Deliverable summary D3.6

Guidelines for generic trapping devices in ports and containers

Project acronym:	**HOMED**
Project full title:	**Holistic Management of Emerging forest pests and Diseases**
GA n°:	**771271**
Start date of the project:	**October 1st 2018**
Duration:	**48 months**
Project coordinator:	**Herve Jactel (INRA)**
Planned delivery date:	**M42**
Actual submission date:	**M43**
Work package:	**WP3**
WP leader:	**CNR**
Lead beneficiary:	**MENDELU**
Partners involved:	**INRA, UNIPD**
Version:	**01**

Dissemination Level	
PU Public	**PU**
CI Classified, as referred to Commission Decision 2001/844/EC	
CO Confidential, only for members of the consortium (including the Commission Services)	

1. Summary

Objectives:

This report summarises the results of research activities intended to develop generic trapping devices for non-native forest pests in ports and containers.

- At first, we aimed at testing the effective genericity of lures previously developed for cerambycidae in Europe to catch related insect species on various continents, and thus allowing us to define a list of species susceptible to being trapped at arrival in Europe when using such lures.
- Secondly, we intended to test the effectiveness of the deployment in ports and their surroundings of a network of black and green traps baited with such lures for early detection of non-native xylophagous species at arrival.
- Thirdly, we developed a sticky-light trap for the generic surveillance of hitchhiker insects transported inside containers during shipment. The aims of this research were to:
    - Verify if light could be an effective broad-spectrum attractant for different insect species belonging to different orders
    - Verify if the status of the container (i.e., if the container is empty or loaded) affects the catching performance of the trap
    - Study the optimal trap number per container to maximise captures
    - Improve the catching performances of the trap by testing different light colours (i.e., wavelengths) and testing the addition of a stronger entomological glue and an insecticide on the sticky cards

Rationale:

Insects are one of the most successful groups of invasive species in the world and the number of new introductions is increasing worldwide. In Europe, the number of new species introduced annually is also increasing exponentially. Biological invasions of insects are mainly and positively affected by the increase in speed and volume of international trade. In addition, present invaders include a large proportion of “emerging”, “unknown” species, which have never been found outside of their native range, and often have never been considered pests in their native area (“unknown unknowns”). These new arrivals likely result from new trade routes, new pathways including ornamental and horticultural trade, and changing climatic conditions. Containers on ships carry about 90% of global trade: with such a large volume of commodities transported in containers all around the world, even minimal percentages of container contamination can represent a serious risk of introductions of new alien pests. Given the wide variety of alien insects that can easily be introduced in new areas through international trade and the gaps occurring in border phytosanitary controls, new early-detection tools helping inspectors’ surveillance are badly needed.

Significant progress in the chemistry of cerambycid pheromones in recent years allowed to define more than 400 sex- and aggregation-sex pheromones so far, but also showed that most of these pheromones are well-conserved at global level for a number of genera and even tribes of cerambycids. Thus, it made it possible to define lures with generic attractiveness for native and non-native species when combining these pheromones to enhance the trapping scope. Based on previous works, a blend mixing 8 cerambycid pheromones was built up with the following rationale: if a species is regularly trapped in numbers by the blend on a continent, higher is the probability to detect it at arrival on other continents, and if the blend

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement N°771271

effectively shows a generic attractiveness, “unknown” species could be trapped. Therefore, traps using this 8-components lure were tested in most of the European countries, China, USA, Canada and Australia. The addition of plant volatiles known to have a generic attractiveness for bark and ambrosia beetles, such as ethanol and (-) α-pinene, was also expected to enhance trapping scope. To test the real effectiveness of the detection of non-native cerambycid and scolytid species at arrival, traps baited with the lures presented above were deployed in different potential ports of Europe. They consisted of a pair of black and green traps installed in the port and a similar pair placed in nearby forests within a radius of 1 km from the port in order to detect possible expansion and establishment of the non-native species. Green traps were used because of their attractiveness for most jewel beetles (especially *Agrilus* spp.) although no lure was designed for such species.

In parallel, the development of nonspecific broad-spectrum traps to be used within shipping containers during the cargo travel could be a simple and effective way for prompt early detection of alien species at the points-of-entry. The use of pheromones and/or semiochemicals for this application is ruled out: as there is no particular target, it would be impossible to identify such a broad spectrum lure. Moreover, in a confined environment such as a container (even more so if it is loaded) saturation will be reached quickly, making it difficult for the insect to locate the trap, which may be ineffective even with an effective lure. On the contrary, the use of light as an attractant could be the key: in fact, there are numerous studies on phototactic behaviour of insects from different families and orders.

To test this hypothesis, tests with a light-sticky trap were conducted inside a container. First of all, the attraction of four species of insects (belonging to three different orders) to a white light was studied. Then, also the attraction to different light colours (i.e., wavelengths) was tested. Lastly, the effects of some modifications to the trap (use of a different glue or addition of insecticide to prevent the escape of captured insects) and the optimal trap density were also tested.

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