1. Content of the 'Topic Description' document

1.1. Topic area

F: Pest/vector biology, epidemiology, taxonomy

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

1.3. Topic title

Range Expansion of bark beetles in the genus *Ips*.

1.4. Description of the problem the research should solve

First evidence of breeding by *Ips typographus* in the UK and expansion of *Ips amitinus* in Scandinavia, *Ips duplicatus* in central Europe and *Ips cembrae* in Great Britain and western/northern Europe suggest that factors that previously limited or moderated range expansion may be changing. The project shall assess the biotic, abiotic, climatic and anthropogenic factors that could be driving these changes in ecology and distribution of this important group of forest pests.
Bark beetles (Coleoptera: Curculionidae) include some of the most damaging tree pests of both conifers and broadleaves. For example, the European spruce bark beetles *Ips typographus* is a regular problem in its Eurasian range, often resulting in the deaths of thousands of trees extended over large areas. This beetle, along with many other bark beetle species, has been intercepted frequently during inspections of wood products and wood packaging in international trade. In many cases, bark beetles have been transported in sufficient numbers to establish populations in new areas and subsequently to result in damage and death of affected trees. In this respect, human-mediated transportation has resulted in range expansion well beyond those that might be expected from relatively local natural spread through beetle flight.
Despite the many records indicating movement of pests with trade, successful establishment of bark beetles in the arrival locations has not always taken place. Thus, the UK and Ireland have Protected Zone status for several species of *Ips* attacking conifers and manage the threat by requiring conifer wood to be debarked or to be from a pest-free zone to enable importation. Regular surveys are carried out to ensure that the protected zones remain free of the named pests. Despite these measures, regular interceptions of *I. typographus* and other bark beetles have been recorded in pheromone traps at the ports across the UK and during inspections of imported items. Until recently, no successful breeding by *I. typographus* had been recorded although its close relative *I. cembrae* the larch bark beetle had established in the 1950s. However, a viable breeding population of *I. typographus* was discovered in Kent late in 2018 and is now under surveillance and attempted eradication. A key question is, therefore, whether any factors that might previously have prevented breeding have changed to enable the beetle to establish a pioneer population.
Coincidentally with this change in status of *I. typographus*, there has been a recent northward expansion in the range of the closely related species *I. amitinus* in Northern Europe. Here a range of factors have been implicated in the northward spread, including increasing availability of suitable host trees, pre-adaptation to low winter temperatures and potential for increased wind storms with provision of damaged and weakened trees. For this species, there is also the intriguing potential that more southern locations in its natural range may become less suitable with increased warming.

Similar range expansions, with multiple potential factors driving the expansions, have been noted for mountain pine beetle (*Dendroctonus ponderosae*) and Southern pine beetle (*Dendroctonus frontalis*) in North America.
There is, therefore, accumulating evidence that bark beetles are expanding into new areas with associated potential for greatly increased damage and tree mortality. While there are clearly some factors that are species-specific, it is also pertinent to explore whether there are more generic factors underpinning the range expansion and which could be influential in predicting and reacting to future changes in beetle distributions and this will be the main goal of the project. Results will be disseminated to national and regional plant protection organisations and to those concerned with tree health and management of woodlands and forests.
The project will be organised in different workpackages:

- Analysis of key factors determining breeding success of Ips bark beetles
- The role of historic and ongoing changes in forest structure in bark beetle dynamics
- The potential role of climate change as a co-factor for bark beetle dynamics
- Consolidation of the range of factors into a risk matrix leading to management options for existing and invasive bark beetle species

1.5. Description of the expected results

The main objectives will be:

- To analyse and identify factors that are **common** to the main species of *Ips* and those that are **unique** to each species. The information will form a matrix of biotic and abiotic factors for further investigation to determine the likelihood of success or failure when *Ips* spp. encounter host trees.
- Arising from the factor analysis, to quantify the minimum size of a pioneer beetle population in a new location and whether there is an Allee effect limiting population growth if too few beetles are present.
- To investigate historic and ongoing changes in forest structure to assess whether tree species mix and relative density are components determining beetle success in establishment and, particularly, in population expansion.
- To investigate the potential role of climate change as a co-factor in enabling the beetles to gain a foothold in new locations that were previously considered to be climatically limiting. Important known drivers are temperature (affecting both the insect and its host tree), moisture and prevalence of storms (wind and snow).
- To consolidate the range of factors into a risk matrix that is geographically linked to previous and new ranges of bark beetles in the genus *Ips* and, for comparison, the genus *Dendroctonus*. The risk matrix will be used to provide surveillance and management options for the various species of *Ips*, both for general usage and for tailoring phytosanitary measures for those pests invading new areas.
- To disseminate the results in a timely and effective manner so that improved predictive tools and management options can be implemented quickly.

1.6. Beneficiaries of this research product

The project outputs will benefit to NPPOs and EPPO.

1.7. Research funders and research contribution/ distribution

Funding organisation	Research activity and researchers involved
1. Department for Environment Food and Rural Affairs, United Kingdom Elspeth Steel	-Project coordination; -Participation in all workpackages; Contact person: Hugh Evans

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2. Ministry of Agriculture, Rural Development and Environment, Cyprus Tefkros Iacovided tiacovides@da.moa.gov.cy	-Contribution to be detailed; Contact person: Anthemis Melifronidou E-mail address: amelifronidou@da.moa.gov.cy Contact person: Despina Koukkoularidou E-mail address: dkoukkoularidou@da.moa.gov.cy Contact person: Kypros Hadjiafxentis E-mail address: khadjiafxentis@da.moa.gov.cy
3. Department of Agriculture, Food and Marine, Ireland Maria Laura Destefanis Maria.Destefanis@agriculture.gov.ie	-Contribution to be detailed; Contact person: Cathal Ryan E-mail address: cathal.ryan@agriculture.gov.ie
4. Norwegian Institute of Bioeconomy Research, Norway Bjørn Økland Bjorn.Okland@nibio.no	-Participation in all workpackages; Contact person: Bjørn Økland E-mail address: Bjorn.Okland@nibio.no
5. Ministry of Agriculture and Rural Development of the Slovak Republic, Slovakia Katarina Benovska katarina.benovska@land.gov.sk	-Participation in all workpackages; Contact person: Andrej Kunca E-mail address: kunca@nlcsk.org Contact person: Christo Nikolov E-mail address: christo.nikolov@nlcsk.org Contact person: Jozef Vakula E-mail address: jozef.vakula@nlcsk.org
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10. Department of Agriculture, Environment and Rural Affairs, United Kingdom Aoife Smith Aoife.Smith@daera-ni.gov.uk	-Participation in all workpackages; Contact person: Aoife Smith E-mail address: Aoife.Smith@daera-ni.gov.uk

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

None.

2. *Euphresco management aspects of the project*

2.1. Indication of the topic budget

Funding organisation [a]	Mechanism [b]	Total Budget [c]
1. Defra (GB)	NC	€
2. MoA (CY)	NC	€
3. DAFM (IE)	NC	€
4. NIBIO (NO)	NC	€
5. MoA (SK)	NC	€
6. ULB (BE)	NC	€
7. MU (IE)	NC	€
8. SLU (SE)	NC	€
9. AFBINI (GB)	NC	€
10. DAERA (GB)	NC	€
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

None.

[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.