

ARE NEMATODE TOLERANT SUGAR BEET VARIETIES RESISTANT OR SUSCEPTIBLE TO THE BEET CYST NEMATODE *HETERODERA SCHACHTII*?



MARIE REUTHER^{1, 2, ♦}, CHRISTIAN LANG¹, FLORIAN M.W. GRUNDLER²

¹ Verband der Hessisch-Pfälzischen Zuckerrübenanbauer e.V., Rathenastraße 10, D-67547 Worms
² INRES-Molekulare Phytomedizin, Karlrobert-Kreiten Straße 13, D-53113 Bonn



INTRODUCTION

Heterodera schachtii is an important parasite compromising yield of sugar beet in many sugar beet growing areas of the world. Resistant beet varieties reduce infestation level but do not provide a high yield potential. With the introduction of numerous so-called tolerant sugar beet varieties, farmers have now option to earn high yield in nematode infested fields. However, it is not clear, whether these tolerant varieties are susceptible or resistant to nematodes. Therefore, we performed field trials in 15 locations

during three years investigating the variety specific nematode propagation (using pf/pi value).

Hatching test was induced by “Acetox” and hatched juveniles were extracted in sieve trays (modified Oostenbrink dishes). In this way the initial and final population (pi, pf respectively), calculated as the number of second stage juveniles J2 per 100 g, was determined.

TEST FACILITY

Randomized block design with 4 replicates per sugar beet variety

- ✓ One nematode susceptible variety
- ✓ Five nematode tolerant varieties
- ✓ One nematode resistant variety

4 to 6 nematode infested locations per year

Mechanical soil sampling (Nietfeld, d=2cm) two times per year



Fig. 1: After sowing → pi



Fig. 2: After harvesting → pf

8 soil subsamples per plot and soil depth



- ✓ 0-30cm
- ✓ 30-60cm

Fig. 3: Soil samples per plot

Chemical hatching test via Acetox* and sieve tray extraction of hatched juveniles J2



- ✓ Incubation time 3 days, 25°C
*1-Acetoxy-2-Ethylhexa-1-dien (2% in aceton)
- ✓ Extraction time 3 days, RT

Fig. 4: Water filled sieve tray with 150g of soil

Infestation level in number of juveniles J2 in 100g of soil

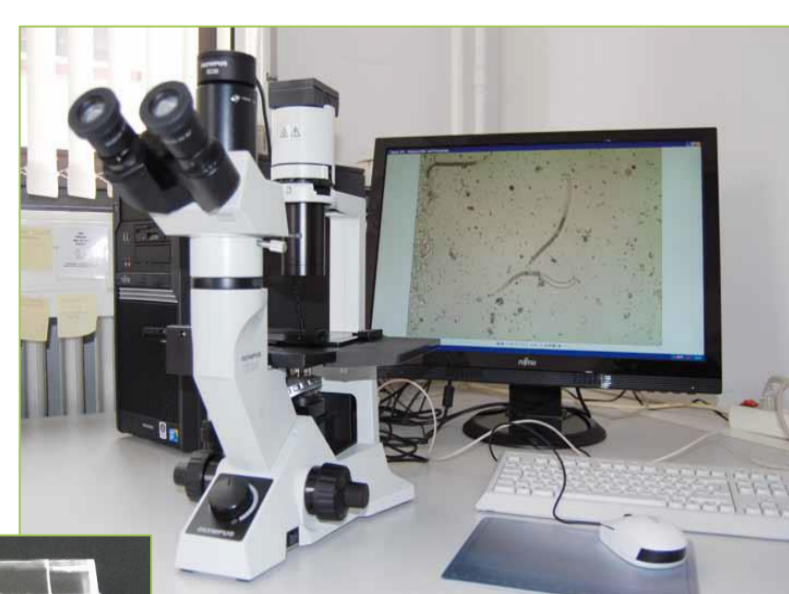


Fig. 5: microscopy

- ✓ collecting of extracted J2s
- ✓ J2s are counted from 3 x 1ml using a counting chamber (Fig. 6) and microscopy (Fig. 5)
- ✓ calculating of variety specific pf/pi values per plot and soil depth

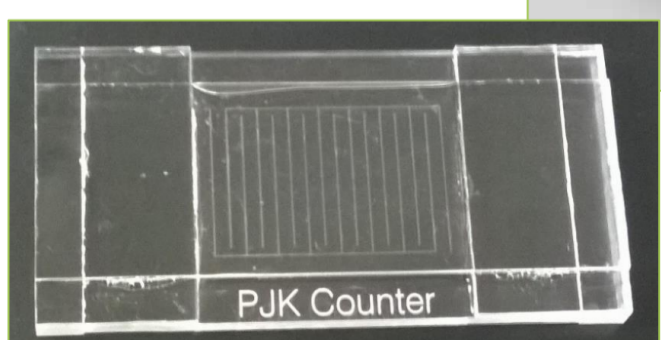


Fig. 6: counting chamber

RESULTS & DISCUSSION

The susceptible reference variety Beretta shows the highest, and that of the resistant reference variety Nemata the lowest during the three years. The tested tolerant varieties show moderate propagation with medium values ranging from 1.21 to 2.00 (in 0-60 cm, see Fig.7).

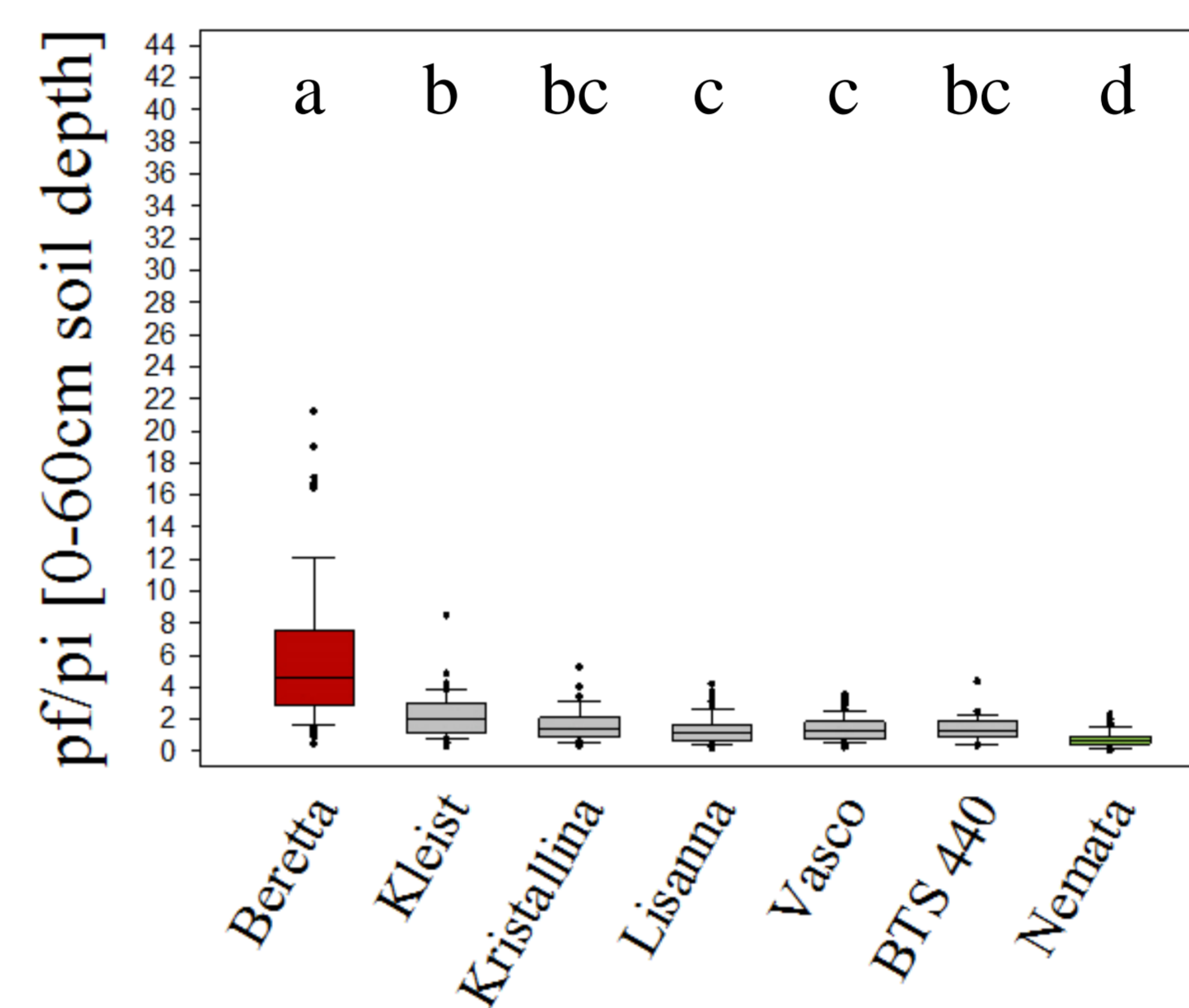


Fig. 7: Median pf/pi values of a resistant reference, a susceptible reference variety and five tolerant varieties of 15 locations in three years of field trials in 0-60cm soil depth.

Different significant letters indicate statistical difference with $P \leq 0,05$; Kruskal-Wallis-ANOVA on Ranks and Dunn's test.

Tolerant sugar beet varieties are not per se resistant or susceptible. Based on the pf/pi values, we propose 4 classes (R1; R2; S1; S2) for the determination of the host response:

highly resistant (R2) or **highly susceptible (S2)**, when not statistically different from resistant or susceptible reference variety, respectively

moderately resistant (R1) or **moderately susceptible (S1)**, when statistically different from resistant or susceptible reference variety, respectively

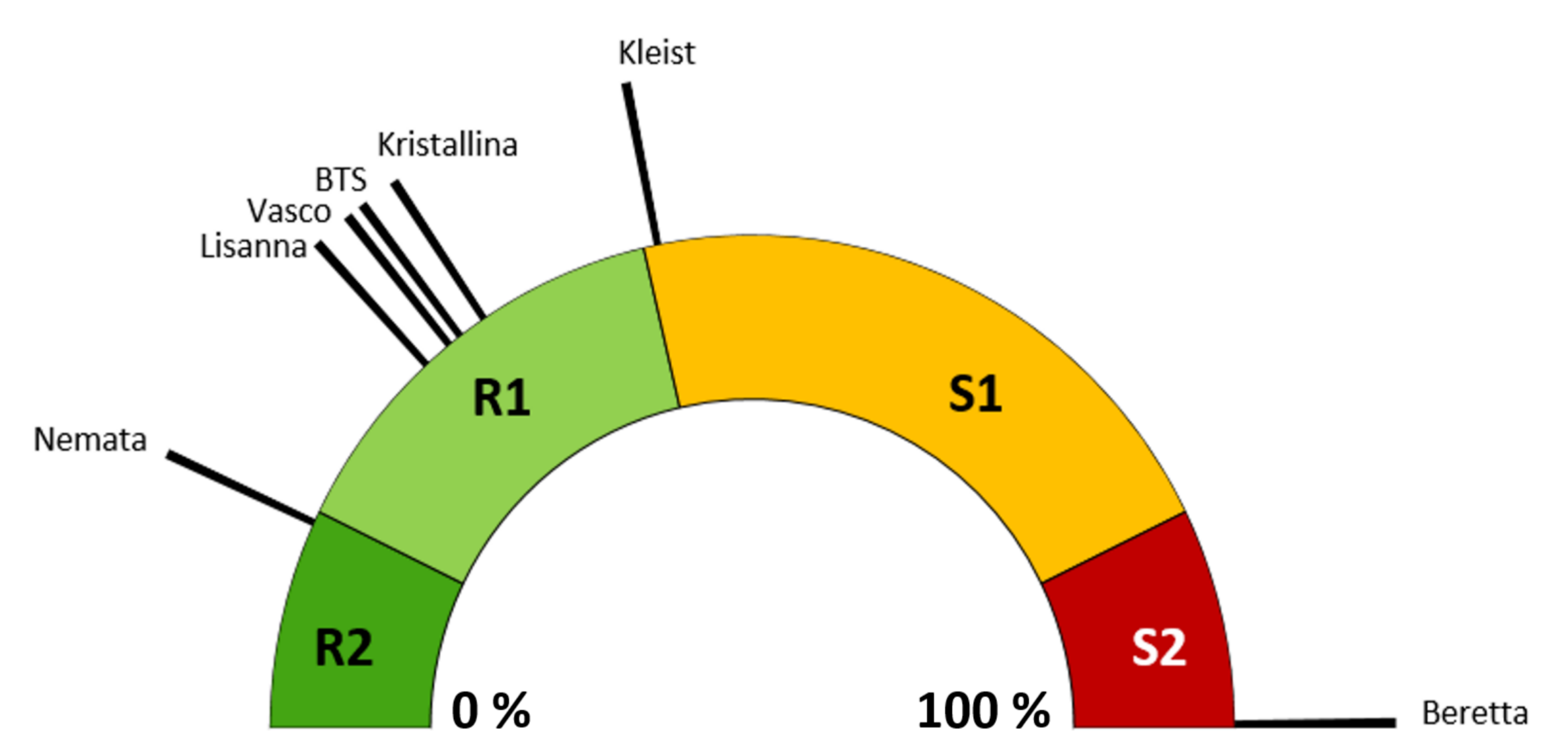


Fig. 3: Nematode propagation in percent of highest susceptibility (Beretta = 100 %). Marked are the medians of pf/pi values of tolerant sugar beet varieties in 0-60 cm soil depth at 15 locations in three years of field trials. Colors indicate host suitability according to the statistical analysis of the different lines (see Fig.7).

The triannual field trials show that tolerant varieties tend to respond moderately resistant rather than susceptible or highly resistant.

TAKE HOME MESSAGE

- Nematode propagation of tolerant varieties is lower than in the susceptible varieties.
- A reduction of initial field infestation can be reached by the tested tolerant varieties.
- A classification of pf/pi value of tolerant varieties is needed: it is important to clarify whether tolerant varieties are increasing or decreasing nematode populations.
- The genetic background of the host response of tolerant varieties is unknown.
- Moderately or highly resistant tolerant varieties can be used for nematode management.
- Tolerant varieties with different levels of resistance should be used to manage nematode populations in the field.
- Integrated management should also include catch crops and biologicals.