The new method of insect mating disruption by vibrational noise

Valerio Mazzoni & Jernej Polajnar

FONDAZIONE EDMUND MACH

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SESSION: Biological tools and technologies

pure
Innovative crop protection for sustainable agriculture

Scaphoideus titanus

WHO MAKES VIBRATIONAL SIGNALS ?

> 150.000 INSECT SPECIES

WHAT FUNCTIONS ?

REPRODUCTION

- **Identification**
- **Partner search**
- **Courtship**
- **Male Rivalry**

PREDATION

PARASITIZATION

DANGER ALERT

MATERNAL CARE

.....

BASIC PAPERS

Descrizione fenomeno (2009)

Bulletin of Entomological Research (2009) 99, 401–413
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doi:10.1017/S0007485308006408
Printed in the United Kingdom

Reproductive strategy of the Nearctic leafhopper *Scaphoideus titanus* Ball (Hemiptera: Cicadellidae)

Valerio Mazzoni[1,2], Janez Prešern[3], Andrea Lucchi[1] and Meta Virant-Doberlet[3]*†

Test di "confusione" in lab (2009)

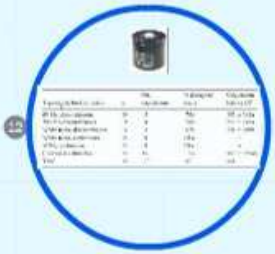
DOI: 10.1111/j.1570-7458.2009.00911.x

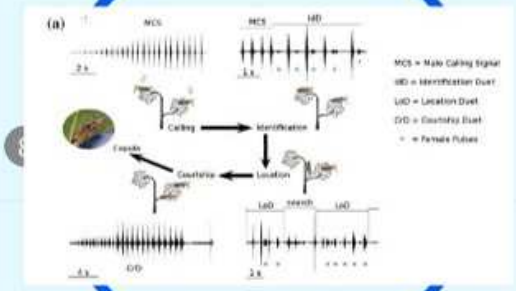
Disruption of the reproductive behaviour of *Scaphoideus titanus* by playback of vibrational signals

Valerio Mazzoni[1]*, Andrea Lucchi[2], Andrej Čokl[3], Janez Prešern[3] & Meta Virant-Doberlet[3]

VIBRATIONAL SIGNALS

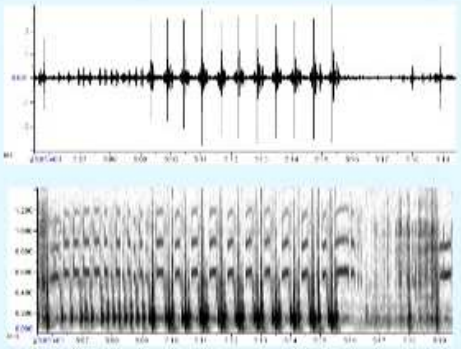
Species - specificic
Sex - specificic

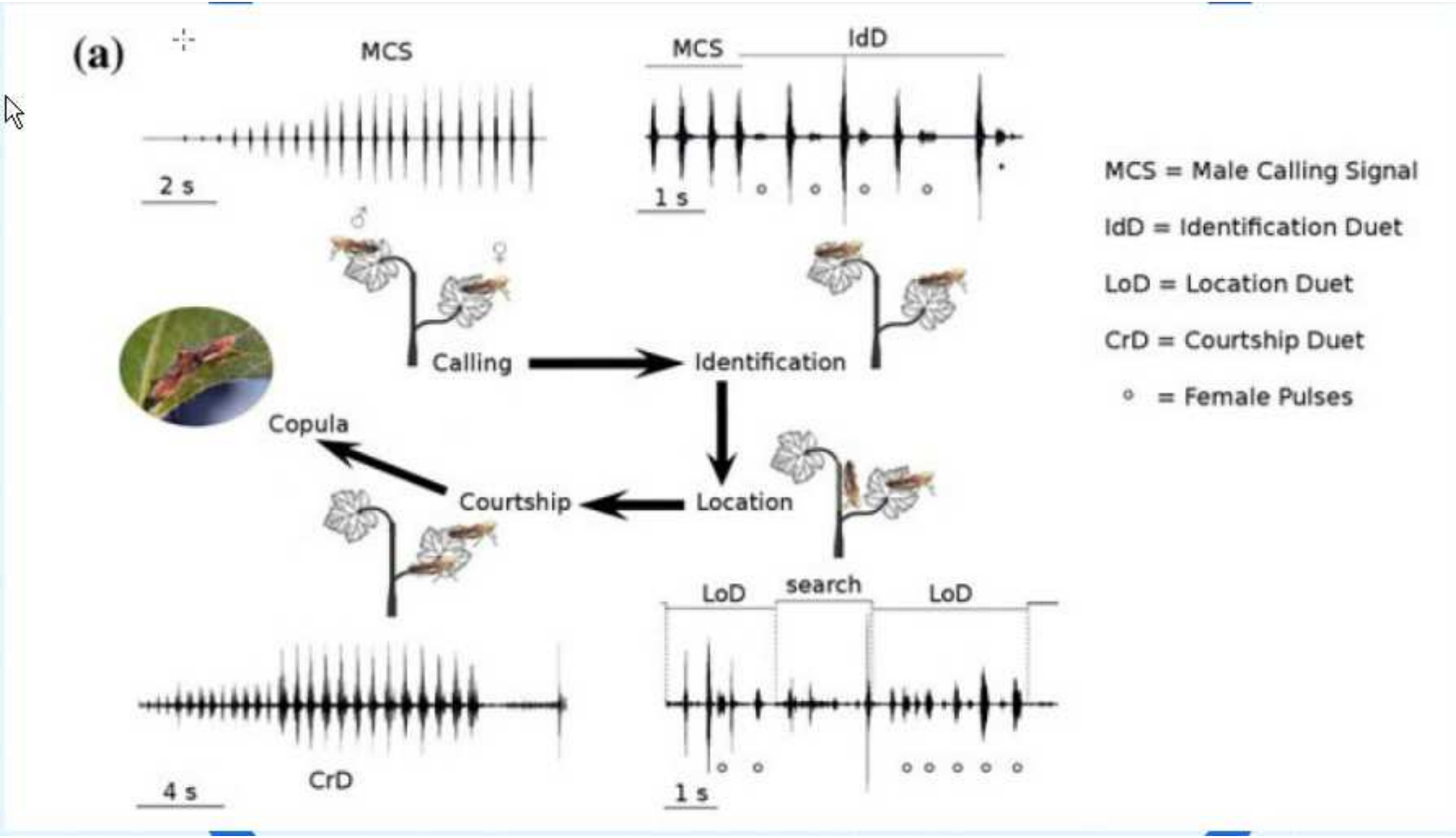




MALE-MALE RIVALRY

MATING DUET




(a)
MCS
2 s
MCS
IdD
1 s
♂
♀
Calling
Identification
Location
Courtship
Copula
CrD
4 s
LoD
search
LoD
1 s
MCS = Male Calling Signal
IdD = Identification Duet
LoD = Location Duet
CrD = Courtship Duet
= Female Pulses

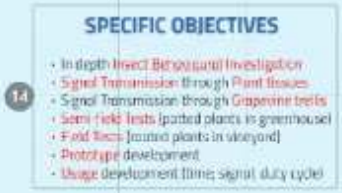
Type of playback stimulus	n	No. copulations	% disrupted duets	Copulation latency (s)[1]
60 Hz, discontinuous	10	3	70b	191 ± 148a
200 Hz, discontinuous	9	4	56b	211 ± 140a
White noise, discontinuous	6	2	67b	758 ± 296b
White noise, continuous	15	0	100c	–
MDS, continuous	15	0	100c	–
Control, no stimulus	15	15	0a	367 ± 179ab
Trio[2]	15	1[3]	87	468

STARTING CONDITIONS:

- **Vibrational Signals associated to the Mating Behaviour**
- **Disruptive Signals associated to the Male Rivalry**
- **Playback of Disruptive Signals interrupts the Mating Process in lab trials on single leaf**

PROJECT GOAL:

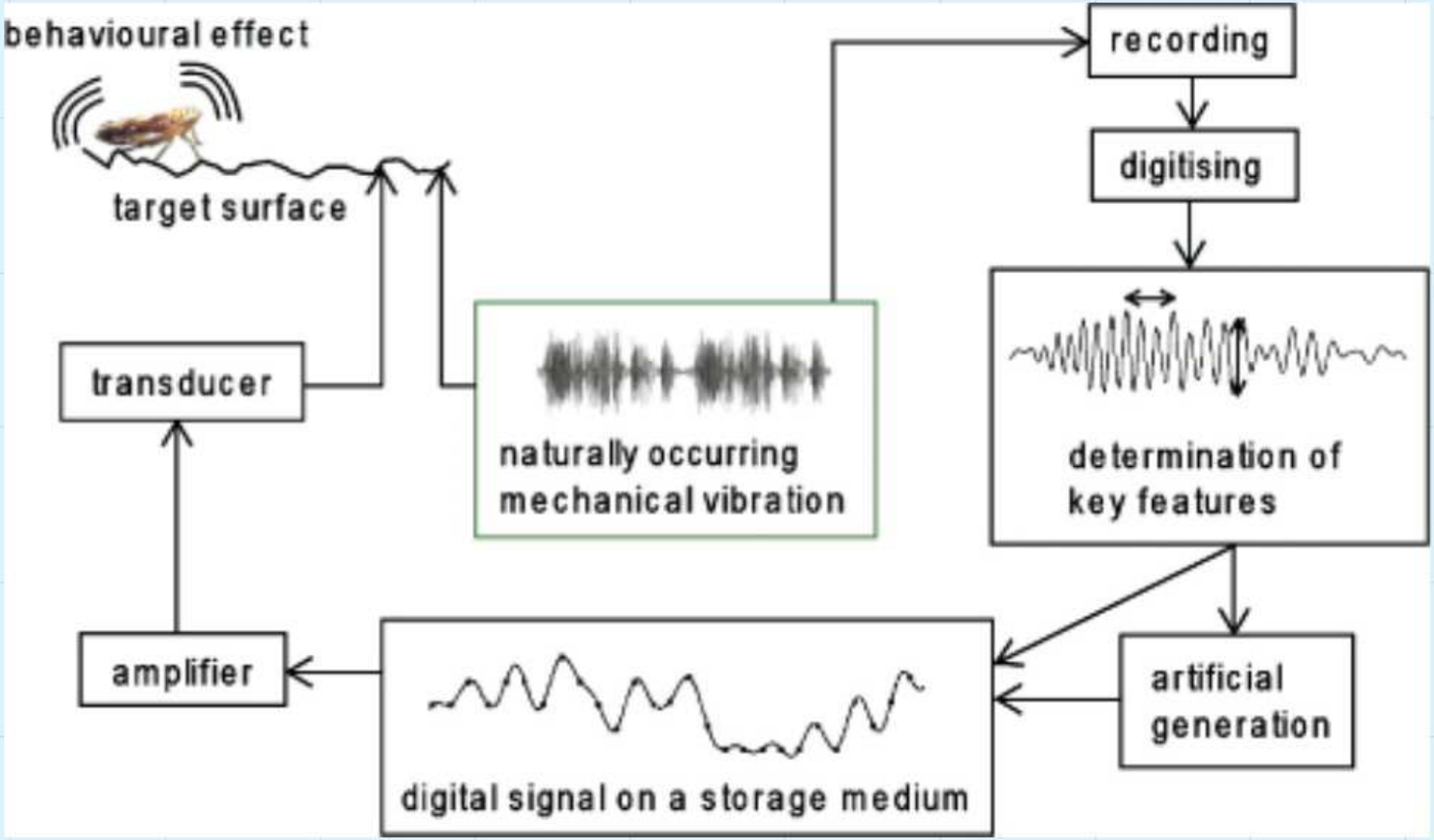
To develop a new Method of Mating Disruption by means of Vibrational Signals for Agricultural Application



SPECIFIC OBJECTIVES

- In depth Insect Behavioural Investigation
- Signal Transmission through Plant tissues
- Signal Transmission through Grapevine trellis
- Semi-field Tests (potted plants in greenhouse)
- Field Tests (rooted plants in vineyard)
- Prototype development
- Usage development (time; signal; duty cycle)

BASIC CONCEPT



Contents lists available at ScienceDirect

Behavioural Processes

journal homepage: www.elsevier.com/locate/behavproc

The process of pair formation mediated by substrate-borne vibrations in a small insect

Jernej Polajnar[a,*], Anna Eriksson[a,b], Marco Valerio Rossi Stacconi[a], Andrea Lucchi[b], Gianfranco Anfora[a], Meta Virant-Doberlet[c], Valerio Mazzoni[a]

Chapter 8
Active Space and the Role of Amplitude in Plant-Borne Vibrational Communication

Valerio Mazzoni, Anna Eriksson, Gianfranco Anfora, Andrea Lucchi and Meta Virant-Doberlet

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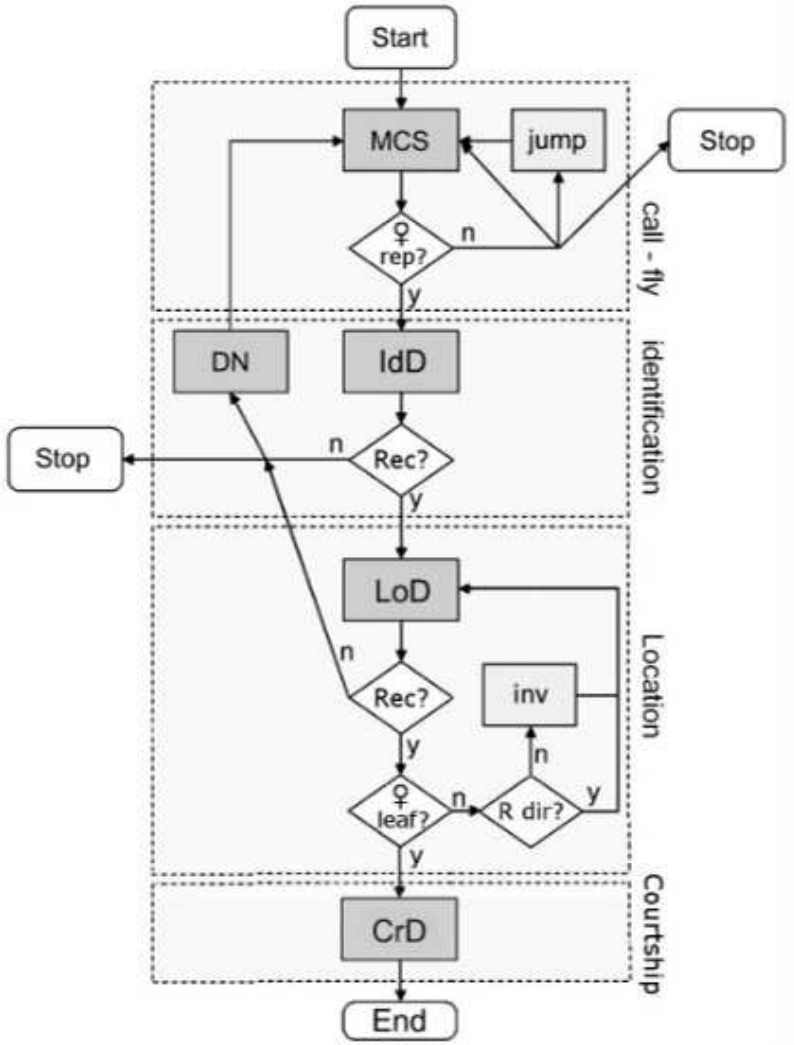

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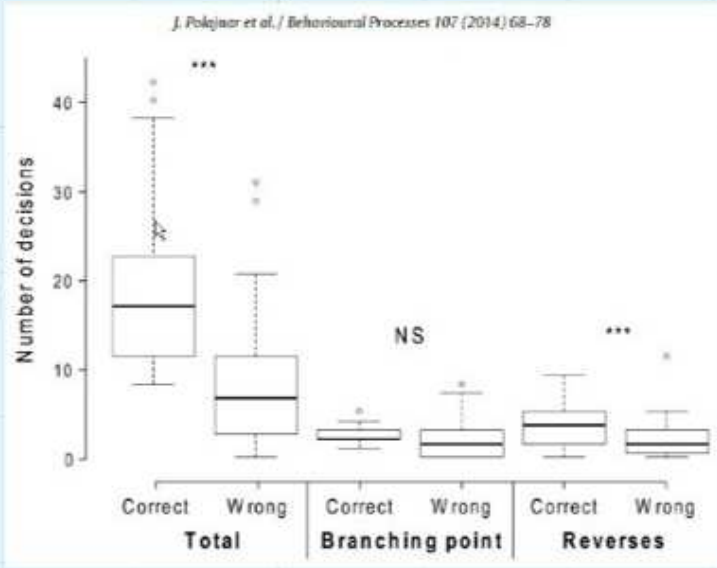
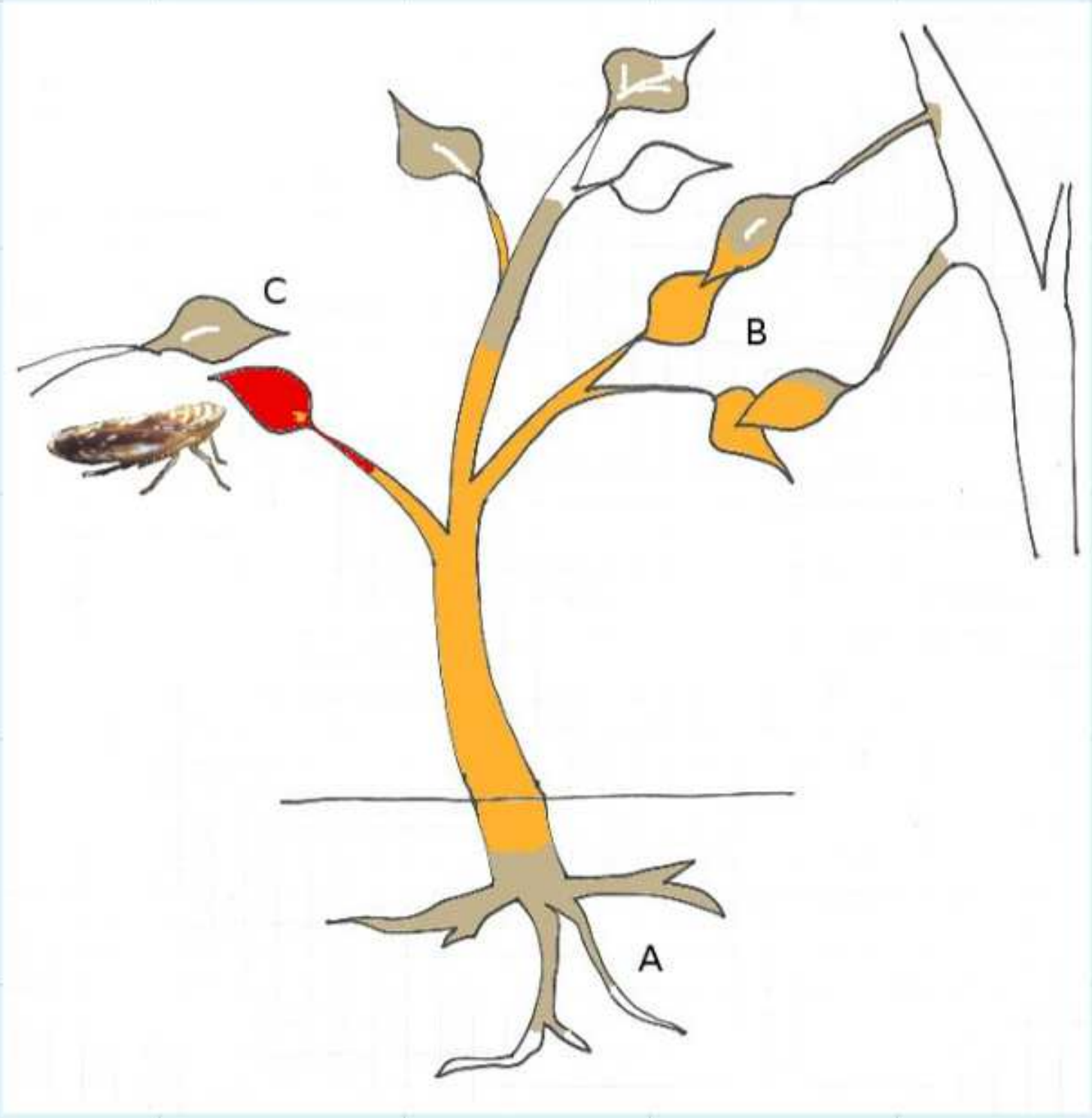


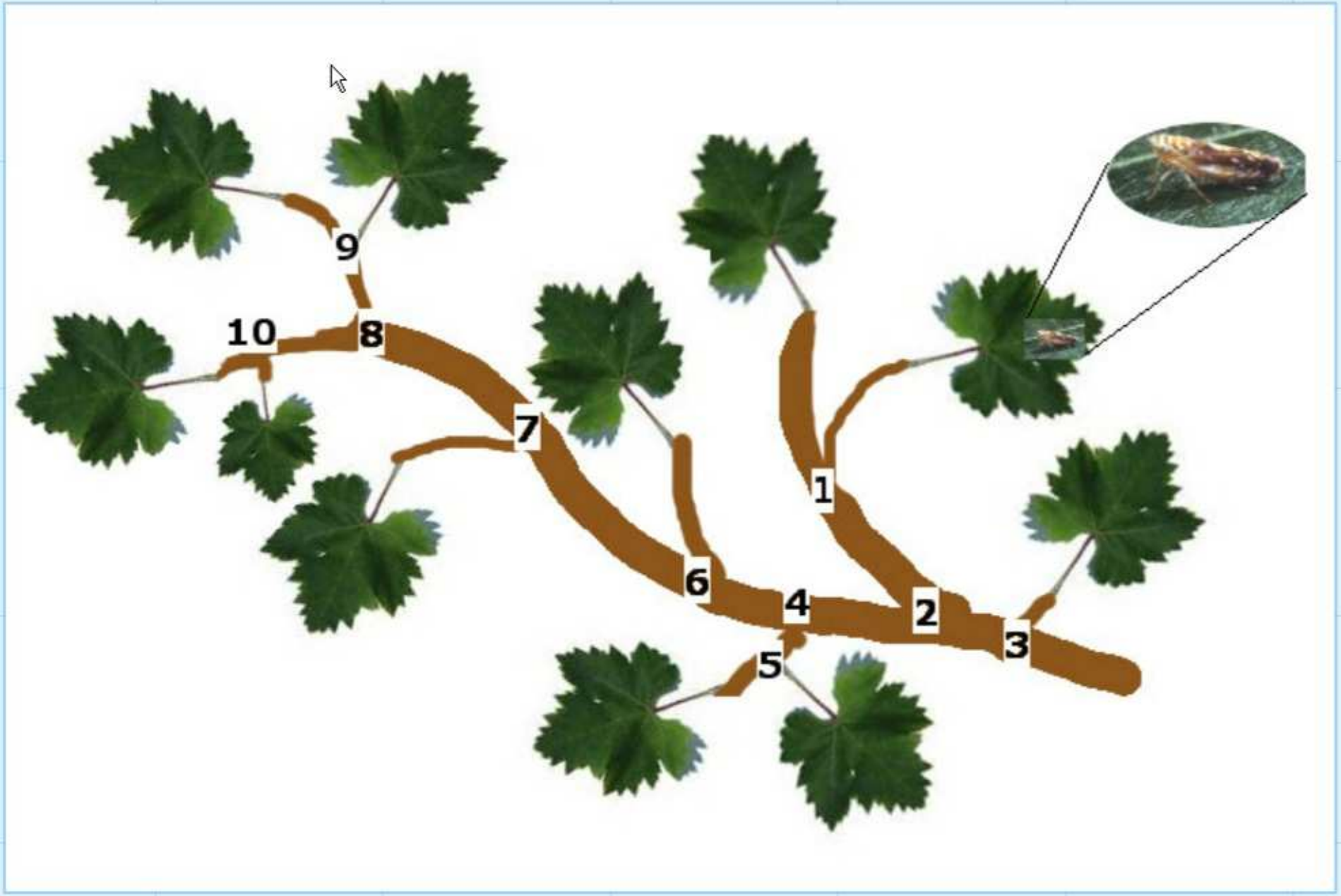
DIRECTIONALITY

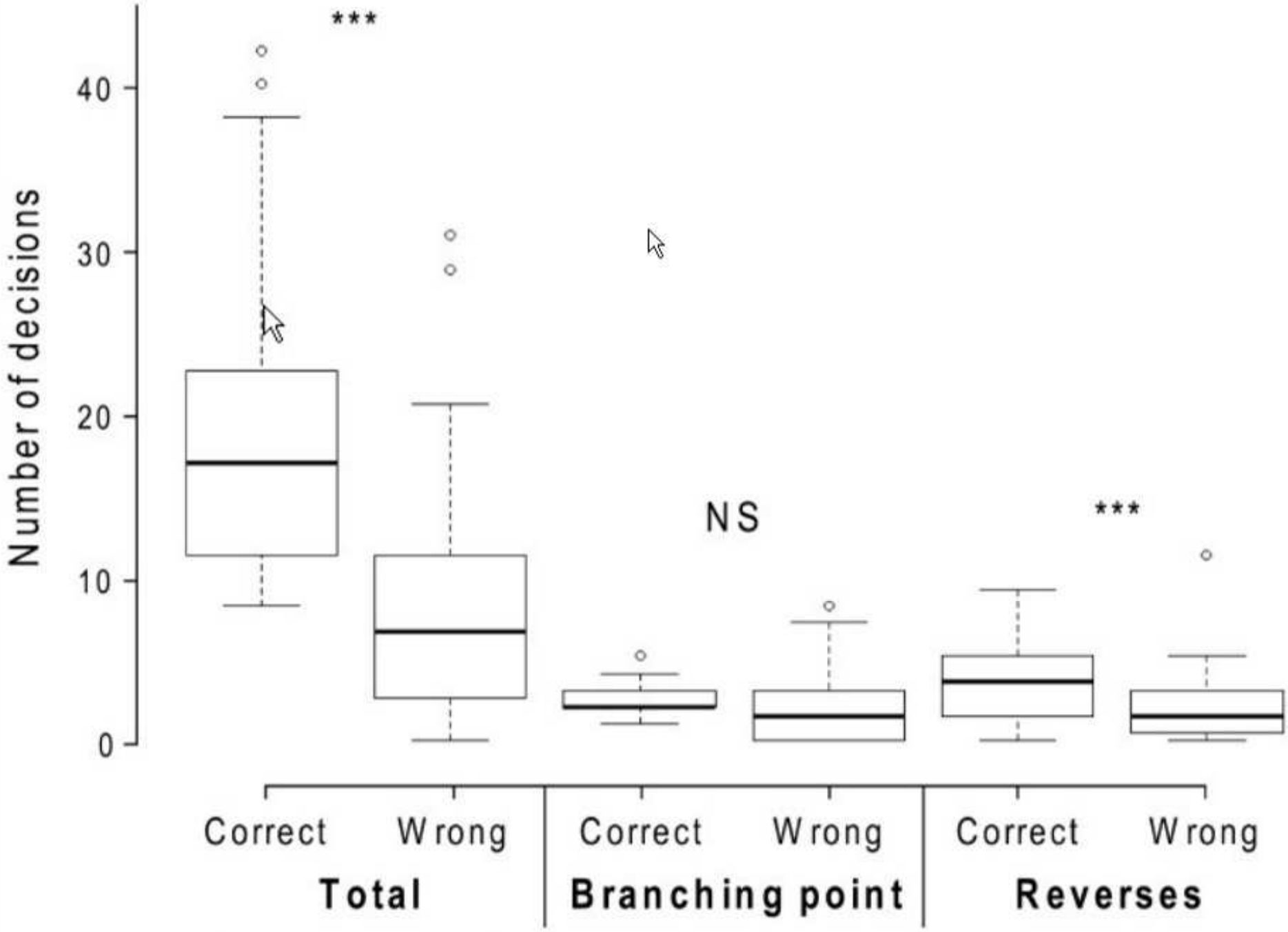
SIGNAL INTENSITY

ACTIVE SPACE NETWORK

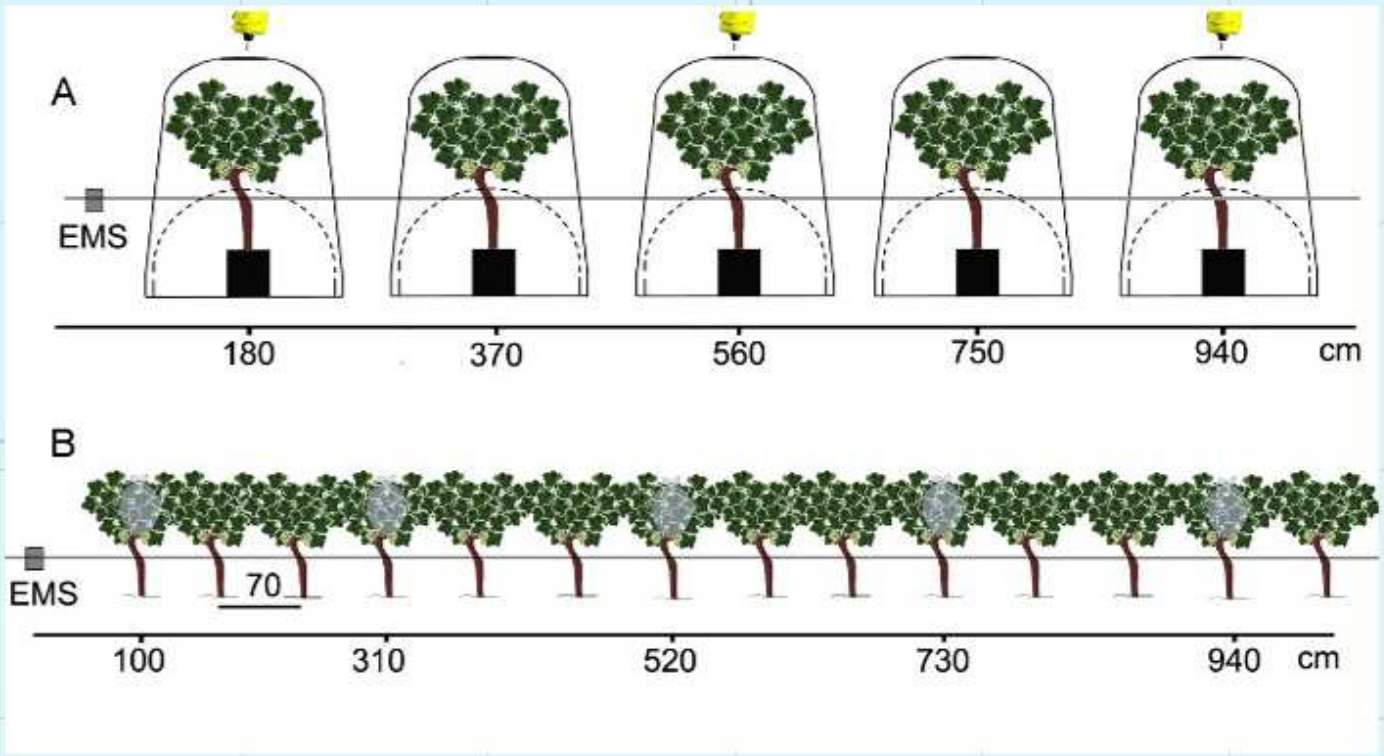


Partner Search





DIRECTIONALITY


A
EMS
180
370
560
750
940
cm
B
EMS
70
100
310
520
730
940
cm

Vibrational Mating Disruption

OPEN ACCESS Freely available online

PLoS one

Exploitation of Insect Vibrational Signals Reveals a New Method of Pest Management

Anna Eriksson[1,2], Gianfranco Anfora[1]*, Andrea Lucchi[2], Francesco Lanzo[2], Meta Virant-Doberlet[3], Valerio Mazzoni[1]

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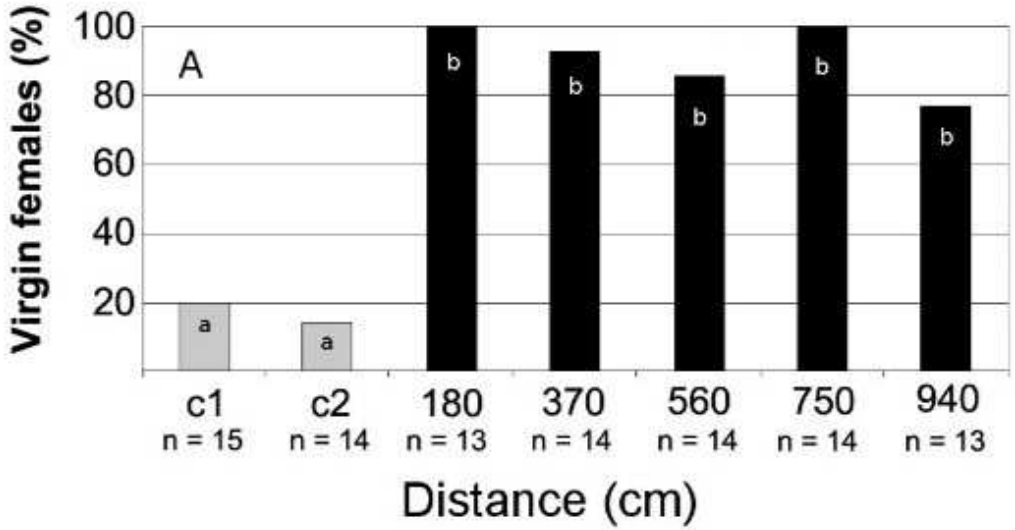
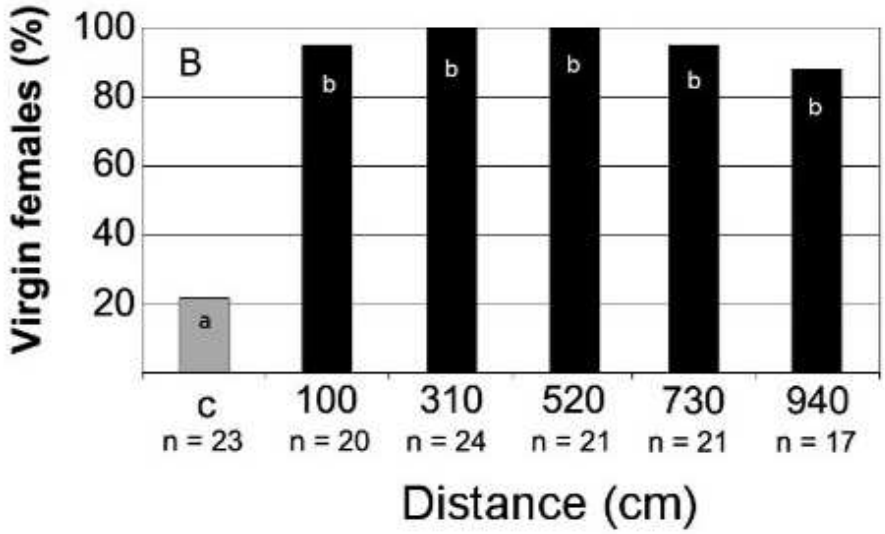
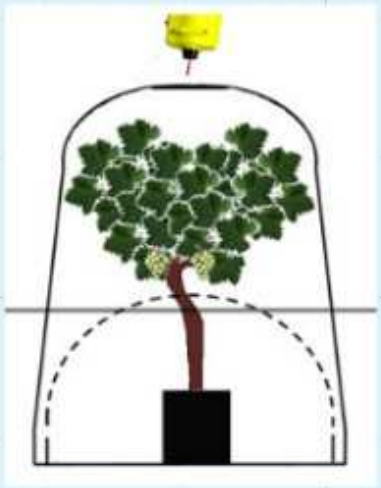
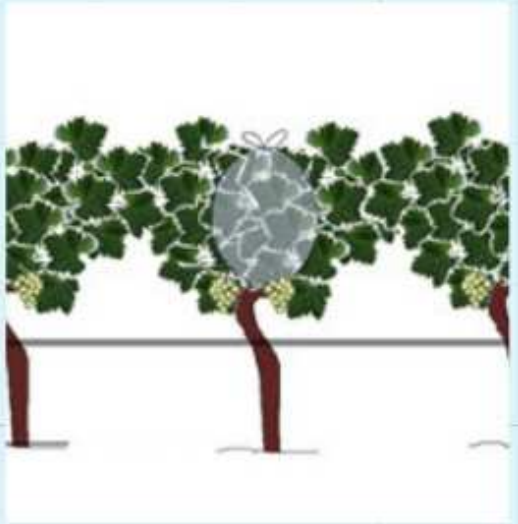




Semi field





Vineyard

What is Next?

- **TECHNOLOGICAL ADVANCE**

ENERGY
WIRELESS
COST
SMART TECH

- **OTHER TARGETS**

HEMIPTERA

Pentatomidae

White flies

Other leafhoppers

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