Action A1
Development of an initial lure-based beetle trapping protocol

Deliverable:

Initial trapping design for monitoring *Xylosandrus compactus* and *X. crassiusculus* in project areas

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Summary

Before the development of SAMFIX, Ethanol was used as the single lure used to trap *Xylosandrus* species. *X. crassiusculus* has been trapped but in limited numbers unlike *X. compactus* which was not trapped at all. The 2018 SAMFIX tests showed that the combination of a-pinene and ethanol on a black trap is likely to allow an efficient monitoring of both *Xylosandrus* species in natural areas to be protected. No significant differences in *Xylosandrus* captures were observed between crossvane and multifunnel traps suggesting that any black trap design baited with a-pinene and ethanol may be used for monitoring. However, to avoid the captures of non-target species more specific lures would be worth to be tested in the future.

1. Previous state of the art about lures and trap designs to survey *Xylosandrus compactus* and *X.crassiusculus*

X. crassiusculus has been trapped in France since 2016 by the Forest Health Department using artisanal, plastic bottles filled with Ethanol but the traps usually caught a limited number of beetles. Such trappings did not allow to catch any *X. compactus*. Experiments carried out in 2017 in the course of a French project aimed at trapping xylophagous insects allowed to catch both species at Villa Thuret, Antibes, France, using multifunnel traps baited with a lure composed of a 8-pheromone blend of cerambycids (Fan et al., 2019, J. Pest Science) added with Ethanol and a-pinene.

2. SAMFIX experiments aimed at defining effective lures and traps for both *Xylosandrus* species

2.1. Test of lures

2.1.1 No lure vs. a-pinene and ethanol

The attractiveness of multifunnel black traps without any lure was compared to that of traps baited with the 8- cerambycid pheromone blend added with a-pinene and ethanol. The tests were developped at Bois de la Garoupe and Villa Thuret, Antibes, France. The traps baited with a-pinene and ethanol captured significantly more specimens of both *Xylosandrus* species than the unbaited traps which caught quite no insects (Figure 1). Traps baited with a-pinene added to ethanol were also deployed at Circeo National Parka and allowed to trap both both *Xylosandrus* species

2.1.2 Ethanol lure vs. a-pinene and ethanol

These tests have been carried out in the Natura 2000 sites of the Corniches de la Riviera, France. A significantly better trapping of both species by the lure combining a-pinene and ethanol has been observed.

A total of 39 individuals of *X. compactus* have been trapped by the combination of both coumpounds compared to 5 by ethanol alone (Friedman Two-Way Nonparametric statistics: $Q_{1,8}$=5.000; P= 0,0253. For *X. crassiusculus*, 798 individuals have been trapped by the combination of both coumpounds compared to 90 by ethanol alone (Friedman Two-Way Nonparametric statistics: $Q_{1,8}$=8.000; P= 0,0047).

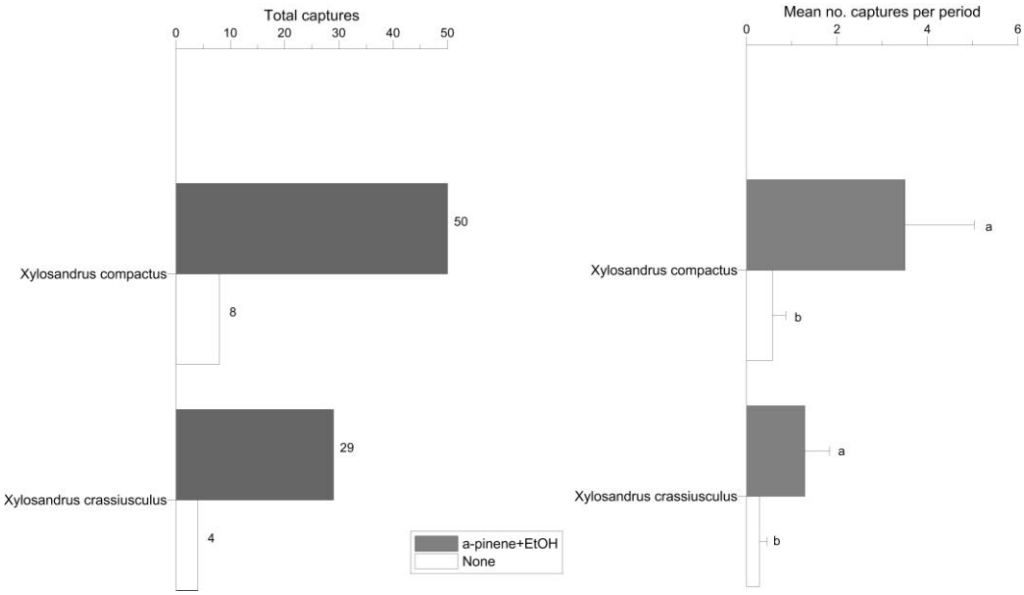

Figure 1: Comparative total captures and captures per collection period (±se) of both *Xylosandrus* species in Antibes by black traps baited with a-pinene and ethanol and unbaited traps of the same color and design.

2.1.3 a-pinene and ethanol lure compared to Manuka oil and Ethanol

The tests were carried out at El Tello Spain. Unfortunately, the too low population of *X. crassiusculus* (10 specimens trapped) prevented any statistics

2.2. Test of different designs of black traps: crossvane vs. multifunnel traps

The tests carried out in France at Antibes did not reveal any significant differences between the two trap designs when baited with the same lure (*X. compactus:* Friedman's $Q_{1,20}$=0.2857 P= 0.593; *X. crassiusculus:* Friedman's $Q_{1,20}$=1.333; P=0.248) although multifunnel traps usually trapped more beetles of both species (Figure 3).

The tests developed in Spain to compare other types of traps also faced low density of beetles which precluded any conclusion.

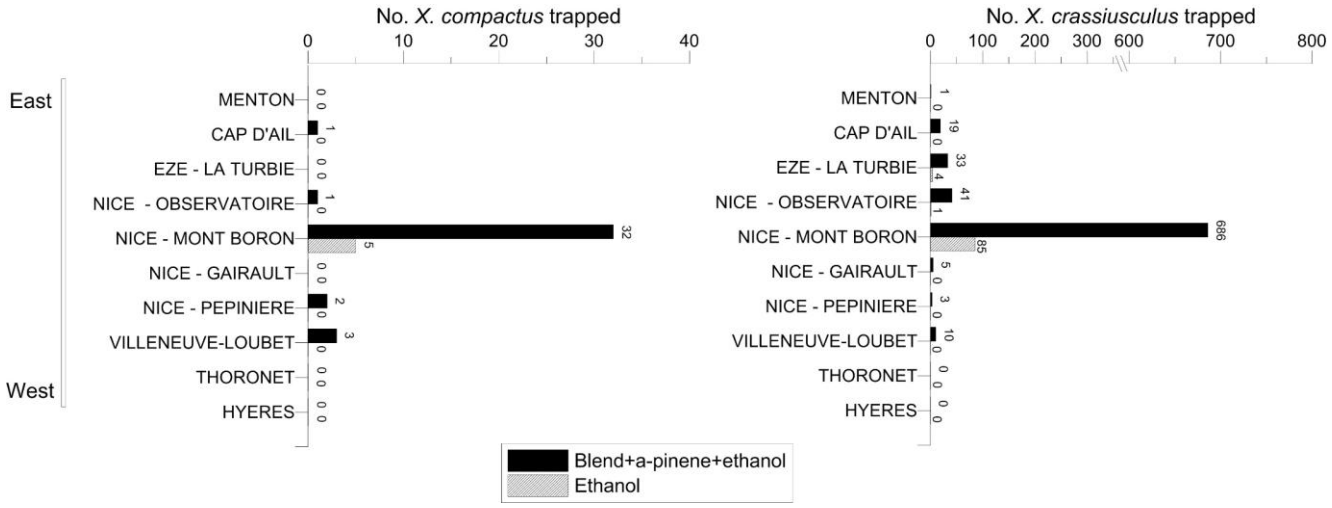

Figure 2 : Comparison of the 2018 captures of *Xylosandrus compactus* and *X. crassiusculus* in France by traps baited with a-pinene and ethanol compared to those only baited with ethanol on the same sites.

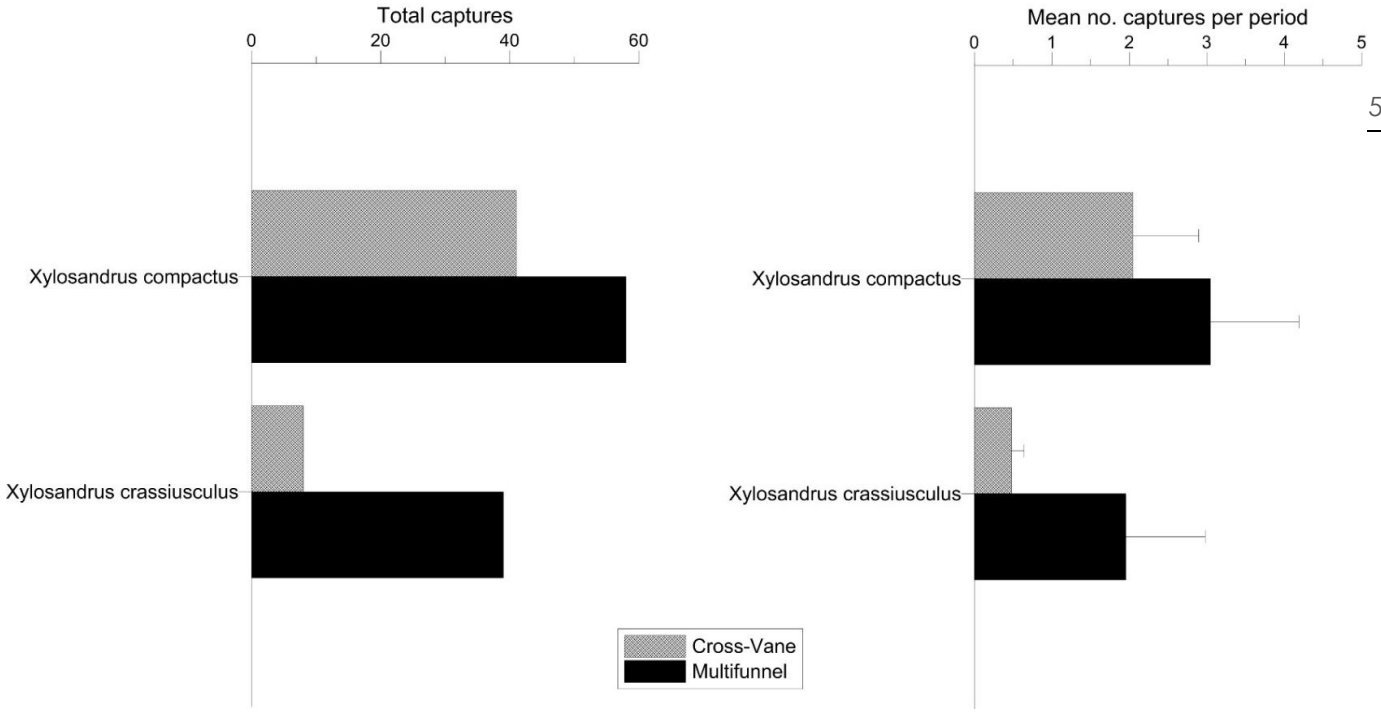

Figure 3: Comparison of the 2018 captures of *Xylosandrus compactus* and *X. crassiusculus* in France by multifunnel and crossvane traps baited with the same lures at the same sites.

3. Conclusion: Lures and traps to be used for monitoring *Xylosandrus* species in project areas

3.1 Trapping designs to be used in project areas

The trapping results suggest to use multifunnel traps baited with both a dose of a-pinene (A) and a dose of UHR ethanol (B) as shown below, a-pinene being fastened to the second funnel from the bottom and Ethanol fastened on the middle funnels of the trap.

It is likely to allow an effective monitoring of both species in projet areas. Such traps have been deployed in 2019 in natural areas of Italy and France to be monitored.

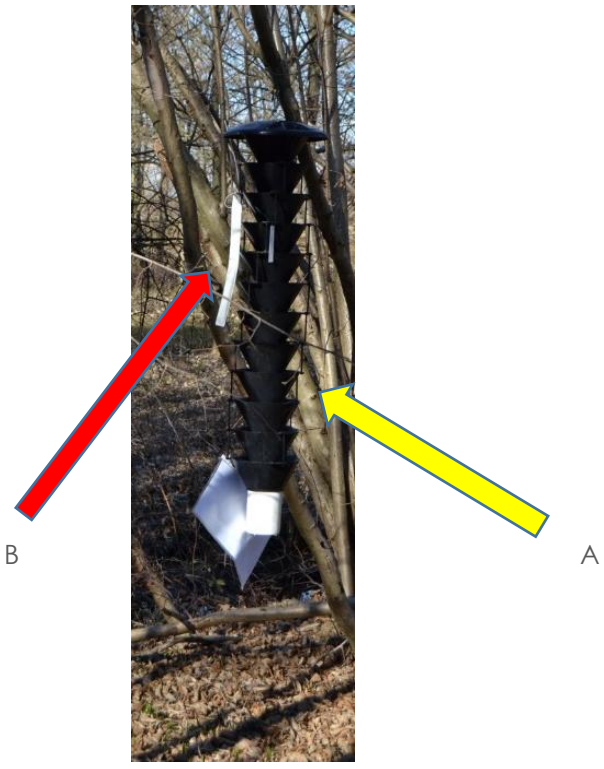

Figure 4: Multifunnel trap to be used for surveying *Xylosandrus compactus* and *X. crassiusculus* in protected areas and position of the attractive compounds :A/ yellow arrow: a-pinene; B/ red arrow: UHR Ethanol).

3.2 Further tests needed for improving the trapping efficacy

Although effective for monitoring, the combination of a-pinene and ethanol cannot be considered as representing an optimal lure, the more as it is largely not specifically attracting *Xylosandrus*.

To define such an optimal lure, new compounds identified from the literature in the other continents were these beetle species are invasive will tested in 2019 in villa Thuret, Bois de la Garoupe and Circeo Park. The tested compounds will include 8 different lure combinations (quercivorol- 1ml; a-copaene- 2 ml; quercivorol + a-copaene ; Ethanol + (-) a-pinene- 2ml; quercivorol + a-copaene + Ethanol + (-) a-pinene- 2ml; quercivorol + Ethanol + (-) a-pinene- 2ml; a-copaene + Ethanol + (-) a-pinene- 2ml; Ethanol +(*E*)-(±)-conophthorin).

Besides, the number of traps to be deployed per area in order to get an optimal monitoring of these ambrosia beetles has also to be tested.