

TRYING OUT A LEAF-DIP BIOASSAY TO ASSESS SUSCEPTIBILITY OF *TETRANYCHUS URTICAE* TO ACARICIDES USED IN STRAWBERRIES AND RASPBERRIES IN NORWAY



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MITES AND ACARICIDES

- Strawberries in open fields and raspberries in tunnels
- Abamectin (Vertimec): MoA 6
- Spirodiclofen (Envidor 240 SC): MoA 23
- Bifenazate (Floramite 240 SC): MoA 20D
- Fenpyroximate (Danitron 5SC): 21A

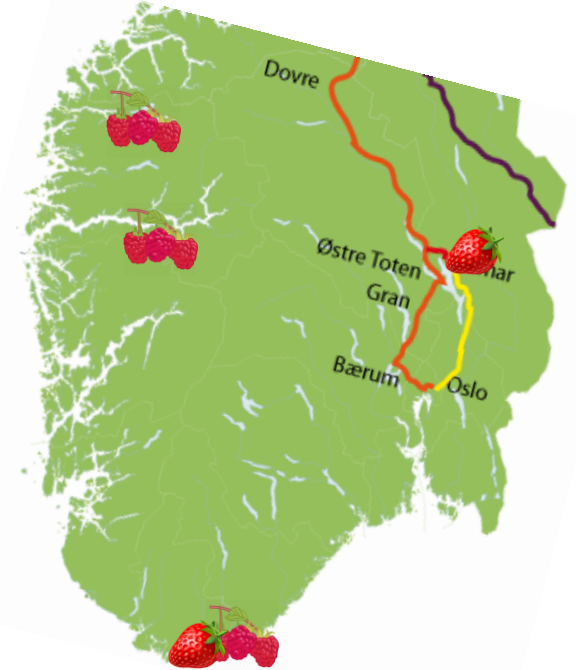


Foto: Finn Måge



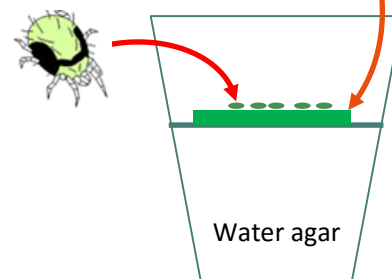
Foto: Finn Måge

CONTACT RESIDUAL LEAF DIP BIOASSAY

- 20 «5-leaf»-samples randomly collected throughout each field, transported to laboratory «over night»
- Minimum 100 individuals isolated and checked for entomopatogenic organisms (1 week)
- Mites reared on strawberry plants until enough female adults for testing (22°C, 60% RH, 16 h light)
- 15 adult females transferred to leaf circles dipped in 6-7 concentrations of each acaricide + untreated control of field strains
- Susceptible reference strain for comparison (Ref-2000)
- 3 replicates, 315-360 mites per test
- Incubation at 22°C, 60 % RH, 16 h light



Transfer of 15 adult *T. urticae* females to leaf discs (Ø 2,1 cm)



PROBIT ANALYSIS

- Mortality (dead and affected mites) scored.
 - Abamectin: After 48 hours (adults)
 - Bifenazate and fenpyroximate: After 72 hours (adults)
 - Spirodiclofen: After 7 days (offspring mortality)
- Dose response for ~ 10-90 % mortality
- LC_{50} , LC_{95} with corresponding 95 % CI
- Reduced susceptibility assumed if 95 % CI of LC_{50} do not overlap

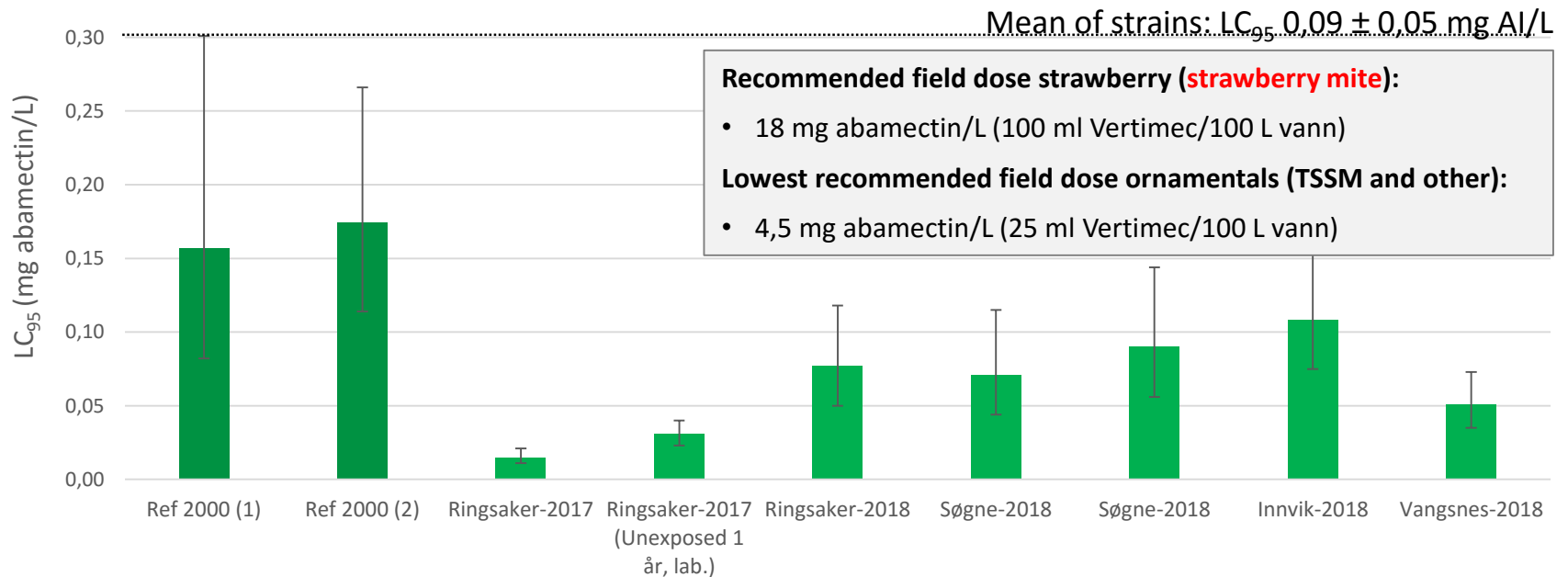
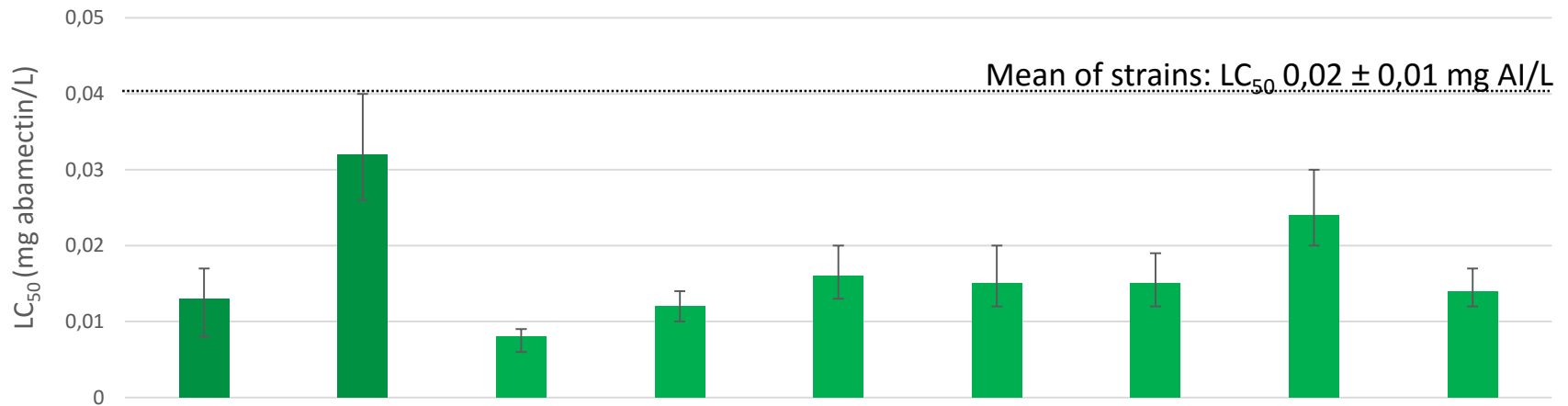


RF (LC_{50})	Resistance category (preliminary scale)
< 2	0
2-10,9	1
11-25	2
>25	3

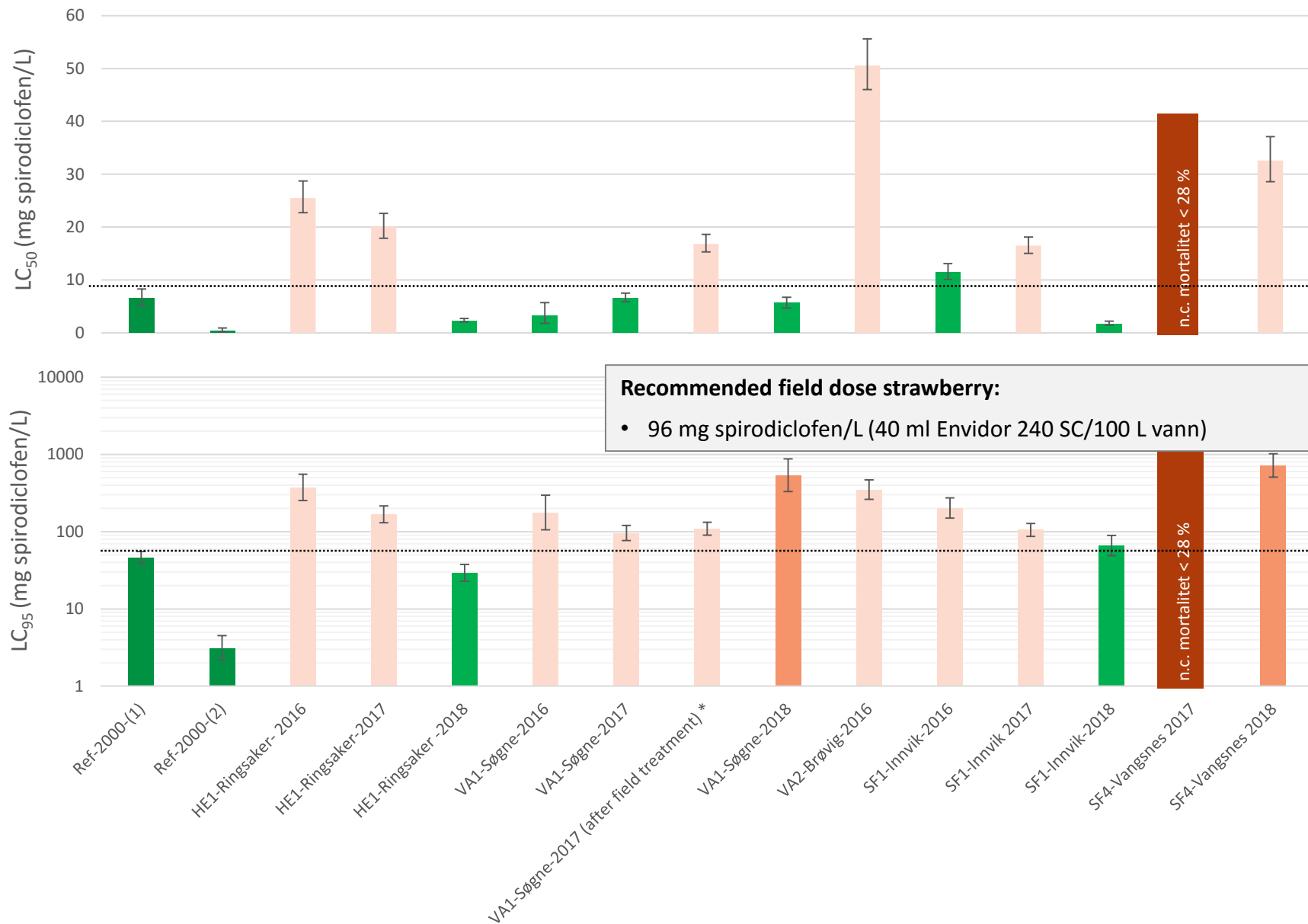
Mite strains and history of acaricide use

Mite strain	County	Crop	Collection date	Acaricides used before collection	Acaricides used last 5 years
VA1-Søgne	Vest-Agder	Strawberry, field	25.04.2016 24.04.2017 05.07.2017 09.05.2018	Spirodiclofen - Spirodiclofen, bifenazate -	Spirodiclofen, bifenazate, abamectin
HE1-Ringsaker	Hedmark	Strawberry, field	10.05.2016 15.05.2017 31.08.2017 15.05.2018	- - Spirodiclofen, bifenazate -	Spirodiclofen, bifenazate (2 x per year)
VA2-Brøvig	Vest-Agder	Raspberry, tunnel	07.06.2016 05.07.2017 -	Thiacloprid Fenpyroximate, spirodiclofen, bifenazate -	Spirodiclofen, bifenazate, fenpyroximate
SF1-Innvik	Sogn og Fjordane	Raspberry, tunnel	24.05.2016 22.05.2017 05.06.2018	Fenpyroximate, bifenazate Fenpyroximate, bifenazate Fenpyroximate, bifenazate	Spirodiclofen, bifenazate, fenpyroximate (3-4 x per year),
SF4-Vangsnes	Sogn og Fjordane	Raspberry, tunnel	- 27.06.2017 11.06.2018	- Fenpyroximate Fenpyroximate	Fenpyroximate
Ref -2000	Laboratory	Strawberry	-	Susceptible referanse strain	

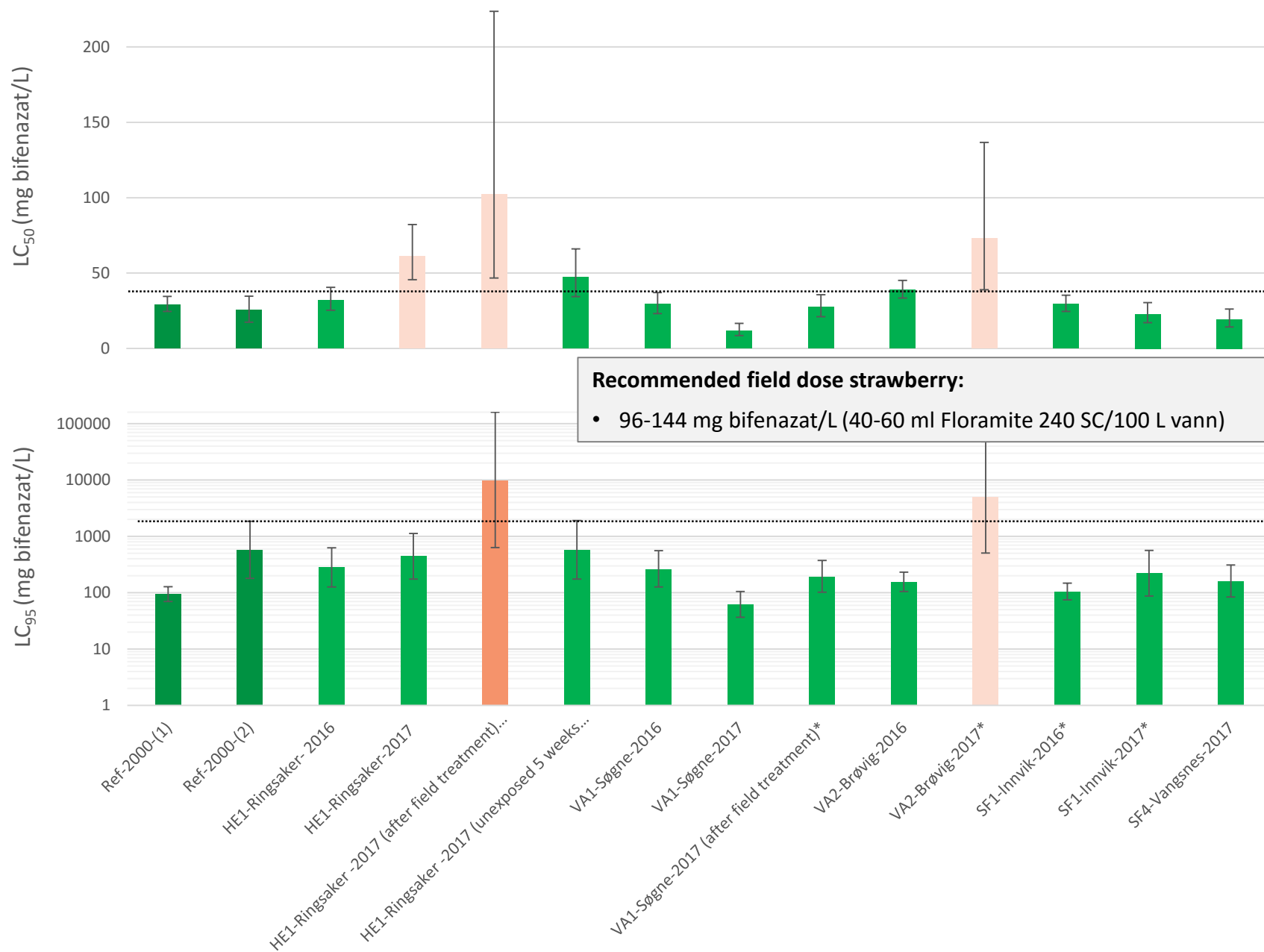
Vertimec – abamectin (IRAC Moa 6): Adult mortality, 48 h



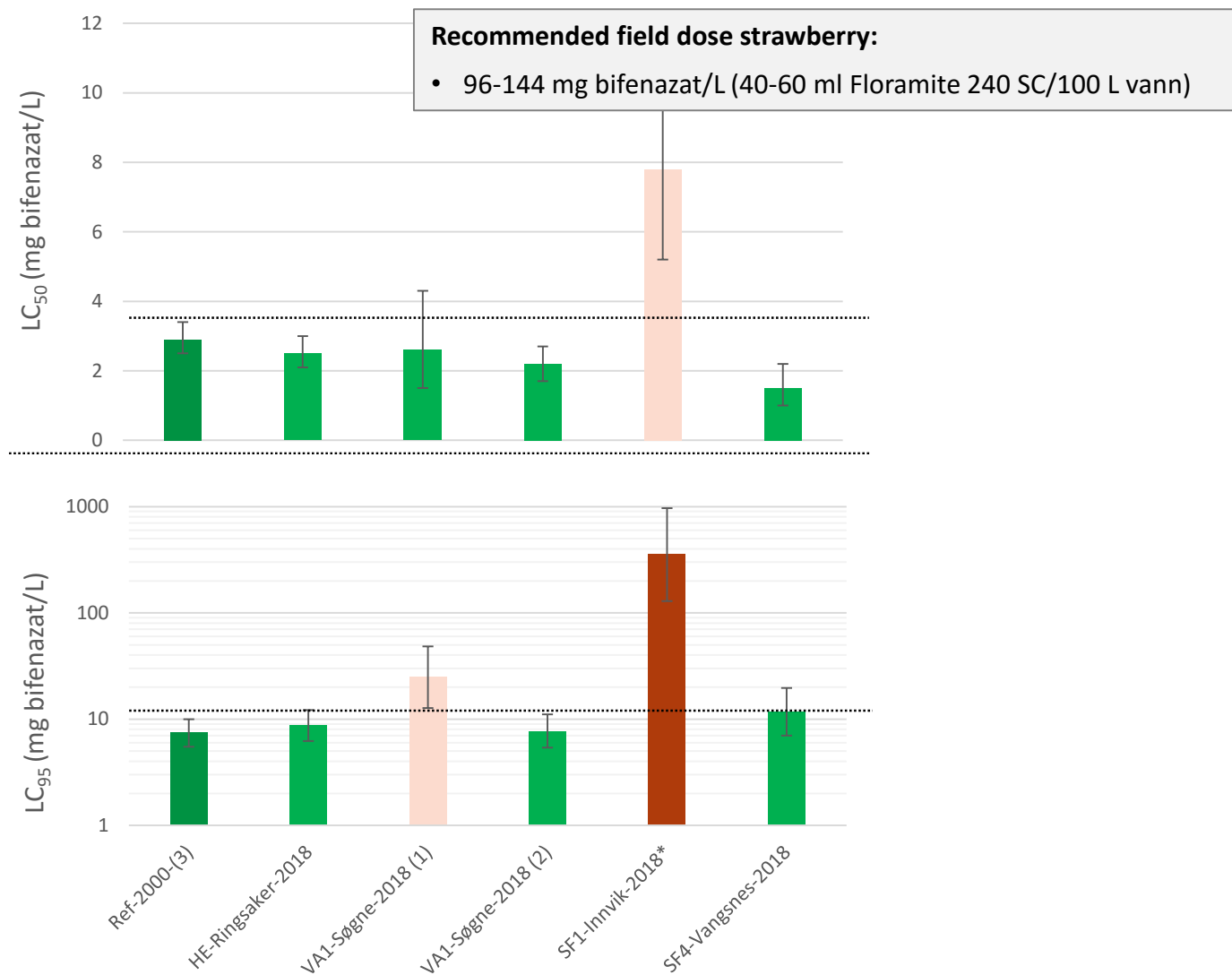
Envidor 240 SC – spirodiclofen (IRAC Moa 23): Offspring mortality, 7 d



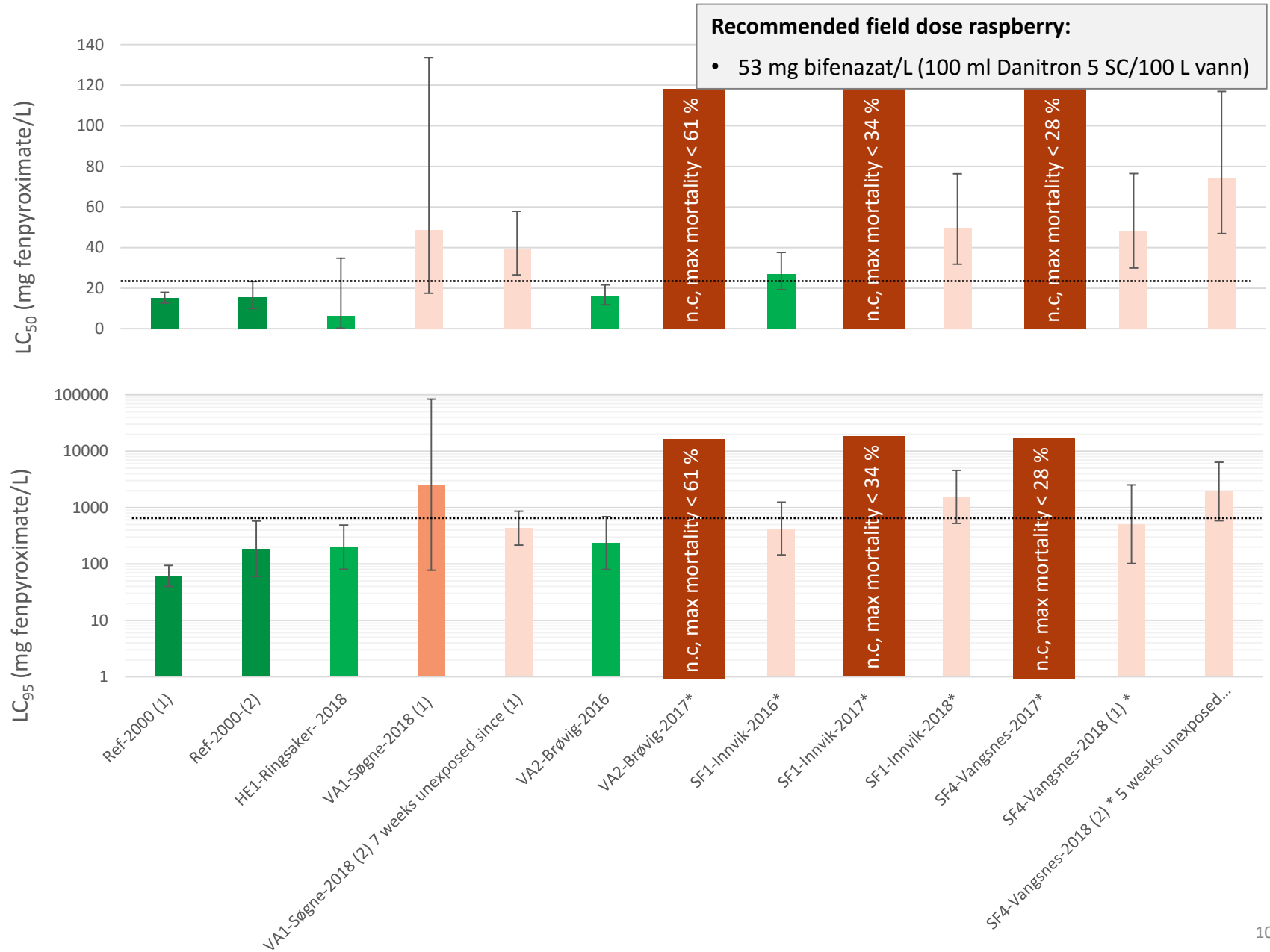
Floramite – bifenazate (IRAC Moa 20D), 2016-2017: Adult mortality, 72 h



Floramite – bifenazate (IRAC Moa 20D), 2018: Adult mortality, 72 h



Danitron – fenpyroximat (IRAC Moa 21A): Adult mortality, 72 h



Spirodiclofen

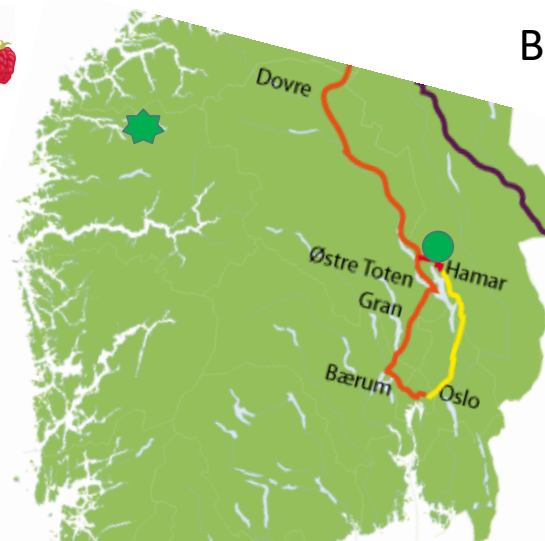
LC₅₀

- RF < 2
- RF 2-10,9
- RF 11-25
- RF > 25

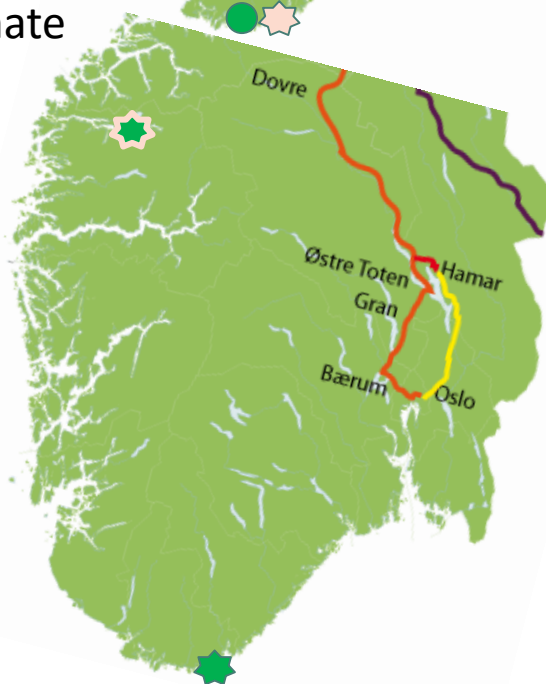


2016

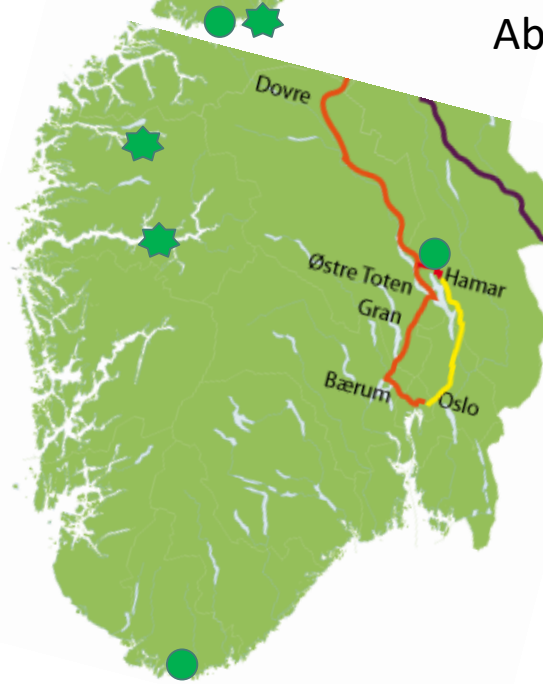
Bifenazate



Fenpyroximate



Abamectin



Spirodiclofen



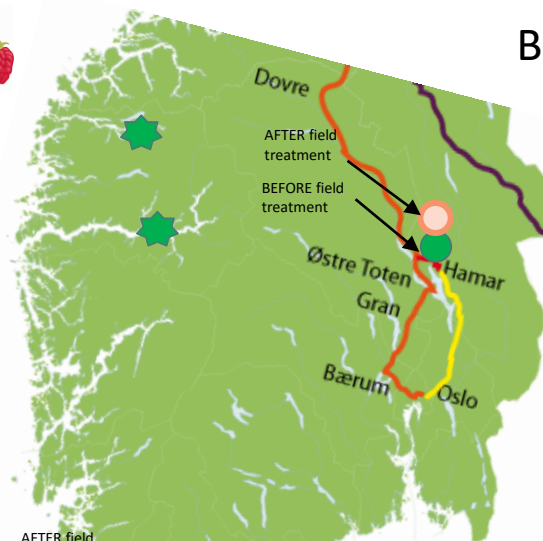
2017

LC₅₀

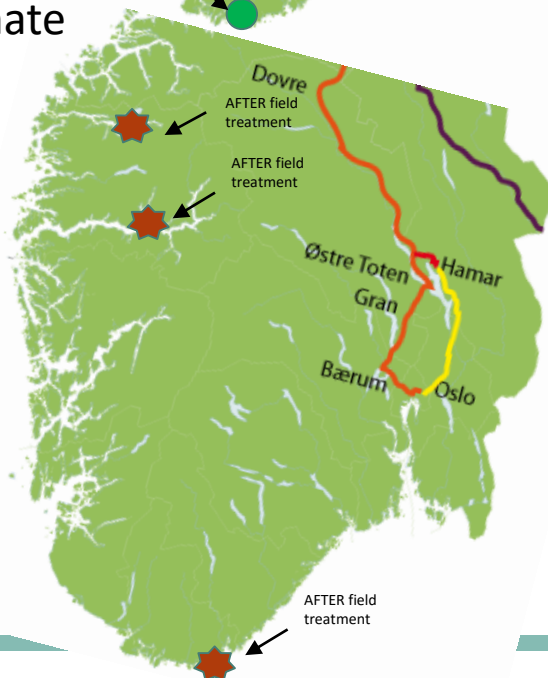
- RF < 2
- RF 2-10,9
- RF 11-25
- RF > 25



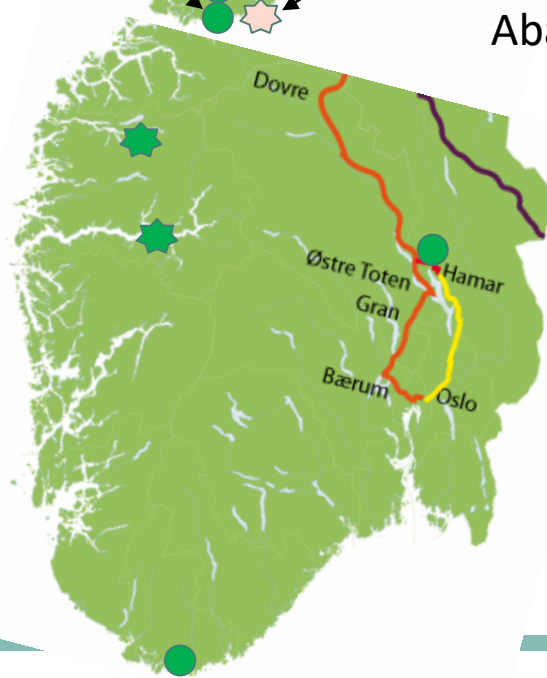
Bifenazate



Fenpyroximate



Abamectin



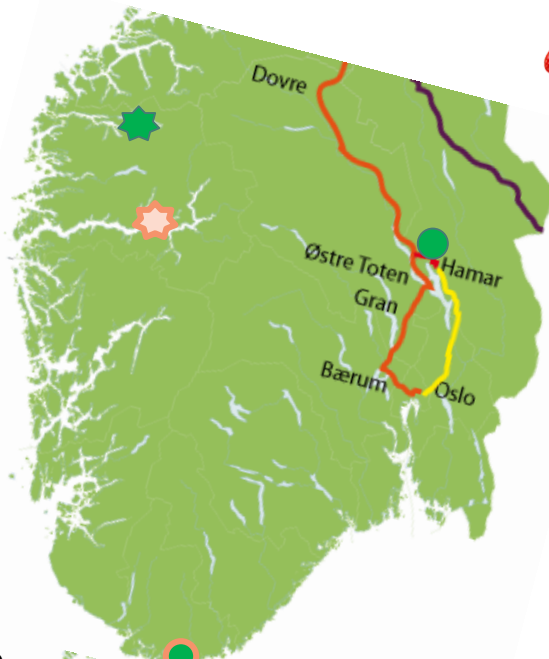
Spirodiclofen



2018

LC₅₀

- RF < 2
- RF 2-10,9
- RF 11-25
- RF > 25



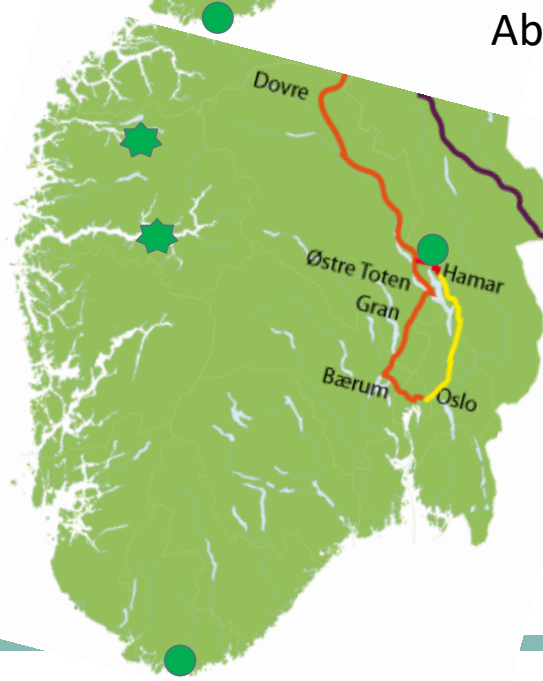
Bifenazate



Fenpyroximate



Abamectin



CONCLUSIONS FROM THE FIVE SITES

- No resistance to abamectin
- Indications on initial resistance development to spiroticlofen, bifentazate and fenpyroximate
- Variance in susceptibility profile between sites and years. Explanation?
- Susceptibility to spiroticlofen and bifentazate lower after than before field treatment: important to rotate between MoAs
- Susceptibility to fenpyroximate reduced in all but 2 cases where fenpyroximate had not been used prior to mite collection
- Susceptibility seem to be restored to a certain degree when not exposed to bifentazate for some weeks in lab., but not to fenpyroximate (not tested with spiroticlofen)
- **High resistance risk**  **Broader resistance survey**
Resistance monitoring
Anti-resistance strategies



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The «spider mite resistance testing team»



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Thank you for your attention!