

Yitzhak Spiegel , PhD

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Biography

Division of Nematology (Retired 2016)

ARO, Volcani Center

Rishon LeZion

Israel

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Personal

Born 1949; Holon, Israel

Married; three children and five grandchildren

Citizenship: Israeli.

University Education and Additional Training

1973: B.Sc, Chemistry & Biochemistry, Hebrew University of Jerusalem.

1975: Teacher's Diploma, Hebrew University of Jerusalem.

1975: M.Sc, Organic Chemistry, Hebrew University of Jerusalem.

1981: Ph.D, in Plant Protection & Nematology, at the Hebrew University of Jerusalem. Title: "Influence of Plant Nutrition on the Parasitism of Some Phytophagous Nematodes".

Supervision by Prof. Eli Cohn and Prof. Uzi Kafkafi.

1988-9: Sabbatical leave at the University of Arizona, Tucson, AZ, USA, with Professor M. A. McClure. Research topic: “Corynebacterium – Anguina interaction and surface coat of Anguina and Meloidogyne.

2005-6: Sabbatical leave at Scientia Terrae Research Institute, St. Katalijne-Waver, Belgium. Research topic: “Biological control of plant-parasitic nematodes with Trichoderma”.

2012-14: Sabbatical leave at Rockefeller University, New York, NY, USA, with Prof. Shai Shaham. Research topic: “The amphid-sheath glia matrix in *C. elegans*”

Main Research topics

— Biological control of plant-parasitic nematodes (currently, the main topic).

— Control of plant-parasitic nematodes by intervention with the host finding and host-recognition processes.

Professional and Administrative positions & special National Assignments (selected)

1981 – 2019: Senior Research Scientist in Nematology, Agricultural Research Organization (ARO), Volcani Center. (Scientists’ Grade A+, since 1997)

1990-1994: Head, Division of Nematology, Volcani Center, ARO.

1994 – 1998: Director, Plant Protection Institute, Volcani Center, ARO.

1996 – Present: Associate professor, Faculty of Agriculture, The Hebrew University of Jerusalem.

1999 – 2004: Deputy Director for R & D and Academy, Volcani Center, ARO.

2007 – 2011: Head (General Director), Volcani Center, ARO.

1999 – Member of the Minister of Education’ steering committee for nomination of the “1999 Israeli Prize in Life Science and Agriculture”.

2002 – Member of the Minister of Education’ steering committee for nomination of the “2002 Israeli Prize in Agriculture”.

2010 – Member of the Minister of Education’ steering committee for nomination of the “2010 Israeli Prize in Agriculture”.

Teaching experience

1991 – Present: Teaching the course “Host-parasite relations of plant- parasitic nematodes” (2 credits, for graduate students; since 2002 for undergraduate & graduate students), Faculty of Agriculture, The Hebrew University of Jerusalem, Rehovot.

Graduate Students:

Since 1990 – eight Ph.D; nine M.Sc; two Post-docs.

Selected List of Publications (reviewed journals & books)

A. Publications in reviewed journals

1. Roffman, E., Y. Spiegel, and M. Wilcheck. (1980). Ferritin hydrazide, a novel covalent electron dense reagent for the ultrastructural location of glycoconjugates. *Biochem. Biophys. Res. Commun.* 97:1192-98.

2. Wilcheck, M., S. Spiegel and Y. Spiegel. (1980). Fluorescent reagents for the labelling of glycoconjugates in solution and on cell surface. *Biochem. Biophys. Res. Commun.* 94:1215-22.

3. Spiegel, Y. and E. Cohn. (1982). Lectin binding to *Meloidogyne javanica* eggs. *J. Nematol.* 14:406-7.

4. Spiegel, Y., E. Cohn and U. Kafkafi. (1982). The influence of ammonium and nitrate nutrition of tomato plants on parasitism by the root-knot nematode. *Phytoparasitica* 10: 33-40.

5. Spiegel, Y., E. Cohn and Sarah Spiegel. (1982). Characterization of sialyl and galactosyl residues on the body wall of different plant parasitic nematodes. *J. Nematol.* 14: 33-49.
6. Spiegel, Y., E. Cohn, U. Kafkafi and Meira Sulami. (1982). The influence of potassium and nitrogen fertilization on parasitism by the root-knot nematode *Meloidogyne javanica*. *J. Nematol.* 14: 530-35.
7. Spiegel, Y., W. M. Robertson, S. Himmelhoch and B. M. Zuckerman. (1983). Electron microscope characterization of carbohydrate residues on the body wall of *Xiphinema index*. *J. Nematol.* 15: 528-534.
8. Spiegel, Y. and D. Netzer. (1984). Effect of nitrogen form at various levels of potassium, on the *Meloidogyne – Fusarium* wilt complex in muskmelon. *Pl. Soil* 81: 85-92.
- 9 Spiegel, Y. and E. Cohn. (1985). Chitin is present on gelatinous matrix of *Meloidogyne*. *Revue Nematol.* 8:184-186.
10. Spiegel, Y. and I. Chet. (1985). Chitin synthetase inhibitors and their potential to control the root-knot nematode, *Meloidogyne javanica*. *Nematologica* 31: 480-482.
11. Spiegel, Y., E. Cohn and I. Chet. (1986). Use of chitin for controlling plant parasitic nematodes. I. Direct effects on nematode reproduction and plant performance. *Pl. Soil* 95: 87-95.
12. Spiegel, Y., D. Netzer and U. Kafkafi. (1987). The role of calcium nutrition on *Fusarium*-wilt syndrome in muskmelon. *Phytopathol. Zeitschrift* 118: 220-226.
13. Spiegel, Y., I. Chet and E. Cohn. (1987). Use of chitin for controlling plant parasitic nematodes. II. Mode of action. *Pl. Soil* 98: 337-345.
14. Spiegel, Y., I. Chet, E. Cohn, S. Galper and E. Sharon. (1988). Use of chitin for controlling plant – parasitic nematodes. III. Influence of temperature on nematicidal effect, mineralization and microbial population buildup. *Pl. Soil* 109: 251-256.
15. Spiegel, Y., U. Kafkafi and E. Pressman. (1988). Evaluation of a protein-chitin derivative of crustacean shells as a slow-release nitrogen fertilizer on Chinese cabbage. *J. Horticult. Sci.* 63: 621-627.
16. Spiegel, Y. and W. M. Robertson. (1988). Wheat germ agglutinin binding to the outer cuticle of the plant – parasitic nematode *Anguina tritici*. *J. Nematol.* 20: 499-501.
17. Forrest, J. M. S., Y. Spiegel and W. M. Robertson. (1988). A possible role for the amphids of potato cyst nematode *Globodera rostochiensis* in host finding. *Nematologica* 34: 173-181.
18. Spiegel, Y., E. Cohn and I. Chet. (1989). Use of chitin for controlling *Heterodera avenae* and *Tylenchulus semipenetrans*. *J. Nematol.* 21: 419-22.
19. Robertson, W. M., Y. Spiegel, H.-B. Jansson, N. Marban- Mendosa and B. M. Zuckerman. (1989). Surface carbohydrates of plant parasitic nematodes. *Nematologica* 35: 180-86.
20. Galper S, E. Cohn, Y. Spiegel and I. Chet. (1989). Nematicidal effect of collagen-amended soil and the influence of protease and collagenase. *Revue Nematol.* 13: 67-71.
21. Spiegel, Y., and M. A. McClure. (1991). Stage-specific differences in lectin binding to the surface of *Anguina tritici* and *Meloidogyne incognita*. *J. Nematol.* 23: 259-263.
22. Galper, S, E. Cohn, Y. Spiegel and I. Chet. (1991). A collagenolytic fungus, *Cunninghamella elegans*, for biological control of plant-parasitic nematodes. *J. Nematol.* 23: 269-274.
23. Spiegel, Y., E. Cohn, S. Galper, E. Sharon and I. Chet. (1991). Evaluation of a newly isolated bacterium, *Pseudomonas chitinolytica* sp. nov. for controlling the root-knot nematode, *Meloidogyne javanica*. *Biocon. Sci. Technol.* 1: 115-125.

24. Spiegel, Y., M. A. McClure, I. Kahane, W.M. Robertson, and R. Salomon. (1991). Wheat germ agglutinin associated with the outer cuticle of the seed-gall nematodes, *Anguina agrostis* and *A. tritici*. *J. Nematol.* 23: 451-456.
25. McClure, M. A. and Y. Spiegel. (1991). Role of the nematode surface coat in the adhesion of *Clavibacter* sp. to *Anguina funesta* and *Anguina tritici*. *Parasitology* 103: 421-427.
26. Sharon, E, D. Orion and Y. Spiegel. (1993). Binding of soil microorganisms and red blood cells by the gelatinous matrix and eggs of *Meloidogyne javanica* and *Rotylenchulus reniformis*. *Fundamen. Appl. Nematol.* 16: 5-9.
27. Bowman, J. P., L. I. Sly, Hayward, A. C., Y. Spiegel, and E. Stackebrandt. (1993). *Telluria mixta* (*Pseudomonas mixta* Bowman, Sly, and Hayward 1988) gen. nov., comb. nov., and *Telluria chitinolytica* sp. nov., soil-dwelling organisms which actively degrade polysaccharides. *Inter. J. Sys. Bacteriol.* 43: 120-124.
28. Oka, Y, I. Chet and Y. Spiegel. (1993). Control of the root-knot nematode *Meloidogyne javanica* by *Bacillus cereus*. *Biocon. Sci. Technol.* 3: 115-126.
29. Sharon, E and Y. Spiegel. (1993). Glycoprotein characterization of the gelatinous matrix in the root-knot nematode *Meloidogyne javanica*. *J. Nematol.* 25: 584-588.
30. Clemens, C. D., J. Aumann, Y. Spiegel and U. Wyss. (1994). Attracted-mediated behavior of mobile stages of *Heterodera schachtii*. *Fundamen. Appl. Nematol.* 17: 569-574.
31. Spiegel, Y., J. Inbar, I. Kahane and E. Sharon. (1995). Carbohydrate-recognition domains on the surface of phytophagous nematodes. *Exp. Parasitol.* 80: 220-227.
32. Sharon, E and Y. Spiegel. (1996). Gold-conjugated reagents for the labelling of carbohydrate-recognition domains and glycoconjugates on nematode surfaces. *J. Nematol.* 28: 124-127.
33. Blaxter, M. L., Y. Spiegel and H. Koltai. (1997). Regulated use of a spliced leader exon in the plant- parasitic nematode *Meloidogyne javanica*. *Mol. Biochem. Parasitol.* 86: 107-110.
34. Koltai, H. N. Chejanovski, B. Raccha and Y. Spiegel. (1997). The first isolated collagen gene of the root-knot nematode *Meloidogyne javanica* is developmentally regulated. *Gene* 196: 191-199.
35. Oka, Y, I. Chet and Y. Spiegel. (1997). Are Pathogenesis- Related proteins induced by *Meloidogyne javanica* or *Heterodera avenae* invasion? *J. Nematol.* 29: 501-508.
36. Spiegel, Y., I. Kahane, L. Cohen and E. Sharon. (1997). *Meloidogyne javanica* surface proteins: Characterization and lability. *Parasitology* 115: 513-519.
37. Oka, Y, I. Chet, M, Mor and Y. Spiegel. (1997). A fungal parasite of *Meloidogyne javanica* eggs: valuation of its use to control the root-knot nematode. *Biocon. Sci. Technol.* 7: 489-497.
38. Oka, Y., I. Chet and Y. Spiegel. (1997). An immunoreactive protein to wheat-germ agglutinin antibody is induced in oat roots following invasion of the cereal cyst nematode *Heterodera avenae* and by jasmonate. *Mol. Pl.-Microbe Inter.* 10: 961-969.
39. Oka, Y, I. Chet and Y. Spiegel (1997). Accumulation of lectins in cereal roots invaded by the cereal cyst nematode *Heterodera avenae*. *Physiol. Mol. Pl. Pathol.* 51: 333-345.
40. Sela, S., H. Schickler, I. Chet and Y. Spiegel (1998). Purification and characterization of a *Bacillus cereus* collagenolytic/proteolytic enzyme and its effect on *Meloidogyne javanica* cuticular proteins. *Eur. J. Pl. Pathol.* 104: 59-67.
41. Oka, Y., Y. Cohen and Y. Spiegel (1999). Local and systemic induced resistance to the root-knot nematode in tomato by DL- β - Amino-n-butyric acid. *Phytopathology* 89:1138-1143.

42. Ferris, V. R., S. A. Subbotin, A. Ireholm, Y. Spiegel, J. Faghihi and J. M. Ferris (1999). Ribosomal DNA sequence analysis of *Heterodera filipjevi* and *H. latipons* isolates from Russia and comparisons with other nematode isolates. *Russian J. Nematol* 7:121-125.
43. Oka, Y., S. Nacar, E. Putievsky, U. Ravid, Z. Yaniv and Y. Spiegel (2000). Nematicidal activity of essential oils and their components against the root-knot nematode. *Phytopathology* 90:710-715.
44. Sharon, E., M. Bar-Eyal, I. Chet, A. Herrera-Estrella, O. Kleifeld and Y. Spiegel. (2001). Biocontrol of the root-knot nematode *Meloidogyne javanica* by *Trichoderma harzianum*. *Phytopathology*, 91: 687-693.
45. Liu, J., H. Koltai, N. Chejanovski and Y. Spiegel. (2001). Isolation of a novel collagen gene in *Meloidogyne javanica* and studies on its expression pattern. *J. Parasitol.*, 87: 801-807.
46. Sharon, E., Y. Spiegel, R. Solomon and R. H. C. Curtis. (2002). Characterization of *Meloidogyne javanica* surface coat using antibodies and their effect on nematode behavior. *Parasitology* 125:177-186.
47. Spiegel, Y., P. M. Burrows and M. Bar-Eyal. (2003). A chemo attractant in onion root exudates recognized by *Ditylenchus dipsaci* in laboratory bioassay. *Phytopathology* 93: 127-132.
48. Tadmor, Z., S. Sachs, I. Chet, Y. Spiegel, I. Ravina, G. Manor and S. Yannai . (2005). An innovative approach: The use of di-nitrogen tetroxide for soil fumigation. *Biosystems Engineering* 91: 413-419.
49. Bar-Eyal, M, E. Sharon and Y. Spiegel. (2006). Nematicidal activity of *Chrysanthemum coronarium* L. *Eur. J. Pl. Pathol.* 114: 427-433.
50. Sharon, E. I. Chet, A. Viterbo, M. Bar-Eyal, H. Nagan, G. J. Samuels and Y. Spiegel. (2007). Parasitism of *Trichoderma* on *Meloidogyne javanica* and role of the gelatinous matrix. *Eur. J. Pl. Pathol.* 118:247-258.
51. Mor, M., Y. Spiegel and Y. Oka. (2008). Histological study of syncytia induced in cereals by the Mediterranean cereal cyst nematode, *Heterodera latipons*. *Nematology* 10:279-287.
52. Mahgodia, A. K. , Y. Spiegel and S. Sela. (2008). Interactions between *Escherichia coli* and the plant- parasitic nematode, *Meloidogyne javanica*. *J. Appl. Microbiol.* 105:1810-1816.
- 53 Bar-Eyal, M., E. Sharon, Y. Spiegel and Y. Oka. (2008). Laboratory studies on the biocontrol potential of the predatory nematode *Koerneria sudhausi* (Nematoda: Diplogastridae). *Nematology* 10: 633-637.
54. Sharon, E., I. Chet and Y. Spiegel (2009). Improved attachment and parasitism of *Trichoderma* on *Meloidogyne javanica* in vitro. *Eur. J. Pl. Pathol.* 123:291-299.
55. Iberkleid, I., P. Vieira, J. de Almeida Engler, K. Firester, Y. Spiegel and S. Horowitz-Brown (2013). Fatty acid-and retinol-binding protein, Mj-FAR-1, induces tomato host susceptibility to root-knot Nematodes. *PlosOne* 8: e64586
56. Kroupitski, Y., R. Pinto, P. Bucki, E. Belausov, L. Ruess, Y. Spiegel and S. Sela (Saldinger). (2015). *Acroboloides buetschlii* as a potential vector for enteric pathogens. *Nematology*, 17:447- 457.
57. Aroch, I., I. Arogeti, A. Marcovics, Y. Spiegel, and E. Lavy. (2017). In vitro lectin binding to the outer surface of *Spirocerca lupi* at different life-stages. *Veterinary Parasitology* 235:

94–99.

B: Invited reviews and book chapters

58. Spiegel, Y., E. Cohn and I. Chet. (1990). Recent advances in biological control of plant parasitic nematodes. *Agricultural Research in Israel*, vol. 3, No. 1. (in Hebrew with summary in English).
59. Spiegel, Y. and E. Cohn. (1990). Evaluation of chitin and various protein sources to control root-knot nematode. Exercise 35, In: "Plant Nematology Laboratory Manual" pp. 234-237. Revised Edition. B.M. Zuckerman, W.F. Mai and L.R. Krusberg, eds. Published by Agricultural Experiment Station, University of Massachusetts at Amherst, Amherst, MA, U.S.A.
60. Cohn, E. and Y. Spiegel. (1991). Root-nematode interactions. In: "Plant Roots: The Hidden Half" (Waisel et al., eds.), pp. 789-805. Marcel Dekker Inc. New York, N.Y.
61. Spiegel, Y. and M. A. McClure. (1995). The surface coat of plant-parasitic nematodes: chemical composition, origin and biological role – a review. *J. Nematol.* 27: 127-134.
62. Cohn, E., H. Koltai, E. Sharon, and Y. Spiegel. (1996). Root- nematode interactions: recognition and pathogenicity. In: "Plant Roots: The Hidden Half" (Waisel et al., eds.), 2nd Edition. Chapter 39, pp. 783-796. Marcel Dekker Inc., New York, N. Y.
63. Spiegel, Y. and E. Sharon. (1997). Control of plant parasitic nematodes in organic farms. *Israel Agresearch*, Vol. 7, No. 1 (in Hebrew with summary in English).
64. Spiegel, Y. and I. Chet. (1998). Evaluation of *Trichoderma* spp. as a biocontrol agent against soil borne fungi and plant-parasitic nematodes in Israel. *Integ. Pest Manag. Rev.* 3: 1-7.
65. Oka, Y., H. Koltai, M. Bar-Eyal, M. Mor,, E. Sharon,, I. Chet and Y. Spiegel. (2000). New strategies for the control of plant-parasitic nematodes. *Pest Management Science.* 56:983- 988.
66. Oka, Y., I. Chet, H. Koltai, M. Bar-Eyal, M. Mor, E. Sharon and Y. Spiegel. (2000). Chemical and non-chemical control of phytophagous nematodes: new perspectives. *Acta Horticulturae* 532: 177-182.
67. Koltai, H., E. Sharon and Y. Spiegel (2002). Root- nematode interactions: recognition and pathogenicity. In: "Plant Roots: The Hidden Half" (Waisel et al., eds.), 3rd Edition. Chapter 51, pp. 933-948. Marcel Dekker Inc., New York, N. Y.
68. Spiegel, Y. (2005). A Book Review: *Nematology: Advances and Perspectives. Volume II: Nematode Management and Utilization.* Edited by Z.X. Chen, S.Y. Chen, and D.W. Dickson. 2004. 608 pp. CABI Publishing, U.K. *Eur. J. Pl. Pathol.* 113: 221-222.
69. Spiegel, Y. (2005). A Book Review: *Plant Parasitic Nematodes in Subtropical and Tropical Agriculture. Second Edition.* Edited by M. Luc, R.A. Sikora and J. Bridge. 2005. 871 pp. CABI Publishing, UK. *Eur. J. Pl. Pathol.* 113: 439-439.
70. Curtis R., Davies K., Jones J., Sharon E. and Spiegel Y. (2011). Plant nematode surfaces. In: K. Davies and Y. Spiegel, (eds). *Biological Control of Plant Parasitic Nematodes: Building Coherence between Microbial Ecology and Molecular Mechanisms*, Chapter 5, Springer, The Netherlands
71. Sharon, E., I Chet and Y Spiegel (2011). *Trichoderma* as a biological control agent. In: K. Davies and Y. Spiegel, (eds). *Biological Control of Plant Parasitic Nematodes: Building Coherence between Microbial Ecology and Molecular Mechanisms*, Chapter 8, Springer, The Netherlands

72. Davies, K. and Y. Spiegel (2011). Root Patho-Systems Nematology and Biological Control. In: K. Davies and Y. Spiegel, (eds). Biological Control of Plant Parasitic Nematodes: Building Coherence between Microbial Ecology and Molecular Mechanisms, Chapter 12, Springer, The Netherlands
73. Davies, K. and Y. Spiegel (eds) (2011). Biological Control of Plant Parasitic Nematodes: Building Coherence between Microbial Ecology and Molecular Mechanisms. Springer, ISBN 978-1-4020-9647-1, The Netherlands.
74. Davies K.G., and Y. Spiegel. (2011). Biological control of plant- parasitic nematodes: towards understanding field variation through molecular mechanisms. In: Jones J, Gheysen G, Fenoll C (eds). Exploiting Genomics to Understand Plant-Nematode Interactions. Springer
75. Spiegel, Y., O. Oren and R-U. Ehlers. (2021). Critical terms during development and commercialization of microbial agents for the control of plant parasitic nematodes. In: Integrated Nematode Management: State-of-the-art and visions. Chapter 62. (eds. R.A. Sikora et al) DOI: 10.1079/9781789247541.0062. CAB International. Pp. 446-453.
76. שפיגל, י. שפיגל, י. אוקה, פ. בוקי, ס. בראון-מיארה. א. גלזר, ע. כהן. עורך: יצחק" 2025). מטודות בחקלאות" (2025). שפיגל. 200 עמודים. פרסום מקוון באתרי האינטרנט של מנהל המחקר החקלאי
- C. Patents

Spiegel, I., I. Chet and E. Cohn. (1988). Method and composition for combating soil nematodes comprising chitinolytic bacteria and novel pure cultures of certain such bacteria. Israel Patent Pending 087388.090260

Spiegel, I., I. Chet, E. Cohn and S. Galper. (1989). Nematicidal microorganisms, their isolation and their use as bionematicides. European Patent Pending 89114460.2

Spiegel, I., I. Chet, E. Cohn and S. Galper. (1992). Nematicidal strain of Pseudomonas and its use as a biocontrol agent. U.S. Patent Pending 5,089,263

Oka, Y. , Spiegel Y. and Cohen Y. (2001). Methods and compositions to protect crops against plant-parasitic nematodes. Patent number: 6201023

Brown S., Oren O., Spiegel Y., Mazar Y., Glanz E. and Ehlers R.-U. (2024). Composition of predatory nematodes and methods of using them. Publication number: 20240008494