



# A risk assessment framework for biological control agents: the ERBIC\* approach

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\* Environmental Risks of **BI**ological **C**ontrol introductions into Europe, EU-FAIR5-CT97-3489

# Background



- Some 25 countries already have decided to regulate the use of all biological control agents, also for inundative use  
e.g., Austria, Australia, Czech Republic, Japan, Hungary, New Zealand, Norway, Sweden, Switzerland
- Reasons for regulating:
  - potential human health hazards
  - environmental risks
  - questions of efficacy
- General guidelines concerning BCA-regulations have been prepared e.g. by FAO, EPPO, NAPPO, CABI
- No specific system or principles have been available for assessing environmental risks of BCAs



**For a full risk assessment, three steps are distinguished:**

- (1) the **risk identification and evaluation** procedure concerning the release of a natural enemy,
- (2) a **risk management** plan dealing with risk reduction and risk mitigation, and
- (3) a **risk/benefit analysis** of the proposed release of the natural enemy, together with risk/benefit analyses of current and alternative pest management methods

$$\text{RISK} = (\text{LIKELIHOOD of adverse effect}) \times (\text{MAGNITUDE of effect})$$

For environmental risk assessment, data on 5 parameters are necessary: establishment, dispersal, host range, direct NT-effects, indirect effects

**Proposed descriptions of **likelihood** for establishment, dispersal, host range, direct and indirect effects (\* as in Hickson *et al.*, 2000)**

Establishment <sup>1*</sup> in non-target habitat	Dispersal <sup>2</sup> potential	Host range <sup>3</sup>	Direct* and Indirect* effects	<b>Risk index value for likelihood</b>
Very unlikely	< 10 m	0 species	Very unlikely	=> <b>1</b>
Unlikely	< 100 m	1-3 species	Unlikely	=> <b>2</b>
Possible	< 1,000 m	4-10 species	Possible	=> <b>3</b>
Likely	< 10,000 m	11-30 species	Likely	=> <b>4</b>
Very likely	> 10,000 m	>30 species	Very likely	=> <b>5</b>

<sup>1</sup> the propensity to overcome adverse conditions (winter or summer: physical requirements) and availability of refuges

<sup>2</sup> distance moved per release (take number of generations per season into account); determine dispersal curve, sampling points at 10, 100 and 1000 m, sampling period is 50% life span

<sup>3</sup> the propensity to realise its ecological host range in the release area



## Proposed new descriptions of **magnitude** for establishment, dispersal, host range, direct and indirect effects

Magnitude	Establishment in non-target habitat	Dispersal potential	Host range restriction	Direct and Indirect effects	<b>Risk index value for magnitude</b>
Minimal	local (transient in time and space)	< 1%	species	< 5% mortality	<b>=&gt; 1</b>
Minor	<10%	< 5%	genus	< 40% mortality	<b>=&gt; 2</b>
Moderate	10 - 25%	< 10%	family	> 40% mortality, and/or > 10% short term pop. suppression	<b>=&gt; 3</b>
Major	25 - 50%	< 25%	order	> 40% short term pop. suppression, or > 10% permanent pop. suppression	<b>=&gt; 4</b>
Massive	>50%	> 25%	none	> 40% long term pop. suppression, or local extinction	<b>=&gt; 5</b>





## LOWEST POSSIBLE RISK INDEX

	Likelihood	Magnitude	L x M
Establishment	1	1	1
Dispersal	1	1	1
Host range	1	1	1
Direct effects	1	1	1
Indirect effects	1	1	1
			<hr/>
	<b>SUM = risk index</b>		<b>5</b>



## HIGHEST POSSIBLE RISK INDEX

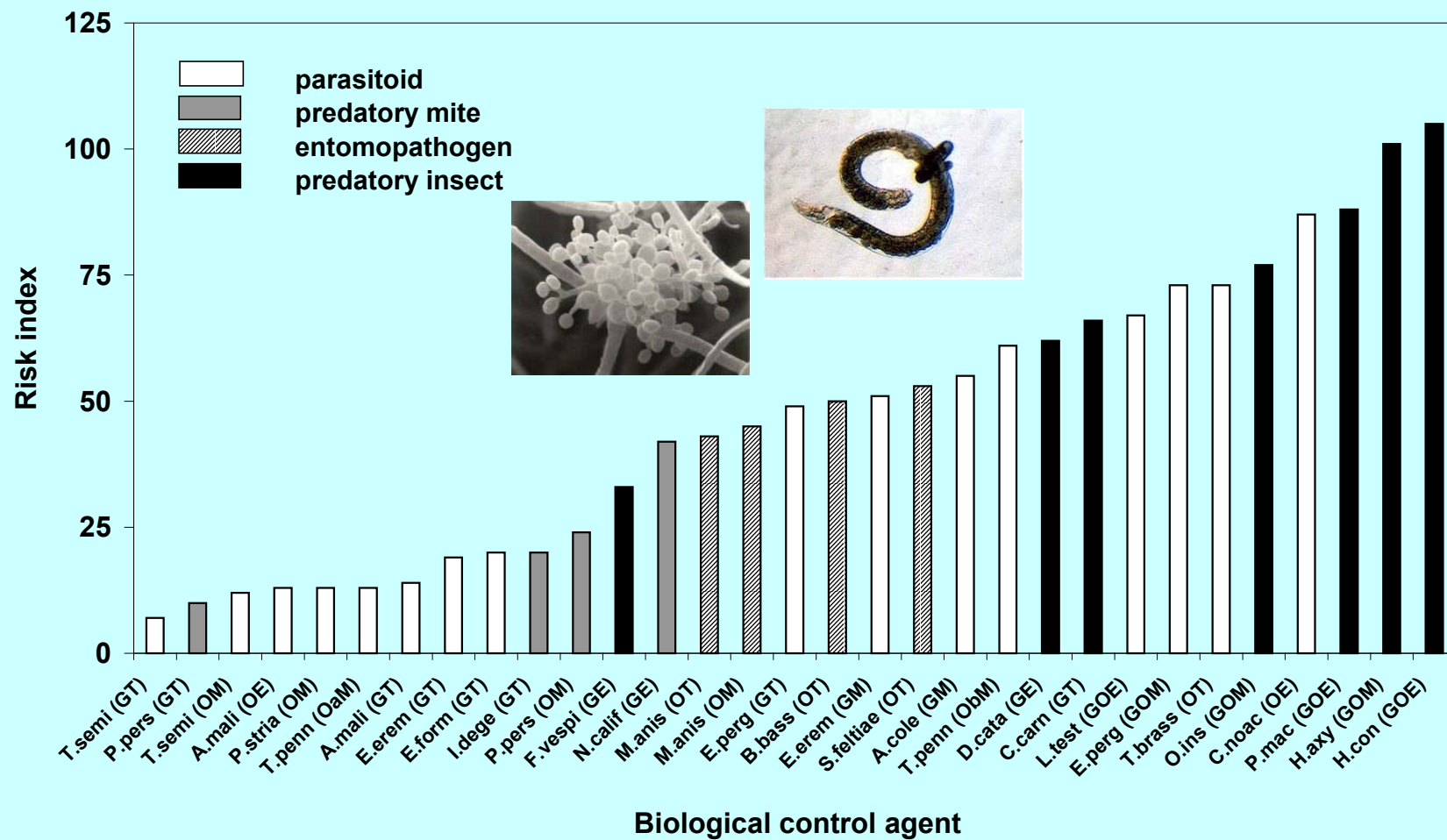
	Likelihood	Magnitude	L x M
Establishment	5	5	25
Dispersal	5	5	25
Host range	5	5	25
Direct effects	5	5	25
Indirect effects	5	5	25
			<hr/>
	<b>SUM = risk index</b>		<b>125</b>



## Case: risk index for *Steinernema feltiae* in field crops in Finland

	Likelihood	Magnitude	L x M
Establishment	3	5	15
Dispersal	1	1	1
Host range	5	5	25
Direct effects	4	2	8
Indirect effects	4	1	4
			<hr/>
		<b>SUM = risk index</b>	<b>53</b>





a = risk index after release, b = risk index before release,  
 G = greenhouse, O = open field,  
 M = Mediterranean climate, T = Temperate climate, E = across Europe



## Case: Regulation of BCAs in Norway

- During 2001 all BCA products in current use were evaluated and granted new 5-year authorisations
- A total of 31 applications were handled by the Norwegian Agricultural Inspection Service
- 4 of these were new organisms that had not previously been used in Norway.
- 20 of the BCAs were approved
- 11 were denied approval.



## *Approved BCAs:*

1. *Amblyseius cucumeris*
  2. *Hypoaspis miles*
  3. *Hypoaspis aculeifer*
  4. *Phytoseiulus persimilis*
  5. *Aphidius colemani*
  6. *Aphidius ervi*
  7. *Dacnusa sibirica*
  8. *Diglyphus isaea*
  9. *Encarsia formosa*
  10. *Eretmocerus californicus*
  11. *Cryptolaemus montrouzieri*
  12. *Macrolophus caliginosus*
  13. *Orius majusculus*
  14. *Aphidoletes aphidimyza*
  15. *Feltiella acarisuga*
  16. *Heterorhabditis megidis*
  17. *Steinernema feltiae*
- ... and propagation foods*
18. *Ephestia kuehniella*
  19. *Rhopalosiphum padi*
  20. *Sitobion avenae*



## 11 species were denied approval:

1. *Harmonia axyridis*
2. *Orius laevigatus*
3. *Aphelinus abdominalis*
4. *Amblyseius californicus*
5. *Podisus maculiventris*
6. *Trichogramma brassicae*
7. *Adalia bipunctata*
8. *Crysoperla carnea*
9. *Phasmarhabditis nematode*
10. *Heterorhabditis bacteriophora*
11. *Steinernema carpocapsae*



## Reasons for the denials were:

- (1) risk of establishment of alien species in Norway (*Harmonia*, *Orius*, *Aphelinus*, *Amblyseius*, and *Podisus*),
- (2) uncertainty whether the species exists in Norway or not (*Phasmarhaptitis*, *Trichogramma*) and
- (3) lack of sufficient efficacy (*Adalia bipunctata*).
- (4) *Crysoperla* was denied registration due to uncertainty about taxonomy, several sibling species exist, and the distribution of these is not clear.
- (5) The nematodes *Heterorhabditis bacteriophora* and *Steinernema carpocapsae* were denied approval as these species don't occur naturally in Norway, and the nematode *H.megidis*, which does occur naturally, has the same area of use. Only the nematode *Heterorhabditis megidis* is currently approved for field application (in strawberries, ornamentals and lawns)



# Biological control is safe

usually...

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