

# **The importance of ecological studies for risk assessments of insect pathogenic fungi**

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- \* EU Directive 91/414
- \* Ecological and physiological host range
- \* *Entomophthora muscae* complex
- \* *Metarhizium anisopliae*
- \* So, what do we do ?

# EU Directive 91/414

*'Reappraisal of the basis for selection of key non-target organisms is required for assessment of the effects of exposure to other organisms in the environment. Those key non-target organisms usually used for assessment of chemical pesticides may simply not be appropriate'*

EU Comm., SCP/Annex VI B/002-Final, adopted by the Scientific Committee on plants on 30/01-2003

# Ecological and physiological host range

'The range of species that a fungus can infect often differs between that found in the laboratory (*physiological host range*) and that found in nature (*ecological host range*)'

Goettel *et al.*, 2001

**'A *host range* is the set of species that allow survival and reproduction of a pathogen.**

***The ecological host range* is the current, yet evolving, set of species with which a parasite naturally forms symbiosis, resulting in viable parasite offspring.**

***Physiological host range* is based solely on laboratory observations of infection and propagule production'**

**EDWIP, Onstad, 2000**

*Entomophthora muscae* complex

***Entomophthora muscae* s.l. occurs on several dipteran families**

**Anthomyiidae**

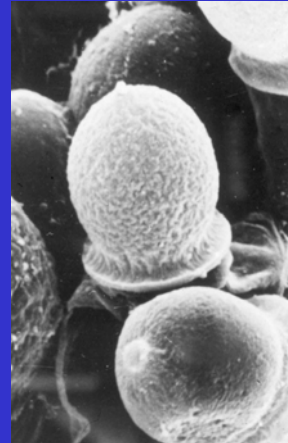


**Scathophagidae**



**Syrphidae**





***Entomophthora  
muscae* s.l. on  
Coleoptera**

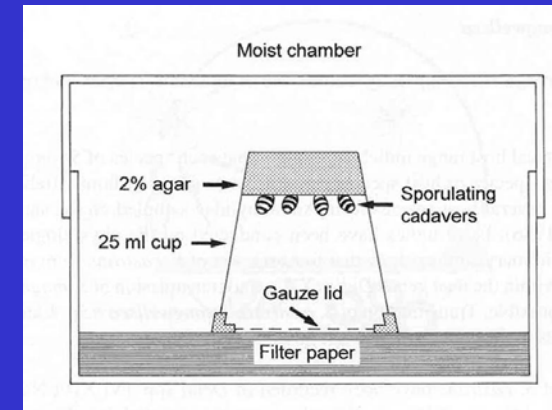


**Disease  
transmission  
in the field**

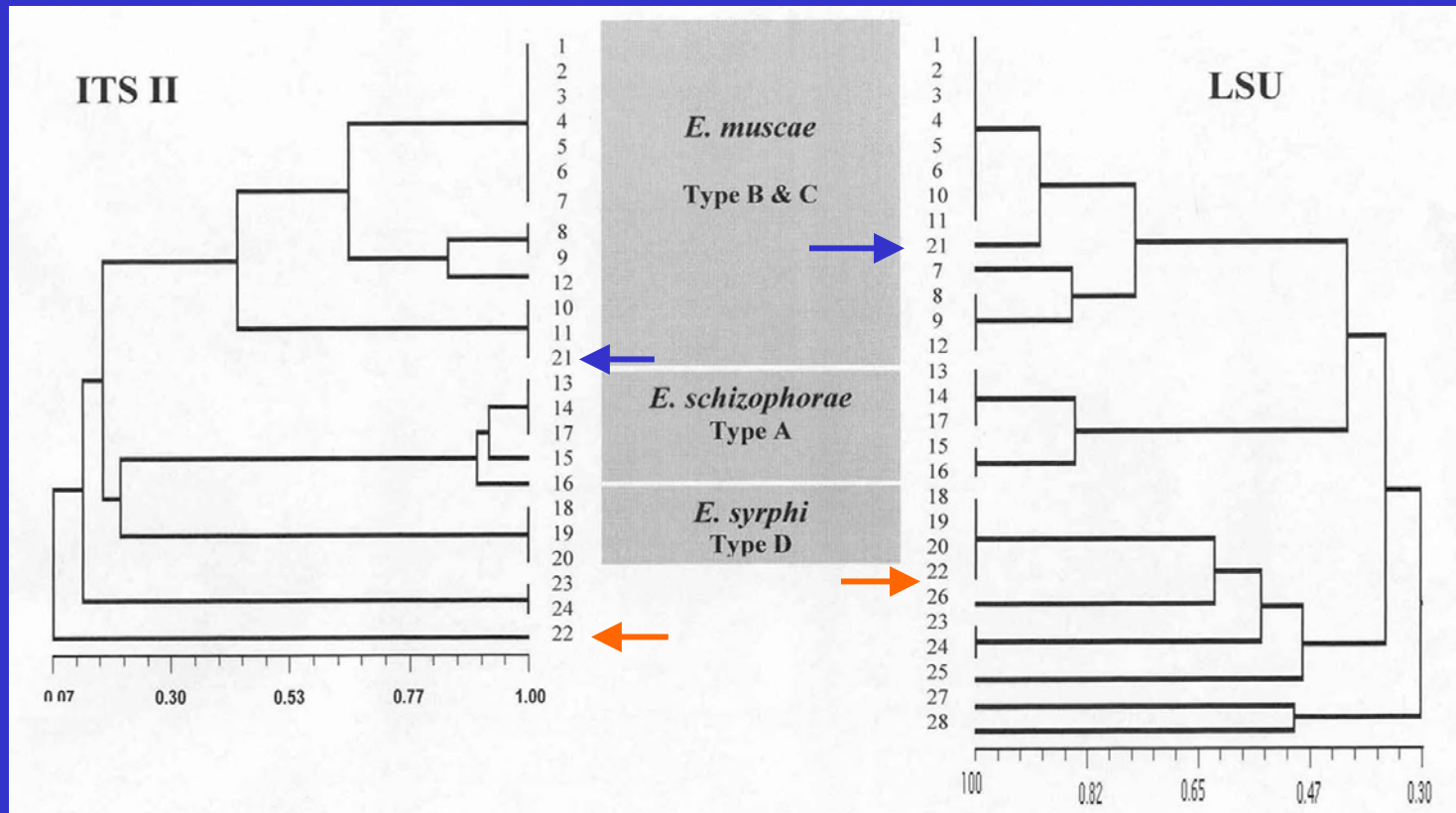
*Entomophthora muscae* s.l. on  
Hymenoptera



**Physiological  
host range of  
*E.muscae* complex**

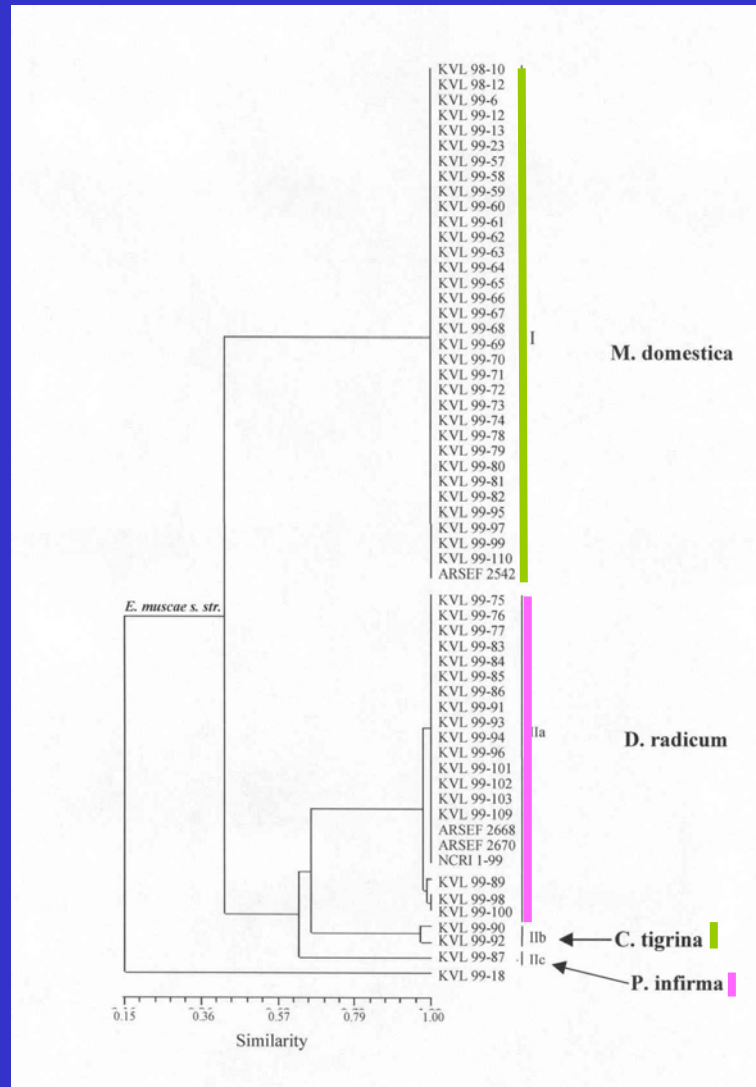


Donor	Receptor	Success
<i>Musca domestica</i>	<i>Delia radicum</i>	+
<i>Delia radicum</i>	<i>Musca domestica</i>	+
<i>Torymus druparum</i>	<i>Chamaepsila rosae</i>	+
<i>Rhagozycha fulva</i>	<i>Musca domestica</i>	-



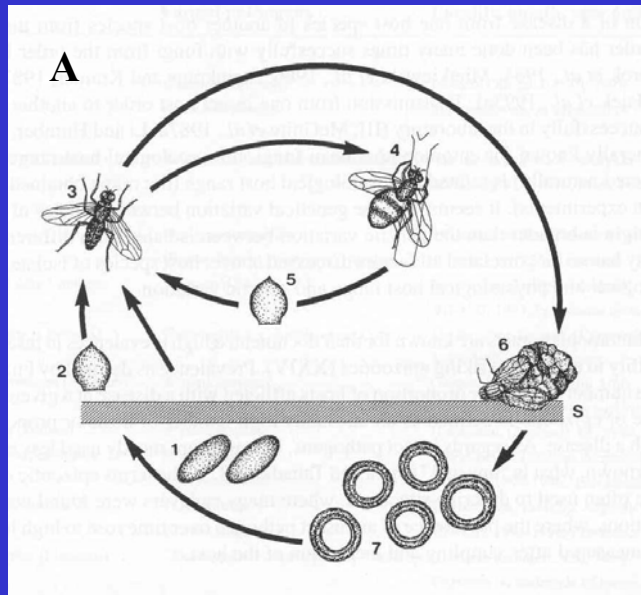
Comparison of two dendrograms based on PCR-RFLP data on isolates from the genus *Entomophthora*

Blue = Hymenoptera isolate Red = Coleoptera isolate



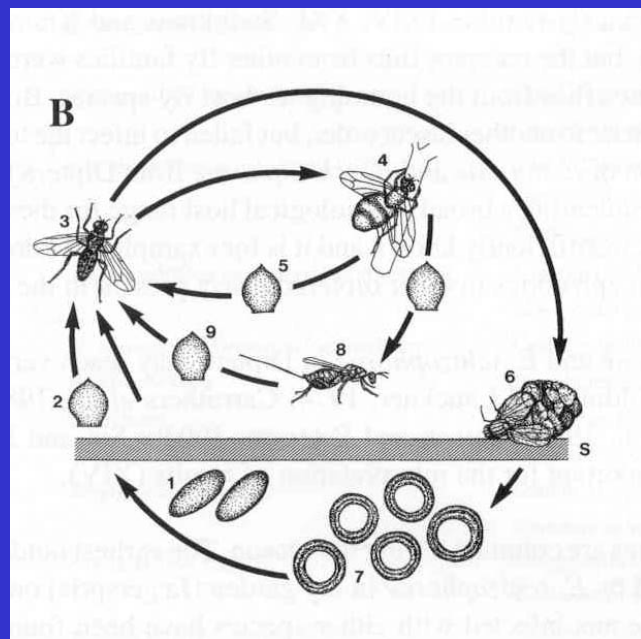
Dendrogram of *Entomophthora muscae* from Muscidae and Anthomyiidae based on RAPD pattern

Each host species harbours its own genotypes



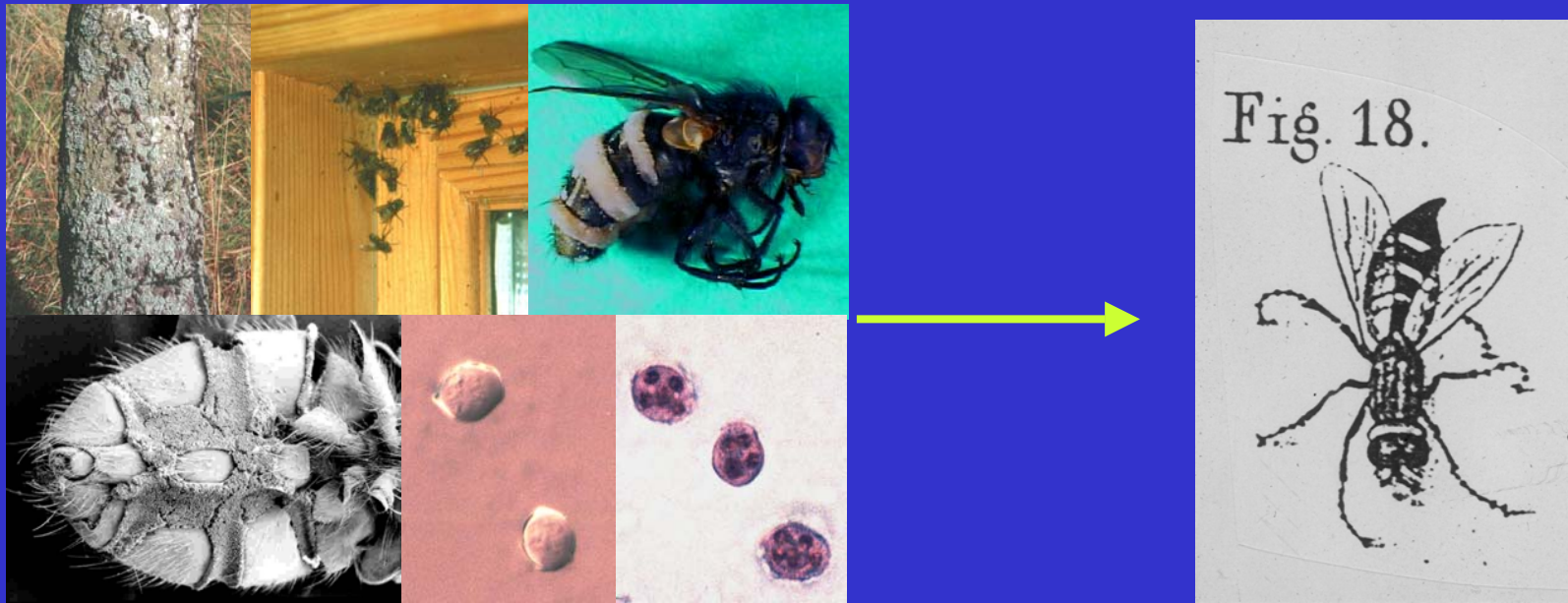
**One host species**

**YES !**



**More host species ?**

**Normally NO !**



Attempts to use *E. schizophorae* from Calliphoridae to inoculate in *Musca domestica* populations have been successful

Geden *et al.*, 1993

*Metarhizium anisopliae*



**Target:**  
***Strophosoma* spp.**



**Agent: *Metarhizium*  
*anisopliae***



**Successfull  
infection**



**Application in  
the greenery**



**Methods for non-target sampling: direct collection, pit-falls and flagging**



**Non-targets infected with *M. anisopliae*:**

**Bug: Pentatomidae, and Tick: *Ixodes ricinus***

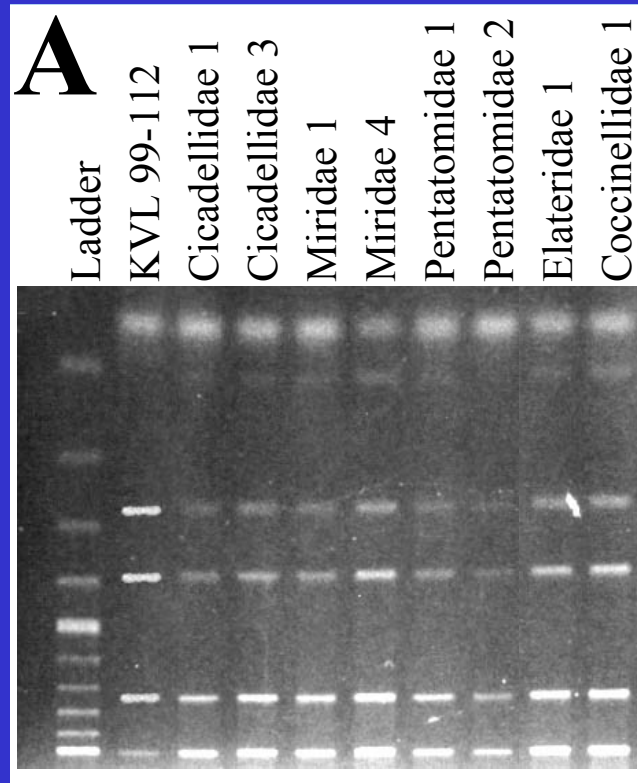
Non-target	Days after treatment with <i>M. anisopliae</i>				
	Control	7	14	75	277
<b>INSECTA</b>					
Psocoptera (bark lice)	-	(0/40) = 0%	-	-	-
Hemiptera					
Cicadellidae (leafhoppers)	(0/51) = 0%	(3/4) = 75%	(5/44) = 11%	(0/60) = 0%	-
Miridae (capsid bugs)	(0/117) = 0%	(33/64) = 52%	(9/47) = 19%	(2/82) = 2%	-
Pentatomidae (shield bugs)	(0/1) = 0%	(4/8) = 50%	(0/1) = 0%	(0/2) = 0%	-
Coleoptera					
Coccinellidae (ladybirds)	(1/97) = 1%	-	-	-	(3/30) = 10%
Carabidae (ground beetles)	(0/6) = 0%	-	(1/6) = 16%	-	-
Curculionidae (target weevils)	(1/103) = 1%	(50/87) = 57%	(69/90) = 77%	-	-
<b>ARACHNIDA</b>					
Ixodidae (ticks)	(0/29) = 0%	-	(38/67) = 57%	-	-
Opiliones	-	(1/16) = 6%	-	-	-

**Prevalence of *M. anisopliae* on non-targets collected in the specific eco-system**

## Medium time non-target effects:

Ticks infected (%) with *M. anisopliae*

	19/7	9/8	29/8	12/9
1) Triton x	0	0	0	0
2) <i>M. anisop.</i>	90.5	100	69.2	0



**Identity of *M. anisopliae* on non-targets compared with released isolate**

**So, what do we do ?**

- \* We need to define ecological host range (with or without the evolutionary aspect ?)**
- \* We should take ecological host range much more into account and sample different taxa in the eco-system**

**\* We need to distinguish between non-target effects in relation to three time scales:**

**1) immediate effects**

**2) medium time effects**

**3) long-term establishment  
in non-target populations**

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