway is significantly underestimated.

1.5. Description of the expected results

This project will gather together information on seed borne pathogens of conifers with the aim of establishing a baseline on current knowledge. The project will aim to increase understanding of the legislation on seed movement and identify seed sources for each participant country; to compare the methodology used in different laboratories for the identification of pathogens on seeds (ISTA protocols, morphology, sanger sequencing, real-time PCR and high throughput sequencing using using MinION nanopore sequencing or Illumina MiSeq) and promote inter-laboratory training on the used methodology. To achieve this, the first objective will be a case study using seeds from *Pinus*, *Picea*, *Abies*, *Pseudotsuga* and *Cedrus* obtained from the same source which will be tested in each laboratory using the selected methodology. These conifer genera were selected as they are significant forestry and ornamental trees, and currently known to be at some risk from seed borne diseases. The project will also aim to investigate the presence of pathogens in selected tree species (one or more) of particular interest for each participant country. The knowledge generated will help understand the fungal community present on conifer seeds and will provide scientific evidence to guarantee further research and future projects. There is a need to understand the impact or the ecological meaning of the presence of these pathogens on seeds. Finally, the results of this project will help to improve understanding and management of known and emerging risks.

1.6. Beneficiaries of this research product

The project will benefit to National and EU policy makers, National Plant Protection Organizations, including risk managers and diagnosticians, EPPO and its members, forestry industry and other stakeholders testing laboratories including National Reference Laboratories.

1.7. Research funders and research contribution/ distribution

Funding organisation	Research activity and researchers involved
1. Forest Researc, United Kingdom Ana Perez-Sierra ana.perez-sierra@forestresearch.gov.uk	-Literature review (for fungal pathogens); -Enquiry on sources of conifer seeds and seed movements for UK ; -Comparison of diagnostic methods: 5 seed lots analysed using ISTA protocols; -Analysis of seed lots for UK (species to be confirmed); Contact person: Ana Perez-Sierra E. mail address: ana.perez-sierra@forestresearch.gov.uk
2. Austrian Research Centre for Forest, Austria Thomas Cech thomas.cech@bfw.gv.at	-Literature review (for fungal pathogens, insects and control measures); -Enquiry on sources of conifer seeds and seed movements for Austria; -Analysis of seed lots of main important conifer species in Austria (species to be confirmed); Contact person: Thomas Cech E. mail address: thomas.cech@bfw.gv.at
3. Julius-Kühn-Institut, Germany Silke Steinmöller silke.steinmoeller@julius-kuehn.de	-Literature review (for fungal pathogens); -Enquiry on sources of seeds and seed movements for Germany; -Seed lots analysed using morphology (with possibility of using also HTS (Illumina MiSeq), in case CRAW is not in the position to do); -Analysis of seed lots of main important conifer species in Germany; Contact person: Clovis Douanla-Meli E. mail address: clovis.douanla-meli@julius-kuehn.de
4. Norwegian Institute for Bioeconomy Research, Norway Hanne Skomedal Hanne.Skomedal@nibio.no	-Literature review; -Enquiry on sources of seeds and seed movements for Norway; -Comparison of diagnostic methods: 5 seed lots analysed using selected protocols; -Analysis of seed lots for Norway (e.g. imported subalpine fir seed lots from the USA for Christmas tree production, imported

	pine seed lots from Sweden for forest production, and imported spruce seed like Serbian spruce for Christmas trees and landscaping); Contact person: Venche Talgo E. mail address: venche.talgo@nibio.no
5. Biosecurity Science & Risk Assessment Directorate, New Zealand Aurelie Castinel Aurelie.Castinel@mpi.govt.nz	-Diagnostic methodology development; -Control measure development; -Literature reviews and risk analysis; Contact person: Michael Ormsby E. mail address: Michael.Ormsby@mpi.govt.nz
6. Instituto Nacional de Investigação Agrária e Veterinária, I.P., Portugal Leonor Cruz leonor.cruz@iniav.pt	-Literature review (for fungal/insects); -Enquiry on sources of seeds and seed movements for Portugal ; -5 seed lots analysed using ISTA protocols; -Analysis of seed lots of main important conifer species in Portugal (species to be confirmed); Contact person: Helena Braganca E. mail address: helena.braganca@iniav.pt
7. US Department of Agriculture, Animal and Plant Health Inspection Service, United States of America David Schimmelpfennig david.schimmelpfennig@usda.gov	-To be determined;
8. Walloon Centre for Agronomic Research, Belgium Anne Chandelier a.chandelier@cra.wallonie.be	-Literature review (for fungal pathogens and control measures); -Enquiry on sources of conifer seeds and seed movements for Belgium; -Comparison of diagnostic methods: 5 seed lots analysed by the other partners using morphology will be analysed by high throughput sequencing at CRAW (Illumina MiSeq). This objective will be achieved only if a national funding is available (project submitted to the Belgian Plant Protection Service in spring 2020 – feedback in November 2020); -Analysis of seed lots for Belgium (for the main conifer species used in Belgian forests); Contact person: Anne Chandelier E. mail address: a.chandelier@cra.wallonie.be
9. Swedish University of Agricultural Science, Sweden	-Literature review (for fungal pathogens); -Enquiry on sources of conifer seeds and seed movements for Sweden;

Michelle Cleary Michelle.Cleary@slu.se	-Comparison of diagnostic methods: 5 seed lots analysed using selected protocols; -Comparison of methods – seedlots tested using HTS methods (Illumina MiSeq vs. MinION nanopore sequencing) for rapid diagnostics in Pinus seed (sourced from countries and internet purchased). -Analysis of seed lots for Sweden (for the main conifer species spruce and pine, and minor species Douglas-fir, European/hybrid larch, used in Swedish forests) Contact person: Michelle Cleary E. mail address: Michelle.Cleary@slu.se
10. Swiss Federal Institute for Forest, Snow and Landscape Research, Switzerland Simone Prospero simone.prospero@wsl.ch	-Literature review on the movement of conifer seeds in Europe (and possibly worldwide); -Test Performance Study with a common seed lot to compare several methods for assessing the presence of fungi; -Analysis of the presence of fungi (probably isolation and Sanger sequencing, maybe also NGS) in Swiss seeds (Picea abies?); Contact person: Simone Prospero E. mail address: simone.prospero@wsl.ch

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

NIBIO is regularly requested by the Norwegian Forest Seed Center to screen conifer seed lots (mainly *Picea abies* and *Abies* spp.) for fungal infections following the ISTA regulations. NIBIO has a current project on *Diplodia sapinea* through The Ministry of Agriculture and Food where pine seed lots imported from Sweden are tested and from 2021, NIBIO will test imported seed lots (including conifer seeds) for the Norwegian Food Safety Authority.
Publication in a scientific journal would be considered according to results.

2. *Euphresco management aspects of the project*

2.1. Indication of the topic budget

Funding organisation [a]	Mechanism [b]	Total Budget [c]
1. FR (GB)	NC	€
2. BFW (AT)		€
3. JKI (DE)		€
4. NIBIO (NO)		€
5. MPI (NZ)		€
6. INIAV (PT)		€
7. APHIS (US)		€
8. CRAW (BE)	NC	€
9. WSL (CH)		€
10. SLU (SE)		€
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

[a] First member is project coordinator. A minimum of two partners are necessary for each proposal. Add lines as needed.
[b] Please indicate the preferred mechanism (e.g. real pot RP; virtual pot VP; non-competitive NC), or several mechanisms if there is flexibility.
[c] Optional, as this amount can still change in the next phase. In-kind contribution should also be indicated in this column.