Praktické možnosti nechemické ochrany pomocí Esenciálních olejů a parazitických háďátek

Ondřej Douda
Výzkumný ústav rostlinné výroby, v.v.i. Praha

Praha Ruzyně
22. 11. 2022

Kmen Nematoda

- cca 1 mil. druhů
- popsáno asi 25 000 druhů
- cca 1 mil. jedinců /1m^2 půdy
- 60 mld. jedinců/1 člověka
- výskyt všudypřítomný
- extrémofilní organismy
- asi 10% všech ztrát způsobených na zemědělských plodinách

COMMON GENERA OF PLANT PARASITIC NEMATODES

E.C. McGawley & C. Overstreet, 2014. LSU Agricultural Center

Genera (common & scientific names) modified and colorized from: 1.) Lesion (*Pratylenchus* spp.) Siddiqi; 2.) Root knot (*Meloidogyne* spp.) Papp; 3.)Burrowing (*Radopholus* spp.) Thorne; 4.) Needle (*Longidorus* spp.) Pedram-shown at one-half relative size; 5.) Cyst (*Heterodera* spp.) Papp; 6.) Reniform (*Rotylenchulus* spp.) Linford and Oliveira; 7.) Awl (*Dolichodorus* spp.) Chow; 8.) Citrus (*Tylenchulus* spp.) Papp; 9.) Pin (*Paratylenchus* spp.) Raski & Luc; 10.) Sting (*Belonolaimus* spp.) Roman; 11.) Ring (*Mesocriconema* spp.) Loof & DeGrisse; 12.) Ring (*Ogma* spp.) Jairajpuri; 13.) Seed gall (*Anguina* spp.) Goodey; 14.) Spheroid (*Sphaeronema* spp.) Papp; 15.) Stunt (*Tylenchorhynchus* spp.) Allen; 16.) Lance (*Hoplolaimus* spp.) Sher; 17.) Spiral (*Helicotylenchus* spp.) Fortuner; 18.) Sheath (*Hemicycliophora* spp.) Sauer; 19.) Bulb & stem (*Ditylenchus* spp.) Thorne; 20.) Dagger (*Xiphinema* spp.) Pedram; 21.) Foliar (*Aphelenchoides* spp.) Hooper; 22.) Stubby root (*Trichodorus* spp.) Decraemer; 23.) Spiral (*Rotylenchus* spp.) Golden.

Fytoparazitická háďátka přítomná na území ČR

- Háďátko bramborové (téměř výhradně *Globodera rostochiensis*)
- *Meloidogyne hapla*
- *Meloidogyne incognita* + *Meloidogyne* sp.
- Háďátko řepné (*Heterodera schachtii*)
- Další druhy r. *Heterodera* – *H. avenae*, *H. humuli*
- Háďátko zhoubné (*Ditylenchus dipsaci*) + *D. destructor*
- *Xiphinema* sp., *Longidorus* sp.
- *Pratylenchus* sp.???

Vliv rostlinných esencí na životaschopnost háďátka zhoubného

In vitro testy rostlinných esencí

- jednoduchá metodika – pozorování účinku na suspenzi háďátek

Vol. 45, 2009, No. 2: 66–73 *Plant Prote*

Effect of Plant Essential Oils on Mortality of the Stem Nematode (*Ditylenchus dipsaci*)

Miloslav ZOUHAR[1], Ondřej DOUDA[2], David LHOTSKÝ[1] and Roman PAVELA

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Abstract

Zouhar M., Douda O., Lhotský D., Pavela R. (2009): **Effect of plant essential oils on mortality of the stem**

Original Paper *Plant, Soil and Environment*

https://doi.org/10.17221/92/2022-PSE

Effect of plant essential oils on the mortality of *Ditylenchus dipsaci* (Kühn, 1857) nematode under *in vitro* conditions

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	ppm	4h	24h
	7500	59.3 ± 38.1	75.3 ± 29.1
Origanum compactum L.	1500	**82.7** ± 18.1**	**92.7** ± 5.0**
	3000	**100.0** ± 0.0**	**100.0** ± 0.0**
	5000	**99.3** ± 1.2**	**100.0** ± 0.0**
	7500	**98.7** ± 1.2**	**100.0** ± 0.0**
Origanum majorana L.	1500	18.7 ± 18.9	28.7 ± 21.4
	3000	31.3 ± 25.3	55.3 ± 36.5
	5000	22.7 ± 12.1	42.0 ± 33.0
	7500	33.0 ± 47.7	74.7 ± 28.3
Origanum vulgare L.	1500	**98.7** ± 1.2**	**99.3** ± 1.2**
	3000	**99.3** ± 1.2**	**100.0** ± 0.0**
	5000	**100.0** ± 0.0**	**100.0** ± 0.0**
	7500	**99.7** ± 1.6**	**99.3** ± 1.2**

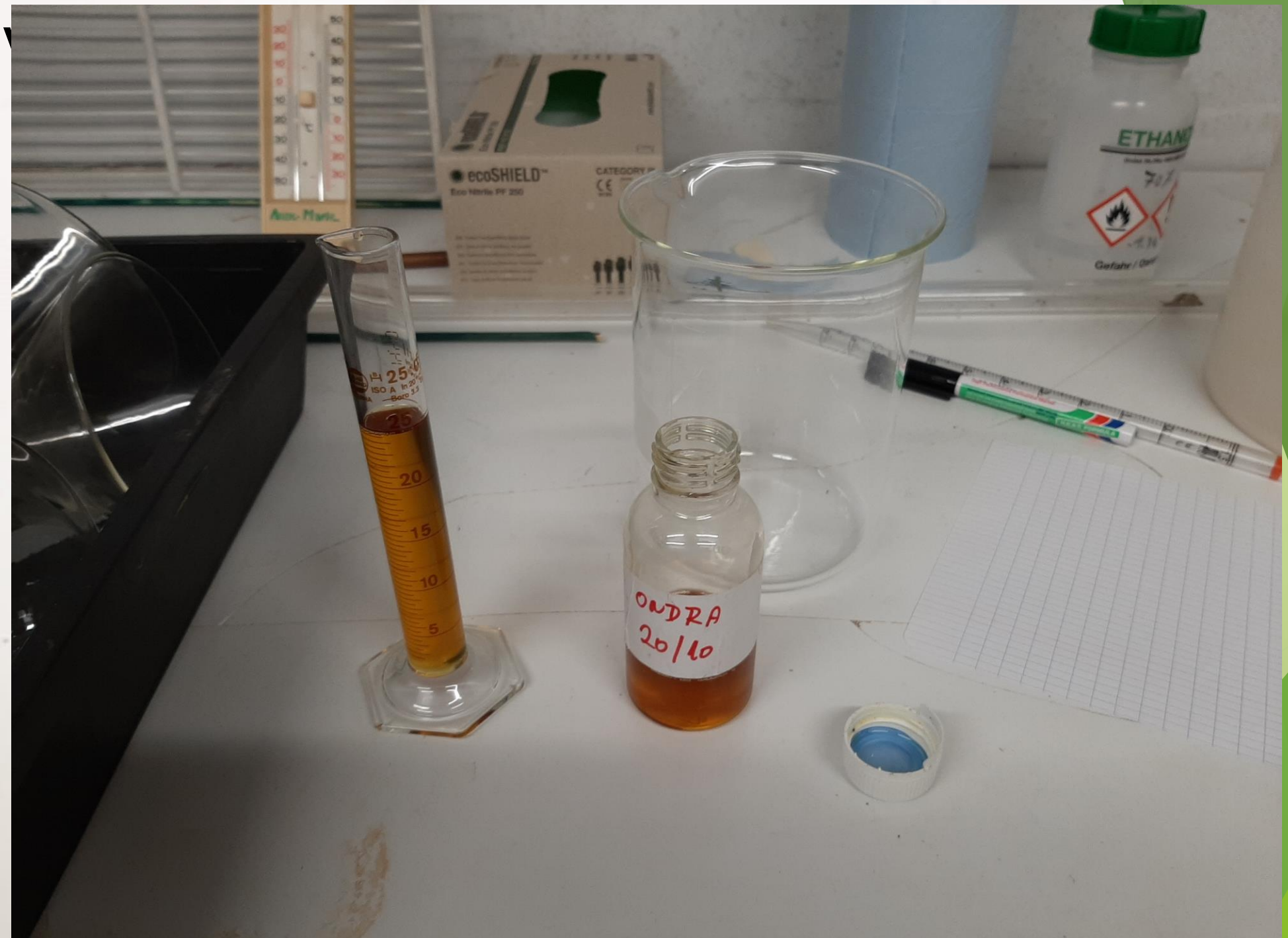
Table 1. Mortality of nematodes after 4 and 24 h of treatment with essential oils dissolved in Tween 20: distilled water (1:1), which also served as a control; values in the same line followed by a different letter(s) are significantly different at $P \leq 0.05$ based on Tukey's multiple range test, ($n = 5$). Experiments were conducted in four separate batches with respective controls

%	Peppermint *Mentha piperita* L.	European spruce *Picea abies* (L.) H. Karst.	Basil *Ocimum basilicum* L.	Common sage *Salvia officinalis* L.	Rose geranium *Pelargonium graveolens* L'Hér.	Wormwood *Artemisia absinthium* L.	Lemon *Citrus limon* (L.) Osbeck	Control
Mortality 4 h	8.83 ± 4.02^{a}	6.01 ± 7.91^{a}	12.7 ± 7.99^{a}	9.79 ± 7.35^{a}	5.96 ± 4.03^{a}	11.86 ± 9.69^{a}	10.27 ± 4.65^{a}	6.59 ± 5.6^{a}
Mortality 24 h	12.05 ± 4.79^{a}	9.61 ± 6.94^{a}	16.2 ± 2.57^{a}	12.48 ± 9.65^{a}	11.86 ± 8.92^{a}	12.52 ± 9.56^{a}	11.64 ± 5.49^{a}	6.98 ± 5.2^{a}

%	Bergamot orange *Citrus bergamia* Risso	Marjoram *Origanum majorana* L.	Southern blue gum *Eucalyptus globulus* Labill.	Mediterranean cypress *Cupressus sempervirens* L.	English lavender *Lavandula angustifolia* Mill.	Fennel *Foeniculum vulgare* Mill.	Lemon-scented teatree *Leptospermum petersonii* F. M. Bailey	control
Mortality 4 h	17.16 ± 3.69^{a}	14.00 ± 5.90^{a}	20.33 ± 4.06^{a}	17.75 ± 8.41^{a}	20.09 ± 9.36^{a}	20.30 ± 7.53^{a}	19.21 ± 22.14^{a}	12.34 ± 2.07^{a}
Mortality 24 h	18.85 ± 3.14^{a}	16.14 ± 4.77^{a}	20.57 ± 3.54^{a}	19.16 ± 7.31^{a}	23.79 ± 9.93^{a}	27.12 ± 9.16^{a}	23.57 ± 18.21^{a}	14.36 ± 2.11^{a}

%	Frankincense *Boswellia sacra* Flueck.	African myrrh *Commiphora myrrha* (Nees) Engl.	Dill *Anethum graveolens* L.	European silver fir *Abies alba* Mill.	Chinese cinnamon *Cinnamomum cassia* (L.) J. Presl	Mountain pine *Pinus mugo* Turra	Scots pine *Pinus sylvestris* L.	control
Mortality 4 h	19.06 ± 3.40^{a}	7.62 ± 6.64^{b}	21.36 ± 8.40^{a}	11.44 ± 5.75^{b}	100.00 ± 0.00^{c}	10.19 ± 2.23^{b}	11.69 ± 3.86^{b}	4.60 ± 3.40^{b}
Mortality 24 h	75.28 ± 6.82^{a}	22.52 ± 11.95^{b}	60.42 ± 11.11^{ad}	48.43 ± 19.27^{de}	100.00 ± 0.00^{c}	66.35 ± 4.76^{ade}	45.56 ± 22.24^{be}	19.67 ± 3.49^{b}

%	Thymol	Broad-leaved thyme *Thymus pulegioides* L.	Common thyme *Thymus vulgaris* L. (Sigma)	Common thyme *Thymus vulgaris* L. white	Common thyme *Thymus vulgaris* L. red	control
Mortality 4 h	13.66 ± 12.49^{a}	30.11 ± 10.49^{ac}	39.82 ± 5.79^{bc}	58.10 ± 7.97^{b}	49.67 ± 11.44^{b}	14.78 ± 11.83^{a}
Mortality 24 h	62.45 ± 11.51^{a}	58.01 ± 9.41^{a}	48.87 ± 11.4^{a}	66.33 ± 9.25^{a}	51.11 ± 9.24^{a}	19.92 ± 12.39^{b}


ecoSHIELD
ONDRA
20/10


ecoSHIELD™
Eco Nitrile PF 250
CATEGORY III
ETHANOL
70%
Gefahr / Danger
1000 ml


SERRECOMPLEX
A
SERRE
7b
G2


TARE
CLEAR
SELECT
ENTER

	20/10, 5% 5 hodin	neošetřená kontrola
počet háďátek na 1 g pletiva	335	1 705
%	20	100

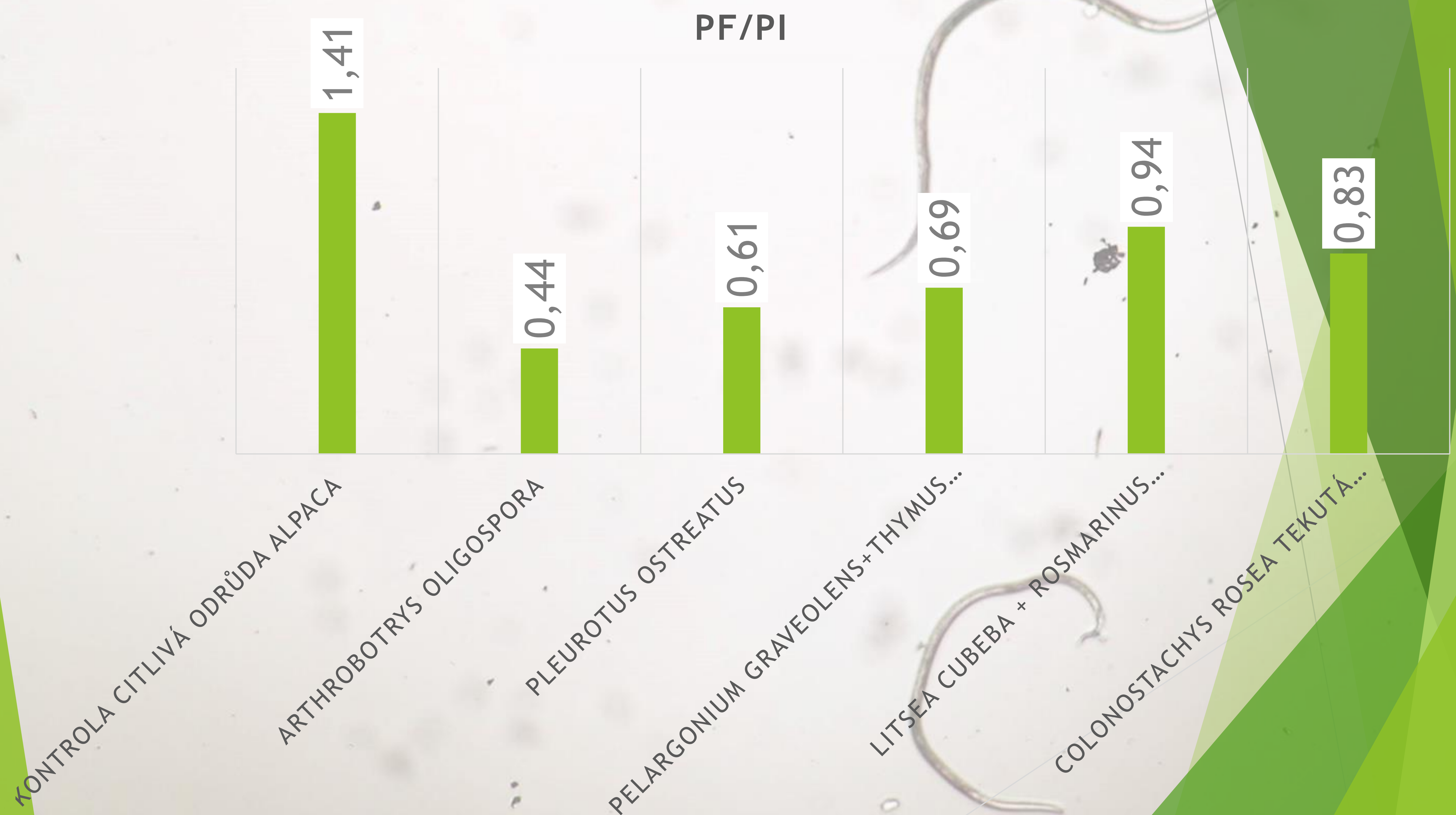
Alternativní ochrana proti háďátku řepnému *H. schachtii* - maloparcelkové pokusy

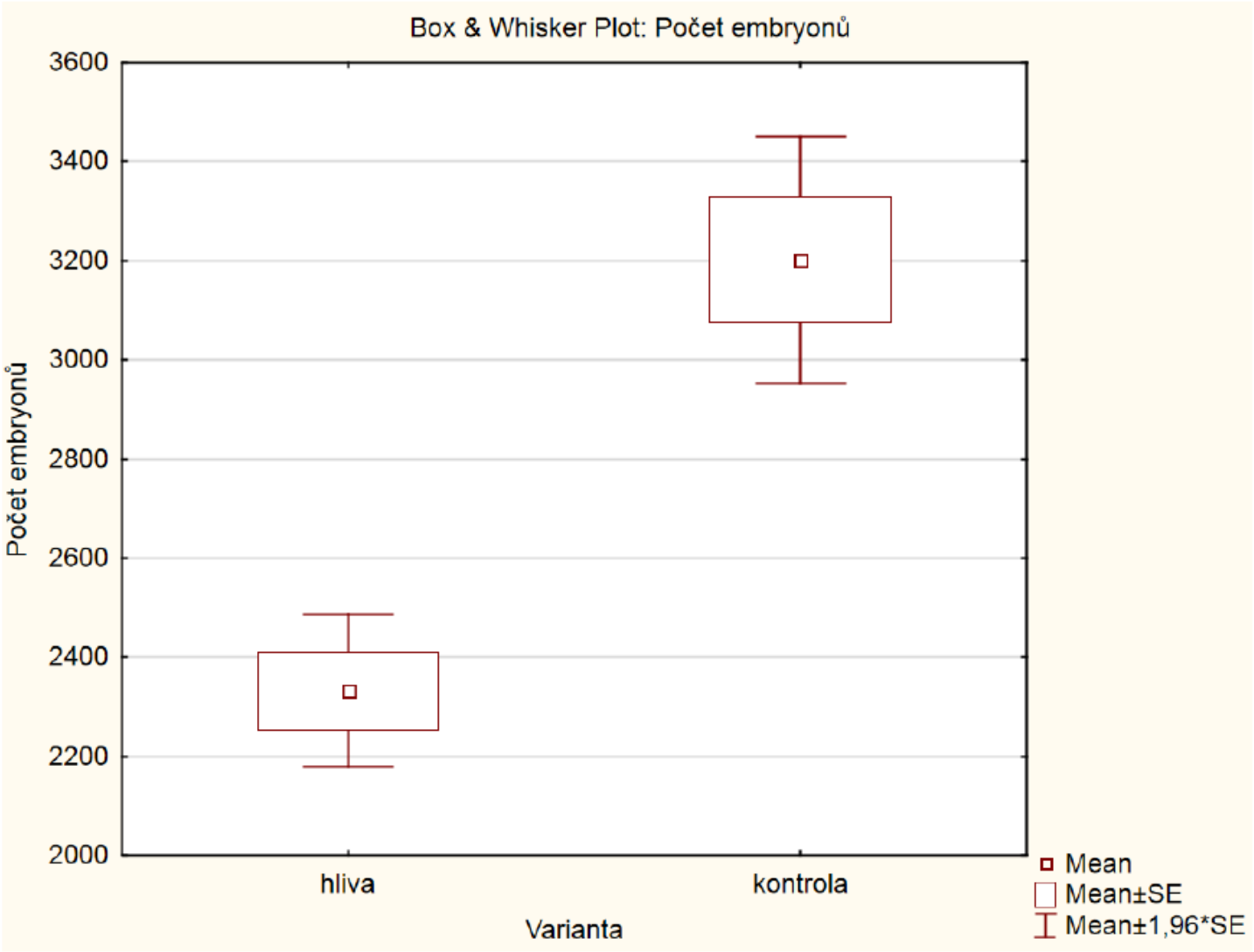
- vytipovány lokality s výskytem *H. schachtii*
- proveden monitoring a rozvržení pokusné plochy
- aplikace rostlinných esencí a bioagens nematofágních hub po setí řepy do meziřádku
- pěstování a sklizeň řepy
- vyhodnocení základních parametrů mobilní laboratoří
- odběr půdních vzorků, extrakce cyst a embryonů


12


2


STOLL
V300

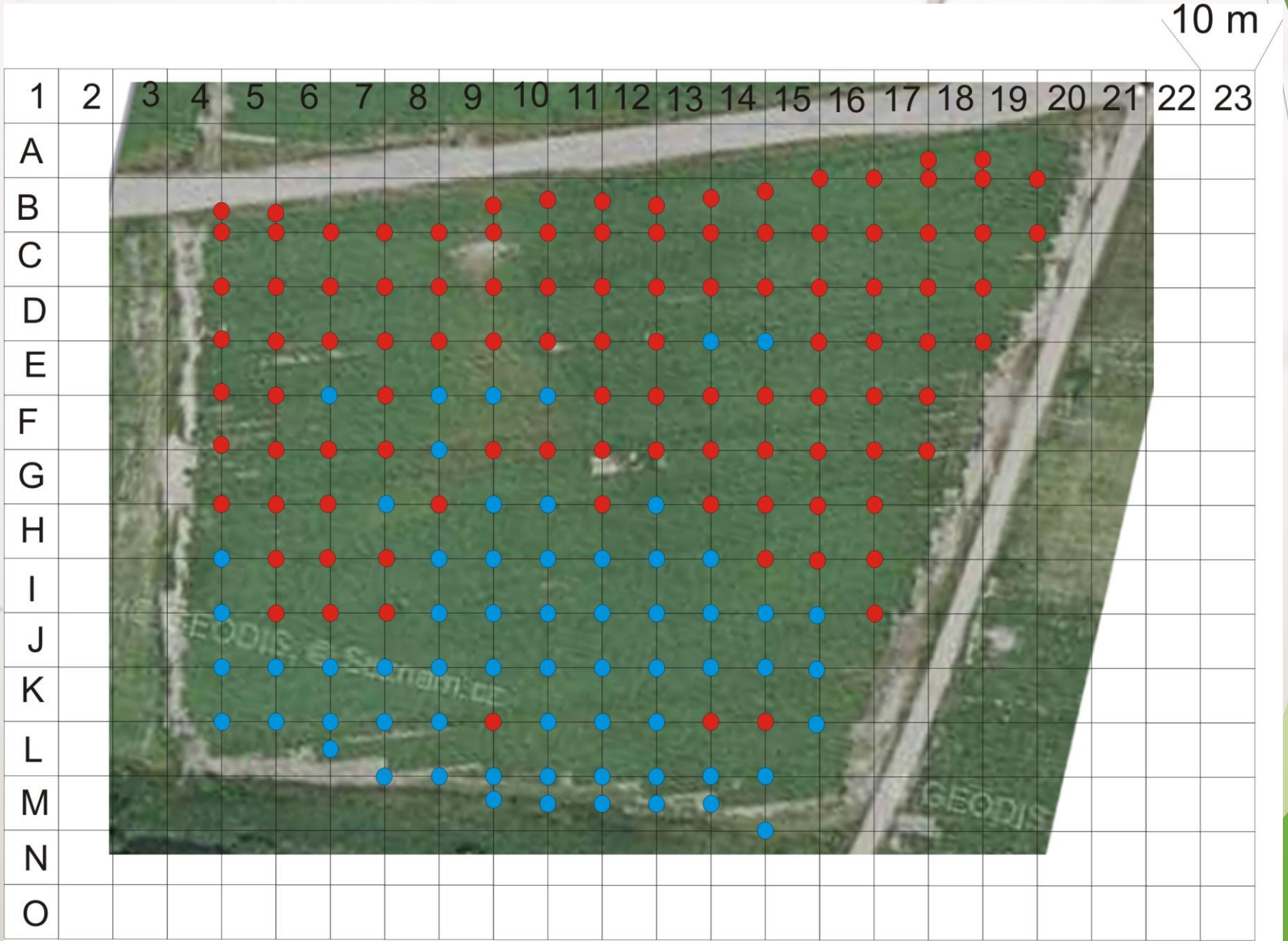

PF/PI
1,41
0,44
0,61
0,69
0,94
0,83
KONTROLA CITLIVÁ ODRŮDA ALPACA
ARTHROBOTRYS OLIGOSPORA
PLEUROTUS OSTREATUS
PELARGONIUM GRAVEOLENS+THYMUS…
LITSEA CUBEBA + ROSMARINUS…
COLONOSTACHYS ROSEA TEKUTÁ…



Variable	T-tests; Grouping: Varianta (Spreadsheet1) Group 1: hliva Group 2: kontrola **Mean hliva**	Mean kontrola	t-value	df	p	Valid N hliva	Valid N kontrola	Std.Dev. hliva	Std.Dev. kontrola	F-ratio Variances	p Variances
Počet embryonů	2332,262	3202,218	-5,82487	548	0,000000	275	275	1303,357	2106,047	2,611015	0,000000

Výzkum v skyt
háďá

Poloprovozní test



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SHORT COMMUNICATION

Alternative methods of carrot (*Daucus carota*) protection against the northern root knot nematode (*Meloidogyne hapla*)

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Abstract

The presence of northern root knot nematode (*Meloidogyne hapla*) has considerably increased in the Czech Republic during the last 10 years. The management of this pest is difficult; thus, the aim of this study was to test two alternative pest management techniques on carrots under field conditions. When Indian mustard (*Brassica juncea*) was ploughed and the treated area was then covered with polyethylene sheets to prolong effect of the treatment, the root gall numbers decreased; whereas a nitrolime application combined with plastic covering had a positive effect on the experimental plants' fresh weight.

Keywords: *Alternative management, biofumigation, Brassica juncea, nitrolime application, soil covering.*

Table I. Summary of numbers of the plants harvested and effect of the treatment on fresh weight and gall index of the experimental and control carrots. In the case of fresh weight and gall index the mean value is followed by the standard deviation; variants with the same number are not significantly different at $p \leq 0.05$.

Variant	Number of plants harvested	Fresh weight (g)	Gall index
Indian mustard	156	42.2 ± 27.8a	3.1 ± 1.0a
Nitrolime	152	73.3 ± 40.8b	3.6 ± 0.9b
Control	182	53.2 ± 30.3c	3.4 ± 0.8b

Nádobové testy

- inokulum – přirozeně zamořená půda
- využito adsorpce rostlinných esencí na perlit
- experimentální rostliny mrkve pěstovány 2 měsíce
- vyhodnocení – Taylor Sasserova stupnice, počet vajíček, hmotnost rostlin

J Pest Sci (2010) 83:217–221
DOI 10.1007/s10340-010-0287-4

ORIGINAL PAPER

Using plant essences as alternative mean for northern root-knot nematode (*Meloidogyne hapla*) management

Ondřej Douda · Miloslav Zouhar · Jana Mazáková · Eva Nováková · Roman Pavela

Table 1 Effects of commercially available plant essences from *O. basilicum*, *M. arvensis*, *A. indica*, and *T. erecta* on the infection potential of *M. hapla* on carrot

Treatment	Gall index	Egg number	Fresh root weight (g)	Fresh leaves weight (g)	Dry root weight (g)	Dry leaves weight (g)
O. basilicum	2.89 ± 1.05 a	154878 ± 115539 a	6.64 ± 3.97 a	1.33 ± 0.47 a	1.04 ± 0.69 a	0.20 ± 0.05 ac
M. arvensis	3.4 ± 1.17 ab	187446 ± 89170 a	7.58 ± 2.40 a	1.49 ± 0.31 a	1.05 ± 0.37 a	0.25 ± 0.05 a
A. indica	3.10 ± 1.10 a	51999 ± 35819 bc	2.31 ± 1.44 b	1.09 ± 0.41 a	0.18 ± 0.10 b	0.15 ± 0.07 bc
T. erecta	3.40 ± 1.43 ab	123035 ± 62462 ac	5.38 ± 2.76 ab	1.31 ± 0.40 a	0.45 ± 0.27 b	0.19 ± 0.06 abc
Control	4.60 ± 0.70 b	181517 ± 99856 a	4.90 ± 2.31 ab	1.18 ± 0.41 a	0.40 ± 0.23 b	0.19 ± 0.09 abc

Mean is followed by SD; variants with the same number are not significantly different at $P \leq 0.05$

Ethandinitrile (cyanogen)

$$N \equiv C\text{-}C \equiv N$$


Draslovka Lučební závody Draslovka a.s. Kolín, Havlíčkova 605, 280 02 Kolín IV, CZECH REPUBLIC, Tel. +420 321 335 265
EDN – CYANOGEN (CAS 460-19-5; min 99 % wg)
UN 1026 CYANOGEN
Production date:
06/2013
2
2
DANGER
Extremely flammable gas.
Contains gas under pressure; may explode if heated. Causes serious eye irritation.
Fatal if inhaled. May cause respiratory irritation. Very toxic to aquatic life with long lasting effects.
Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. Do not breathe gas and vapours. Use only outdoors or in a well-ventilated area. Avoid release to the environment. Wear protective nitrile gloves, protective clothing and eye protection. IF INHALED: Remove person to fresh air and keep comfortable for breathing. Immediately call a doctor. Dispose of container to Lučební závody Draslovka a.s.
Netto:
50 kg
Batch number: 9


HATTAT
7506

agronomy

MDPI

Article

Field Validation of the Effect of Soil Fumigation of Ethanedinitrile (EDN) on the Mortality of *Meloidogyne hapla* and Carrot Yield Parameters

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Abstract: With the increasing importance of soilborne plant pest nematodes and the relatively recent phase-out of methyl bromide as a key soil fumigant, there is an urgent need for new fumigants with good nematicidal properties. Ethanedinitrile (EDN) is a promising fumigant and preparation because of its physical, agrochemical, and nematicidal properties. However, its efficacy against

Figure 2. Samples of carrots from the experimental field; (**A**)—untreated control, (**B**)—untreated control covered by TIF® film, (**C**)—30 g/m^2 of EDN applied, (**D**)—50 g/m^2 of EDN applied.

Table 1. Results of the 1st experiment established in spring; average values per plant ± standard deviation. Variants with significant differences (ANOVA, Tukey's test; $p < 0.05$) are indicated by different letters.

	Untreated Control 1	Untreated Control 2	Untreated Control Covered by Sheet 1	Untreated Control Covered by Sheet 1	30 g EDN 1	30 g EDN 2	50 g EDN 1
fresh root weight [g]	8.3 ± 6.29 ^{a}	12.88 ± 12.21 ^{b}	12.68 ± 8.43 ^{b}	11.20 ± 8.38 ^{a,b}	19.18 ± 13.23 ^{c,d}	17.35 ± 8.46 ^{c}	21.12 ± 8.97 ^{d}
root length [cm]	6.76 ± 3.59 ^{a}	7.91 ± 3.48 ^{a}	7.25 ± 3.86 ^{a}	7.49 ± 3.86 ^{a}	14.12 ± 3.21 ^{b}	15.57 ± 13.39 ^{b}	15.67 ± 9.33 ^{b}
largest root diameter [mm]	12.77 ± 3.93 ^{a}	15.28 ± 10.64 ^{a,b}	16.69 ± 17.08 ^{b}	13.79 ± 6.51 ^{a,b}	15.86 ± 3.18 ^{a,b}	16.67 ± 9.33 ^{b}	17.18 ± 3.39 ^{b}
fresh leaf weight [g]	4.13 ± 2.32 ^{a}	6.31 ± 3.53 ^{a}	6.44 ± 3.28 ^{b}	5.39 ± 3.58 ^{a,b}	8.43 ± 3.97 ^{b,c}	9.82 ± 11.21 ^{c}	11.59 ± 6.30 ^{c}
gall number	32.53 ± 25.78 ^{a}	51.52 ± 38.02 ^{b}	52.07 ± 38.08 ^{b}	55.60 ± 40.43 ^{b}	3.64 ± 10.66 ^{c}	0.87 ± 2.08 ^{c}	1.33 ± 3.37 ^{c}

Table 2. Results of the 2nd experiment established in summer; average values per plant ± standard deviation. Variants with significant differences (ANOVA, Tukey's test; $p < 0.05$) are indicated by different letters.

	Untreated Control 1	Untreated Control 2	Untreated Control Covered by Film 1	Untreated Control Covered by Film 1	30 g EDN 1	30 g EDN 2	50 g EDN 1
fresh root weight [g]	21.68 ± 15.73 ^{a}	17.45 ± 14.21 ^{a}	25.62 ± 17.94 ^{a}	21.93 ± 17.46 ^{a}	46.50 ± 22.24 ^{b}	37.34 ± 17.98 ^{c}	50.78 ± 32.28 ^{b}
root length [cm]	11.66 ± 13.75 ^{a,b}	8.94 ± 4.26 ^{a}	10.85 ± 3.68 ^{a,b}	10.38 ± 3.44 ^{a,b}	15.39 ± 2.82 ^{a}	16.01 ± 12.56 ^{a}	15.97 ± 2.48 ^{a}
largest root diameter [mm]	18.44 ± 6.25 ^{a}	16.76 ± 5.24 ^{a}	19.24 ± 5.47 ^{a}	20.21 ± 18.44 ^{a}	26.28 ± 28.78 ^{b}	21.37 ± 4.27 ^{a}	24.25 ± 4.40 ^{a,b}
fresh leaf weight [g]	5.49 ± 3.24 ^{a}	5.30 ± 5.77 ^{a}	5.77 ± 3.51 ^{a}	5.22 ± 3.10 ^{a}	9.69 ± 4.03 ^{b,c}	8.75 ± 3.83 ^{b}	10.59 ± 6.69 ^{b,c}
gall number	35.91 ± 34.00 ^{a}	29.84 ± 33.75 ^{a}	24.11 ± 30.24 ^{a,b}	21.03 ± 26.60 ^{b}	0.24 ± 0.99 ^{c}	0.42 ± 1.30 ^{c}	0.37 ± 1.11 ^{c}

Závěr

- alternativní způsoby regulace fytoparazitických háďátek se dají v praxi použít
- mohou být poměrně levné a nenáročné
- nelze očekávat 100 % účinnost
- je vhodné používat je opakovaně a střídat s tradičními nepřímými metodami ochrany

Poděkování spoluautorům:

- Katedra ochrany rostlin ČZU
- Moravskoslezské cukrovary, a.s.
- Řepařský institut s.r.o.
- Ing. Jan Procházka, Ing. Jiří Drbohlav
- RNDr David Novotný, Ph.D.
- Doc. Ing. Roman Pavela, Ph.D.

Díky za pozornost!