References

1. Kaya HK, Gaugler R (1993) Entomopathogenic nematodes. Annu Rev Entomol 38:181–206
2. Cranshaw WS, Zimmerman R (2013) Insect parasitic nematodes. Fact sheet no. 5.573. Colorado State University extension
3. Poinar GO (1983) The natural history of nematodes. Prentice-Hall, Englewood Cliffs, NJ, 323 pp
4. Poinar GO Jr (1993) Origins and phylogenetic relationships of the entomophilic rhabditids, *Heterorhabditis* and *Steinernema*. Fundam Appl Nematol 16:333–338
5. Adams BJ, Burnell AM, Powers TO (1998) A phylogenetic analysis of *Heterorhabditis* (Nemata: Rhabditidae) based on internal transcribed spacer 1 DNA sequence data. J Nematol 30(1):22–39
6. Blaxter ML, De Ley P, Garey JR, Liu LX, Scheldeman P, Vierstraete A, Vanfleteren JR, Mackey LY, Dorris M, Frisse LM (1998) A molecular evolutionary framework for the phylum Nematoda. Nature 392:71–75
7. Liu J, Berry R, Poinar G, Moldenke A (1997) Phylogeny of Photorhabdus and Xenorhabdus species and strains as determined by comparison of partial 16S rRNA gene sequences. Int J Syst Bacteriol 47(4):948–951
8. Sudhaus W (1993) Redescription of *Rhabditis (Oscheius) tipulae* (Nematoda: Rhabditidae) associated with leatherjackets, larvae of *Tipula paludosa* (Diptera: Tipulidae). Nematologica 39:234–239
9. Poinar GO, Grewal PS (2012) History of entomopathogenic nematology. J Nematol 44(2):153–161
10. Koppenhöfer HS (2007) Bacterial symbionts of *Steinernema* and Heterorhabditis. In: Nguyen KB, Hunt DJ (eds) Entomopathogenic nematodes: systematics, phylogeny and bacterial symbionts. Brill NV, Leiden
11. Stock SP (2015) Diversity, biology and evolutionary relationships. In: Campos-Herrera R (ed) Nematode pathogenesis of insects and other pests: ecology and applied technologies for sustainable plant and crop protection. Springer International Publishing, Neuchâtel, Switzerland, pp 3–27
12. Tailliez P, Laroui C, Ginibre N, Paule A, Pages S, Boemare N (2010) Phylogeny of Photorhabdus and Xenorhabdus based on universally conserved protein-coding sequences and implications for the taxonomy of these two genera. Proposal of new taxa. *X. vietnamensis* sp. nov., *P. luminescens* subsp. *caribbeanensis* subsp. nov., *P. luminescens* subsp. *hainanensis* subsp. nov., *P. temperata* subsp. *khanii* subsp. nov., *P. temperata* subsp. *tasmaniensis* subsp. nov., and the reclassification of *P. luminescens* subsp. *thracensis* as *P. temperata* subsp. thracensis comb. nov. Int J Syst Evol Microbiol 60 (8):1921–1937
13. Sajnaga E, Kazimierczak W (2020) Evolution and taxonomy of nematode-associated entomopathogenic bacteria of the genera *Xenorhabdus* and *Photorhabdus*: an overview. Symbiosis 80:1–13
14. Glaser RW, Fox H (1930) A nematode parasite of the Japanese beetle (*Popillia japonica* Newm.). Science 71:16–17
15. Weiser J (1955) *Neoaplectana carpocapsae* n. sp. (Anguillata, Steinernematidae) novy

S. Sivaramakrishnan and M. Razia, *Entomopathogenic Nematodes and Their Symbiotic Bacteria*, Springer Protocols Handbooks, https://doi.org/10.1007/978-1-0716-1445-7,

cizopasnik housenek obalece jablecneho, *Carpocapsae pomonella* L. Vestnik Ceskoslovenske Spolecnosti Zoologicke 19:44–52

16. Dutky SR, Hough WS (1955) Note on a parasitic nematode from codling moth larvae, *Carpocapsae pomonella*. Proc. Entomol. Soc. Wash. 57:244
17. Poinar GO Jr, Thomas GM (1967) The nature of Achromobacter nematophilus as an insect pathogen. J Invertebr Pathol 9 (4):510–514
18. Pereira C (1937) Rhabditis hambletoni n.sp. nema apparentemente semiparasito da "broca do algodoeiro" (*Gasterocercodes brasiliensis*). Arch Inst Biol 8:215–230
19. Poinar GO Jr (2011) The evolutionary history of nematodes. Brill, Leiden. 439p
20. Akhurst RJ, Boemare NE (1990) Biology and taxonomy of *Xenorhabdus*. In: Gaugler R, Kaya HK (eds) Entomopathogenic nematodes in biological control. CRC Press, Boca Raton, FL, pp 75–90
21. Boemare NE (2002) Biology, taxonomy and systematics of *Photorhabdus* and *Xenorhabdus*. In: Gaugler R (ed) Entomopathogenic nematology. CABI Publishing, Wallingford, UK, pp 35–56
22. Hunt DJ, Subbotin SA (2016) Taxonomy and systematics. In: Hunt DJ, Nguyen KB (eds) Advances in entomopathogenic nematode taxonomy and phylogeny, Nematology monographs and perspectives, vol 12. Brill, The Netherlands, pp 13–58
23. Dutky SR (1959) Insect microbiology. Adv Appl Microbiol 1:175–200
24. Bhat AH, Chaubey AK, Askary TH (2020) Global distribution of entomopathogenic nematodes, *Steinernema* and *Heterorhabditis*. Egypt J Biol Pest Control 30:31
25. Steiner G (1923) *Aplectana kraussei* n. sp., einer in der Blattwespe *Lyda* sp. parasitierende Nematodenform, nebst Bemerkungen über das Seitenorgan der parasitischen nematoden. Zbl Bakt II Natur 2(59):14–18
26. Mráček Z, Hernandez EA, Boemare NE (1994) *Steinernema cubana* sp. n. (Nematoda: Rhabditida: Steinernematidae) and the preliminary characterisation of its associated bacterium. J Invertebr Pathol 64:123–129
27. Mráček Z (1977) *Steinernema kraussei*, a parasite of the body cavity of the sawfly, *Cephaleia abietis*, in Czechoslovakia. J Invertebr Pathol 30(1):87–94
28. Steiner WA (1994) The influence of air pollution on moss-dwelling animals: methodology and composition of flora and fauna. Rev Swis Zool 101:533–556
29. Hominick WM, Reid AP, Briscoe BR (1995) Prevalence and habitat specificity of *steinernematid and heterorhabditid* nematodes isolated during soil surveys of the UK and the Netherlands. J Helminthol 69(1):27–32
30. Del Pino FG, Palomo A (1996) Natural occurrence of entomopathogenic nematodes (Rhabditida: Steinernematidae and Heterorhabditidae) in Spanish soils. J Invertebr Pathol 68(1):84–90
31. Stock SP, Pryor BM, Kaya HK (1999) Distribution of entomopathogenic nematodes (Steinernematidae and Heterorhabditidae) in natural habitats in California, USA. Biodivers Conserv 8:535–549
32. Filipjev IN (1934) Miscellanea Nematologica 1. Eine neue Art der Gattung Neoaplectana Steiner nebst Bermerkungen über die systematische Stellung der letzteren. Parazitologich 4:229–240
33. Wouts W, Mracek Z, Gerdin S, Bedding RA (1982) *Neoaplectana* Steiner, 1929 a junior synonym of *Steinernema* Travassos, 1927 (Nematoda: Rhabditida). Syst Parasitol 4:147–154
34. Bovien P (1937) Some types of association between nematodes and insects, vol 101. Videnskabelige Meddelelser fra Dansk Naturhistorisk Forening, København, pp 1–114
35. Poinar GO Jr (1985) Neoaplectana intermedia n. sp. (Steinernematidae: Nematoda) from South Carolina. Rev Nematol 8:321–327
36. Mamiya Y (1988) *Steinernema kushidai* n. sp. (Nematoda: Steinernematidae) associated with scarabaeid beetle larvae from Shizuoka, Japan. Appl Entomol Zool 23:313–320
37. Shen CP, Wang GH. (1992). Description of an entomopathogenic nematode, *Steinernema longicaudum* sp. nov. and its application. In Proceedings of the XIX international congress of entomology, Beijing, China, pp 220–231
38. Katumanyane A, Malan AP, Tiedt LR, Hurley BP (2020) *Steinernema bertusi* n. sp. (Rhabditida: Steinernematidae), a new entomopathogenic nematode from South Africa. Nematology 22(3):343–360. https://doi.org/10.1163/15685411-00003309
39. Poinar GO Jr (1976) Description and biology of a new insect parasitic rhabitoid, *Heterorhabditis bacteriophora* n. gen. n. sp. (Rhabditida; Heterorhabditidae n. family). Nematologica 21:463–470
40. Poinar GO (1990) Taxonomy and biology of Steinernematidae and Heterorhabditidae. In: Gaugler R, Kaya HK (eds) Entomopathogenic nematodes in biological control. CRC Press, Boca Raton, FL, pp 23–61

41. Poinar GO Jr, Karunakar GK, David H (1992) *Heterorhabditis indicus* n. sp. (Rhabditida, Nematoda) from India: separation of *Heterorhabditis* spp. by infective juveniles. Fund Appl Nematol 15:467–472
42. Liu J, Berry RE (1996) *Steinernema oregonensis* n. sp. (Rhabditida: Steinernematidae) from Oregon, USA. Fundam Appl Nematol 19 (4):375–380
43. Stock SP, Choo HY, Kaya HK (1997) An entomopathogenic nematode Steinernema monitocolum sp. n. (Rhabditida: Steinernematidae) from Korea with a key to other species. Nematologica 43:15–29
44. Malan AP, Knoetze R, Louwrens T (2014) *Heterorhabditis noenieputensis* n. sp. (Rhabditida: *Heterorhabditidae*), a new entomopathogenic nematode from South Africa. J Helminthol 88:139–151
45. Boag B, Neilson R, Gordon SC (1992) Distribution and prevalence of the entomopathogenic nematode Steinernema feltiae in Scotland. Ann Appl Biol 121:355–360
46. Mracek Z, Becvar S, Kindlann P (1999) Survey of entomopathogenic nematodes from the families Steinernematidae and Heterorhabditidae (Nematoda: Rhabditida) in the Czech Republic. Folia Parasitol 46:145–148
47. Stock SP, Mrácek Z, Webster J (2000) Morphological variation between allopatric populations of *Steinernema kraussei* (Steiner, 1923) (Rhabditida: Steinernematidae). Nematology 2(2):143–152
48. Sturhan D (1999) Prevalence and habitat specificity of entomopathogenic nematodes in Germany. In: Proceedings of a workshop held at Todi, Perugia, Italy, 16 to 29 May 1995. European Commission, COST, Luxembourg, vol 819, pp 123–132
49. Campbell PM, Newcomb RD, Russell RJ, Oakeshott JG (1998) Two different amino acid substitutions in the ali-esterase, E3, confer alternative types of organophosphorus insecticide resistance in the sheep blowfly, Lucilia cuprina. Insect Biochem Mol Biol 28 (3):139–150
50. Griffin CT, Joyce SA, Dix I, Burnell AM, Downes MJ (1994) Characterisation of the entomopathogenic nematode Heterorhabditis (Nematoda: Heterorhabditidae) from Ireland and Britain by molecular and crossbreeding techniques, and the occurrence of the genus in these islands. Fundam Appl Nematol 17:245–253
51. Yoshida M, Reid AP, Briscoe BR, Hominick WM (1998) Survey of entomopathogenic nematodes (Rhabditida: Steinernematidae and Heterorhabditidae) in Japan. Fundam Appl Nematol 21(2):185–198
52. Stock SP, Kaya HK (1996) A multivariate analysis of morphometric characters of *Heterorhabditis* species (Nemata: Heterorhabditidae) and the role of morphometrics in the taxonomy of species of the genus. J Parasitol 82:806–813
53. Stuart RJ, Gaugler R (1994) Patchiness in populations of entomopathogenic nematodes. J Invertebr Pathol 64(1):39–45
54. Constant P, Marchay L, Fischer-Le-Saux M, Briand-Panoma S, Mauléon H (1998) Natural occurrence of entomopathogenic nematodes (Rhabditida: *Steinernematidae* and *Heterorhabditidae*) in Guadeloupe islands. Fundam Appl Nematol 21(6):667–672
55. Griffin CT, Dix I, Joyce SA, Burnell AM, Downes MJ (1999) Isolation and characterisation of *Heterorhabditis* spp. (Nematoda: Heterorhabditidae) from Hungary, Estonia and Dennmark. Nematology 1:321–332
56. Chitwood BG (1933) Notes on nematode systematics and nomenclature. J Parasitol 19:242–243. (W.L. 11428)
57. Örley L (1880) Az anguillulidák magánrajza. A kir. m. természettudom. társulat által a bugat dijjal jutalmazott pályamü. (Monographic der Anguillulidcn. Eine von der k. ung. naturhistorischen Gescllschaft gekronte Prcisschrift). Természetr Fuz 4:16–150. (German text): 154–177; pls. 1–7. (W.L. 21105)
58. Travassos LP (1920) Esboço de uma chave geral dos nematodes parasitos. Rev Vet Rio de J 10:59–70. vis. (W.L. 18971)
59. Chitwood BG, Chitwood MB (1937) "Outline classification of Nematoda". [Appendix to] An introduction to nematology, sect. I, pt. I, pp 49–52
60. Phylogenetic relationships of *Steinernema* Travassos, 1927 (Nematoda: Cephalobina: Steinernematidae) based on nuclear, mitochondrial and morphological data
61. Steiner G (1929) *Neoaplectana glaseri* n. g., n. sp. (Oxyuridae) a new nemic parasite of the Japanese beetle (*Popillia japonica* Newm.). J Wash Acad Sci 19:436–440
62. Nguyen KB, Smart GC Jr (1994) *Neosteinernema longicurvicauda* n. gen., n. sp. (Rhabdifida: Steinernematidae), a parasite of the termite *Reticulitermes flavipes* (Koller). J Nematol 26:162–174
63. Brooks, Hirschmann (1976) *Chromonema heliothidis* n. gen., n. sp. (Steinernematidae, Nematoda), a parasite of Hellothis zea (Noctuidae, Lepidoptera), and other insects. J Nematol 8(2):159–168

64. Khan A, Brooks WM, Hirschmann H (1976) *Chromonema heliothidis* n. gen., n. sp.(*Steinernematidae*, *Nematoda*), a parasite of *Heliothis zea* (Noctuidae, Lepidoptera), and other insects. J Nematol 8(2):159
65. Thomas GM, Poinar GO Jr (1979) *Xenorhabdus* gen. nov., a genus of entomopathogenic nematophilic bacteria of the family Enterobacteriaceae. Int J Syst Bacteriol 29:352–360
66. Boemare NE, Akhurst RJ, Mourant RG (1993) DNA relatedness between *Xenorhabdus* spp. (Enterobacteriaceae), symbiotic bacteria of entomopathogenic nematodes, and a proposal to transfer *Xenorhabdus luminescens* to a new genus, *Photorhabdus* gen. nov. Int J Syst Evol Microbiol 43(2):249–255
67. Bird AF, Akhurst RJ (1983) The nature of the intestinal vesicle in nematodes of the family Steinernematidae. Int J Parasitol 13 (6):599–606
68. Boemare N, Laumond C, Mauleon H (1996) The entomopathogenic nematode-bacterium complex: biology, life cycle and vertebrate safety. Biocontrol Sci Tech 6(3):333–346
69. Endo BY, Nickle WR (1994) Ultrastructure of the buccal cavity region and oesophagus of the insect parasitic nematode, *Heterorhabditis Bacteriophora1*. Nematologica 40 (1–4):379–398
70. Spiridonov SE, Akhmedov EN, Belostotskaya FN (1991) Proliferation of symbiotic bacteria in the intestinal vesicles of invasive larvae of *Neoaplectana* spp. (Nematoda, Steinernematidae). Helminthologia 28:141–142
71. Forst S, Clarke D (2002) Bacteria-nematode symbiosis. In: Gaugler R (ed) Entomopathogenic nematology. CABI Publishing, Wallingford, UK, pp 57–77
72. Koppenhöfer HS, Gaugler R (2009) Entomopathogenic nematode and bacteria mutualism. In: White J, Torres M (eds) Defensive mutualism in microbial symbiosis. CRC Press, Boca Raton, FL, pp 99–116
73. Poinar GO Jr, Thomas GM (1965) A new bacterium, *Achromobacter Nematophilus* sp. nov. (Achromobactericeae Eubacteriales) associated with a nematode. Int Bull Bact Nomen Tax 15:249–252
74. Akhurst RJ (1983) Taxonomic study of Xenorhabdus, a genus of bacteria symbiotically associated with insect pathogenic nematodes. Int J Syst Bacteriol 33(1):38–45
75. Akhurst RJ (1986a) *Xenorhabdus nematophilus* subsp. *poinarii*: its interaction with insect pathogenic nematodes. Syst Appl Microbiol 8 (1–2):142–147
76. Akhurst RJ (1986b) *Xenorhabdus nematophilus* subsp. beddingii (Enterobacteriaceae): a new subspecies of bacteria mutualistically associated with entomopathogenic nematodes. Int J Syst Bacteriol 36:454–457
77. Nishimura Y, Hagiwara A, Suzuki T, Yamanaka S (1994) *Xenorhabdus japonicus* sp. nov. associated with the nematode *Steinernema kushidai*. World J Microbiol Biotechnol 10 (2):207–210
78. Lengyel K, Lang E, Fodor A, Szallas E, Schumann P, Stackebrandt E (2005) Description of four novel species of Xenorhabdus, family Enterobacteriaceae: *Xenorhabdus budapestensis* sp. nov., *Xenorhabdus ehlersii* sp. nov., *Xenorhabdus innexi* sp. nov., and *Xenorhabdus szentirmaii* sp. nov. Syst Appl Microbiol 28(2):115–122
79. Tailliez P, Pages S, Ginibre N, Boemare N (2006) New insight into diversity in the genus Xenorhabdus, including the description of ten novel species. Int J Syst Evol Microbiol 56(12):2805–2818
80. Somvanshi VS, Lang E, Ganguly S, Swiderski J, Saxena AK, Stackebrandt E (2006) A novel species of Xenorhabdus, family Enterobacteriaceae: *Xenorhabdus indica* sp. nov., symbiotically associated with entomopathogenic nematode *Steinernema thermophilum* Ganguly and Singh, 2000. Syst Appl Microbiol 29(7):519–525
81. Tailliez P, Pages S, Edgington S, Tymo LM, Buddie AG (2012) Description of *Xenorhabdus magdalenensis* sp. nov., the symbiotic bacterium associated with *Steinernema australe*. Int J Syst Evol Microbiol 62(8):1761–1765
82. Kuwata R, Qiu LH, Wang W, Harada Y, Yoshida M, Kondo E, Yoshiga T (2013) *Xenorhabdus ishibashii* sp. nov., isolated from the entomopathogenic nematode *Steinernema aciari*. Int J Syst Evol Microbiol 63:1690–1695
83. Ferreira T, van Reenen CA, Endo A, Sproer C, Malan AP, Dicks LMT (2013) Description of *Xenorhabdus khoisanae* sp. nov., the symbiont of the entomopathogenic nematode *Steinernema khoisanae*. Int J Syst Evol Microbiol 63 (9):3220–3224
84. Kämpfer P, Tobias NJ, Ke LP, Bode HB, Glaeser SP (2017) *Xenorhabdus thuongxuanensis* sp. nov. and *Xenorhabdus eapokensis* sp. nov., isolated from Steinernema species. Int J Syst Evol Microbiol 67(5):1107–1114
85. Fischer-Le Saux M, Viallard V, Brunel B, Normand P, Boemare NE (1999) Polyphasic classification of the genus *Photorhabdus* and proposal of new taxa: *P. luminescens* subsp.

luminescens subsp. nov., *P. luminescens* subsp. *akhurstii* subsp. nov., *P. luminescens* subsp. *laumondii* subsp. nov., *P. temperata* sp. nov., *P. temperate* subsp. *temperata* subsp. nov. and *P. asymbiotica* sp. nov. Int J Syst Bacteriol 49 (4):1645–1656

86. Machado RAR, Bruno P, Arce CCM, Liechti N, Köhler A, Bernal J, Bruggmann R, Turlings TCJ (2019) *Photorhabdus khanii* subsp. *guanajuatensis* subsp. nov., isolated from *Heterorhabditis atacamensis*, and *Photorhabdus luminescens* subsp. *Mexicana subsp.* nov., isolated from *Heterorhabditis mexicana* entomopathogenic nematodes. Int J Syst Evol Microbiol 69 (3):652–661
87. Machado RAR, Wüthrich D, Kuhnert P, Arce CCM, Thönen L, Ruiz C, Zhang X, Robert CAM, Karimi J, Kamali S, Ma J, Bruggmann R, Erb M (2018) Whole-genome-based revisit of Photorhabdus phylogeny: proposal for the elevation of most Photorhabdus subspecies to the species level and description of one novel species *Photorhabdus bodei* sp. nov., and one novel subspecies *Photorhabdus laumondii* subsp. *clarkei* subsp. nov. Int J Syst Evol Microbiol 68 (8):2664–2681
88. Hazir S, Stackebrandt E, Lang E, Schumann P, Ehlers R-U, Keskin N (2004) Two new subspecies of *Photorhabdus luminescens*, isolated from Heterorhabditis bacteriophora (Nematoda: Heterorhabditidae): *Photorhabdus luminescens* subsp. Kayaii subsp. nov. and *Photorhabdus luminescens* subsp. thracensis subsp. nov. Syst Appl Microbiol 27(1):36–42
89. Akhurst RJ, Boemare NE, Janssen PH, Peel MM, Alfredson DA, Beard CE (2004) Taxonomy of Australian clinical isolates of the genus *Photorhabdus* and proposal of *Photorhabdus asymbiotica* subsp. asymbiotica subsp. nov. and *P. asymbiotica* subsp. australis subsp. nov. Int J Syst Evol Microbiol 54 (4):1301–1310
90. Tóth T, Lakatos T (2008) Photorhabdus temperata subsp. cinerea subsp. nov., isolated from Heterorhabditis nematodes. Int J Syst Evol Microbiol 58(11):2579–2581
91. An R, Grewal PS (2011) *Photorhabdus luminescens* subsp. kleinii subsp. nov. (Enterobacteriales: Enterobacteriaceae). Curr Microbiol 62(2):539–543
92. Orozco RA, Hill T, Stock SP (2013) Characterization and phylogenetic relationships of Photorhabdus luminescens subsp. sonorensis (γ- Proteobacteria: Enterobacteriaceae), the bacterial symbiont of the entomopathogenic nematode Heterorhabditis sonorensis (Nematoda: Heterorhabditidae). Curr Microbiol 66(1):30–39
93. Mahmoud MF, Mahfouz HM, Mohamed KM (2016) Compatibility of entomopathogenic nematodes with neonctinoids and azadirachtin insecticides for controlling the black cutworm, *Agrotis ipsilon* (Hufnagel) in canola plants. IJEST 2(1):11–18
94. Ehlers RU (2001) Mass production of entomopathogenic nematodes for plant protection. Appl Microbiol Biotechnol 56 (5–6):623–633
95. Kondo E, Ishibashi N (1986) Nictating behavior and infectivity of entomogenous nematodes, *Steinernema* spp., to the larvae of common cutworm, *Spodoptera litura* (Lepidoptera: Noctuidae), on the soil surface. Appl Entomol Zool 21(4):553–560
96. Strauch E, Arnold W, Alijah R, Wohlleben W, Puhler A, Eckes P, Wengenmayer F (1994) U.S. Patent No. 5,276,268. U.S. Patent and Trademark Office, Washington, DC
97. Griffin CT, Boemare NE, Lewis EE (2005) Biology and behavior. In: Grewal PS, Ehler R-U, Shapiro-Ilan DI (eds) Nematodes as biocontrol agents. CABI Publishing, Wallingford, UK, pp 47–64
98. Kaya HK, Koppenhöfer AM (1999) Biology and ecology of insecticidal nematodes. In: Optimal use of insecticidal nematodes in pest management. IntechOpen, Croatia, pp 1–8
99. Sivaramakrishnan S, Razia M (2015) Sustainability of entomopathogenic nematodes against crop pests. In: Biocontrol of lepidopteran pests. Springer, Cham, pp 315–328
100. Chen MJ (1996) Competitor analysis and interfirm rivalry: toward a theoretical integration. Acad Manag Rev 21:100–134
101. Li J, Chen G, Webster JM (1997) Nematophin, a novel antimicrobial substance produced by Xenorhabdus nematophilus (Enterobactereaceae). Can J Microbiol 43:770–773
102. McInerney BV, Taylor WC, Lacey MJ, Akhurst RJ, Gregson RP (1991) Biologically active metabolites from *Xenorhabdus* spp. Part 2. Benzopyran-1-one derivatives with gastroprotective activity. J Nat Prod 54:785–795
103. Webster SP, Alexeev D, Campopiano DJ, Watt RM, Alexeeva M, Sawyer L, Baxter RL (2000) Mechanism of 8-amino-7-oxononanoate synthase: spectroscopic, kinetic, and crystallographic studies. Biochemistry 39 (3):516–528
104. Razia M, Karthik Raja R, Padmanaban K, Chellapandi P, Sivaramakrishnan S (2010) A phylogenetic approach for assigning function

of b-ketoacyl synthase I in entomopathogenic bacteria (Photorhabdus luminescens subsp. laumondii TT01). J Comput Sci Syst Biol 3:21–29

105. Akhurst RJ (1982) Antibiotic activity of *Xenorhabdus* spp., bacteria symbiotically associated with insect pathogenic nematodes of the families *Heterorhabditidae* and *Steinernematidae*. J Gen Microbiol 128:3061–3065
106. Khush RS, Lemaitre B (2000) Genes that fight infection: what the Drosophila genome says about animal immunity. Trends Genet 16:442–449
107. Chaston JM, Suen G, Tucker SL, Andersen AW, Bhasin A, Bode E (2011) The entomopathogenic bacterial endosymbionts *Xenorhabdus* and *Photorhabdus*: convergent lifestyles from divergent genomes. PLoS One 6(11):e27909
108. Ogier J, Calteau A, Forst SJ, Blair H, Roche D, Rouy Z, Suen G, Zumbihl R, Givaudan A, Tailliez P, Médigue C, Gaudriault S (2010) Units of plasticity in bacterial genomes: new insight from the comparative genomics of two bacteria interacting with invertebrates, *Photorhabdus* and *Xenorhabdus*. BMC Genomics 11:568
109. Boemare NE, Boyer-Giglio MH, Thaler JO, Akhurst RJ, Brehelin M (1992) Lysogeny and bacteriocinogeny in *Xenorhabdus nematophilus*, and other *Xenorhabdus* spp. Appl Environ Microbiol 58:3032–3037
110. Böszörményi E, Ersek T, Fodor A, Fodor AM, Földes LS, Hevesi M, Hogan JS, Katona Z, Klein MG, Kormány A, Pekár S, Szentirmai A, Sztaricskai F, Taylor RA (2009) Isolation and activity of Xenorhabdus antimicrobial compounds against the plant pathogens *Erwinia amylovora* and *Phytophthora nicotianae*. J Appl Microbiol 107:746–759
111. Xiao Q, Komori H, Lee CY (2012) Klumpfuss distinguishes stem cells from progenitor cells during asymmetric neuroblast division. Development 139(15):2670–2680
112. Fuchs MA, Sato K, Niedzwiecki D, Ye X, Saltz LB, Mayer RJ et al (2014) Sugar-sweetened beverage intake and cancer recurrence and survival in CALGB 89803 (Alliance). PLoS One 9(6):e99816
113. Tobias NJ, Heinrich AK, Eresmann H, Wright PR, Neubacher N, Backofen R, Bode HB (2017) Photorhabdus-nematode symbiosis is dependent on hfq-mediated regulation of secondary metabolites. Environ Microbiol 19:119–129
114. Zhou Y, Chen C, Johansson MJ (2013) The pre-mRNA retention and splicing complex controls tRNA maturation by promoting TAN1 expression. Nucleic Acids Res 41 (11):5669–5678
115. Bode GH, Coué G, Freese C, Pickl KE, Sanchez-Purrà M, Albaiges B, Borrós S, van Winden EC, Tziveleka LA, Sideratou Z, Engbersen JFJ, Singh S, Albrecht K, Groll J, Möller M, Pötgens AJG, Schmitz C, Fröhlich E, Grandfils C, Sinner FM, Kirkpatrick CJ, Steinbusch HWM, Frank HG, Unger RE, Martinez-Martinez P (2017) An in vitro and in vivo study of peptide-functionalized nanoparticles for brain targeting: the importance of selective blood–brain barrier uptake. Nanomed Nanotechnol Biol Med 13:1289–1300
116. Reimer D, Luxenburger E, Brachmann AO, Bode HB (2009) A new type of pyrrolidine biosynthesis is involved in the late steps of xenocoumacin production in *Xenorhabdus nematophila*. Chembiochem 10:1997–2001
117. Sugar DR, Murfin KE, Chaston JM, Andersen AW, Richards GR, deLéon L (2012) Phenotypic variation and host interactions of Xenorhabdus bovienii SS-2004, the entomopathogenic symbiont of Steinernema jollieti nematodes. Environ Microbiol 14:924–939
118. Park HB, Perez CE, Perry EK, Crawford JM (2016) Activating and attenuating the amicoumacin antibiotics. Molecules 21:E824
119. Reimer D, Nollmann FI, Schultz K, Kaiser M, Bode HB (2014) Xenortide biosynthesis by entomopathogenic *Xenorhabdus nematophila*. J Nat Prod 77:1976–1980
120. Hu MCT, Qiu WR, Wang X, Meyer CF, Tan T-H (1996) Human HPK1, a novel human hematopoietic progenitor kinase that activates the JNK/SAPK kinase cascade. Genes Dev 10:2251–2264
121. Hu Y, Benedict MA, Ding L, Núñez G (1999) Role of cytochrome c and dATP/ATP hydrolysis in Apaf-1-mediated caspase-9 activation and apoptosis. EMBO J 18:3586–3595
122. Webster MS, Marra PP, Haig SM, Bensch S, Holmes RT (2002) Links between worlds: unraveling migratory connectivity. Trends Ecol Evol 17:76–83
123. Gaugler R, Kaya HK (1990) Entomopathogenic nematodes in biological control. CRC Press, Boca Raton, FL
124. Cutler GC, Webster JM (2003) Host-finding ability of three entomopathogenic nematode isolates in the presence of plant roots. Nematology 5(4):601–608
125. Glaser RW, Farrell CC (1935) Field experiments with the Japanese beetle and its nematode parasite. J N Y Entomol Soc. 43p

126. Prasad BC, Reed RR (1999) Chemosensation: molecular mechanisms in worms and mammals. Trends Genet 15(4):150–153
127. Anderson OD, Greene FC (1997) The α-gliadin gene family. II. DNA and protein sequence variation, subfamily structure, and origins of pseudogenes. Theor Appl Genet 95 (1–2):59–65
128. Hui E, Webster JM (2000) Influence of insect larvae and seedling roots on the host-finding ability of *Steinernema feltiae* (Nematoda: Steinernematidae). J Invertebr Pathol 75 (2):152–162
129. Kaya H, Campbell J (2000) Influence of insect associated cues on the jumping behavior of entomopathogenic nematodes (*Steinernema* spp.). Behaviour 137(5):591–609
130. Gaugler R, Campbell JF (1993) Nictation behaviour and its ecological implications in the host search strategies of entomopathogenic nematodes (Heterorhabditidae and Steinernematidae). Behaviour 126 (3–4):155–169
131. Volk J (1950) Die Nematoden der Regenwürmer und der aasbesuchenden Käfer. Zool Jb Syst 79:1
132. Lewis EE (2002) 10 behavioural ecology. In: Entomopathogenic nematology. CABI Publishing, Wallingford, UK, p 205
133. Croll NA (1970) The behaviour of nematodes: their activity, senses and responses. Edward Arnold, London
134. Koppenhöfer AM, Fuzy EM (2003) Steinernema scarabaei for the control of white grubs. Biol Control 28(1):47–59
135. Ali JG, Alborn HT, Stelinski LL (2010) Subterranean herbivore-induced volatiles released by citrus roots upon feeding by *Diaprepes abbreviatus* recruit entomopathogenic nematodes. J Chem Ecol 36(4):361–368
136. Rasmann S, Köllner TG, Degenhardt J, Hiltpold I, Toepfer S, Kuhlmann U, Turlings TC (2005) Recruitment of entomopathogenic nematodes by insect-damaged maize roots. Nature 434(7034):732–737
137. Gulcu B, Hazir S, Kaya HK (2012) Scavenger deterrent factor (SDF) from symbiotic bacteria of entomopathogenic nematodes. J Invertebr Pathol 110(3):326–333
138. Lu JL, Luo W, Li XY, Yang SQ, Cao JX, Gong XG, Xiang HJ (2017) Two-dimensional node-line semimetals in a honeycomb-kagome lattice. Chin Phys Lett 34(5):057302
139. Turlings TC, Hiltpold I, Rasmann S (2012) The importance of root-produced volatiles as foraging cues for entomopathogenic nematodes. Plant Soil 358(1–2):51–60
140. Gang SS, Hallem EA (2016) Mechanisms of host seeking by parasitic nematodes. Mol Biochem Parasitol 208(1):23–32
141. Hallem EA, Dillman AR, Hong AV, Zhang Y, Yano JM, SF DM, Sternberg PW (2011) A sensory code for host seeking in parasitic nematodes. Curr Biol 21(5):377–383
142. Gaugler R, Lebeck L, Nakagaki B, Boush GM (1980) Orientation of the entomogenous nematode *Neoaplectana carpocapsae* to carbon dioxide. Environ Entomol 9(5):649–652
143. Laznik Ž, Trdan S (2016) Attraction behaviors of entomopathogenic nematodes (Steinernematidae and Heterorhabditidae) to synthetic volatiles emitted by insect-damaged carrot roots. J Pest Sci 89(4):977–984
144. Robinson AF (1995) Optimal release rates for attracting MeloIDogyne incognita, Rotylenchulus reniformis, and other nematodes to carbon dioxIDe in sand. J Nematol 27:42–50
145. Ali MS, Kim GD, Seo HW, Jung EY, Kim BW, Yang HS, Joo ST (2011) Possibility of making low-fat sausages from duck meat with addition of rice flour. Asian Australas J Anim Sci 24(3):421–428
146. O'Halloran DM, Burnell AM (2003) An investigation of chemotaxis in the insect parasitic nematode *Heterorhabditis bacteriophora*. Parasitology 127(4):375
147. Köllner TG, Held M, Lenk C, Hiltpold I, Turlings TC, Gershenzon J, Degenhardt J (2008) A maize (E)-β-caryophyllene synthase implicated in indirect defense responses against herbivores is not expressed in most American maize varieties. Plant Cell 20 (2):482–494
148. Helms AM, Ray S, Matulis NL, Kuzemchak MC, Grisales W, Tooker JF, Ali JG (2019) Chemical cues linked to risk: cues from below-ground natural enemies enhance plant defences and influence herbivore behaviour and performance. Funct Ecol 33(5):798–808
149. Dillman AR, Sternberg PW (2012) Entomopathogenic nematodes. Curr Biol 22(11): R430–R431
150. Campbell JF, Kaya HK (1999) How and why a parasitic nematode jumps. Nature 397 (6719):485–486
151. Laznik Z, Trdan S (2013) An investigation on the chemotactic responses of different entomopathogenic nematode strains to mechanically damaged maize root volatile compounds. Exp Parasitol 134(3):349–355
152. Ward S (1973) Chemotaxis by the nematode *Caenorhabditis elegans*: identification of attractants and analysis of the response by

use of mutants. Proc Natl Acad Sci U S A 70:817–821

153. Bargmann CI, Horvitz HR (1991) Chemosensory neurons with overlapping functions direct chemotaxis to multiple chemicals in *C. elegans*. Neuron 7(5):729–742
154. Baiocchi T, Lee G, Choe DH, Dillman AR (2017) Host seeking parasitic nematodes use specific odors to assess host resources. Sci Rep 7(1):1–13
155. Dillman AR, Chaston JM, Adams BJ, Ciche TA, Goodrich-Blair H, Stock SP, Sternberg PW (2012) An entomopathogenic nematode by any other name. PLoS Pathog 8(3): e1002527
156. Baiocchi T, Dillman AR (2015) Chemotaxis and jumping assays in nematodes. Bio-protocol 5:e1587
157. Stilwell RL, Samaniego AC, Atkinson B (2017) U.S. Patent No. 9,801,975. U.S. Patent and Trademark Office, Washington, DC
158. Southey JF (1986) Laboratory methods for work with plant and soil nematodes. HMSO, London
159. Jenkins WRB (1964) A rapid centrifugal-flotation technique for separating nematodes from soil. Pl Dis Rep 48(9)
160. Bedding RA, Akhurst RJ (1975) A simple technique for the detection of insect paristic rhabditid nematodes in soil. Nematologica 21 (1):109–110
161. Fan X, Hominick WM (1991) Efficiency of the Galleria (wax month) baiting technique for recovering infective stages of entomopathogenic rhabditids (Steinernematidae and heterorhabditidae) from sand and soil. Rev Nematol 14(3):381–387
162. White GF (1927) A method for obtaining infective nematode larvae from cultures. Science 66(1709):302–303
163. Kaya HK, Stock SP (1997) Techniques in insect nematology. In: Lacey LA (ed) Manual of techniques in insect pathology. Academic Press, London, pp 281–324
164. Woodring JL, Kaya HK (1988) Steinernematid and Heterorhabditid nematodes: a handbook of techniques. South Co-operative Serv Bull 331(1):30
165. Southey JF (1970) Principles of sampling for mematodes. Technical bulletin. Ministry of Agriculture, Fisheries and Food (5th edn; 2), pp 1–4
166. Seinhorst JW (1959) A rapid method for the transfer of nematodes from fixative to anhydrous glycerin. Nematologica 4(1):67–69
167. Brenner S (1974) The genetics of *Caenorhabditis elegans*. Genetics 77(1):71–94
168. Poinar GO Jr (1967) Description and taxonomic position of the DD-136 nematode (Steinernematidae, Rhabditoidea) and its relationship to *Neoaplectana carpocapsae* Weiser. Proc Helminthol Soc Wash 34:199–209
169. Mayr E (1978) Origin and history of some terms in systematic and evolutionary biology. Syst Zool 27(1):83–88
170. Poinar GO Jr, Thomas GM (1966) Significance of *Achromobacter nematophilus* (Achromobactericeae Eubacteriales) in the development of the nematode, DD-136 (*Neoaplectana* sp. Steinernematidae). Parasitology 56:385–390
171. Dix DR, Bridgham JT, Broderius MA, Byersdorfer CA, Eide DJ (1994) The FET4 gene encodes the low affinity Fe(II) transport protein of *Saccharomyces cerevisiae*. J Biol Chem 269(42):26092–26099
172. Joyce CM, Steitz TA (1994) Function and structure relationships in DNA polymerases. Annu Rev Biochem 63(1):777–822
173. Reid MB, Stokić DS, Koch SM, Khawli FA, Leis AA (1994) N-acetylcysteine inhibits muscle fatigue in humans. J Clin Invest 94 (6):2468–2474
174. Hashmi G, Gaugler R (1998) Genetic diversity in insect-parasitic nematodes (Rhabditida: Heterorhabditidae). J Invertebr Pathol 72 (3):185–189
175. Reid IN, Gizis JE (1997) Low-mass binaries in the Hyades-A scarcity of brown dwarfs. arXiv preprint astro-ph/9709226
176. Reid AP, Homonick WM (1998) Molecular taxonomy of Steinernema by RFLP analysis of the ITS region of the ribosomal DNA repeat unit. In: Abad P, Bernell A, Laumond C, Boemare N, Coudert F (eds) COST 819 entomopathogenic nematodes—genetic and molecular biology of entomopathogenic nematodes. Luxembourg EUR 18261, Brussels, pp 87–93
177. Sneath PH, Sokal RR (1973) Numerical taxonomy. The principles and practice of numerical classification. CABI Publishing, Wallingford, UK
178. SAS Institute (1992) SAS/STAT software: changes and enhancements. SAS Institute, Cary, NC
179. Yamamoto S, Harayama S (1995) PCR amplification and direct sequencing of gyrB genes with universal primers and their application to the detection and taxonomic analysis of *Pseudomonas putida* strains. Appl Environ Microbiol 61(3):1104–1109

180. Wheeler WC, Gladstein DS (1994) MALIGN: a multiple sequence alignment program. J Hered 85(5):417–418
181. Nelson G, Platnick N (1981) Systematics and biogeography, cladistics and vicariance. Colombia University Press, New York
182. Tamura K (2007) MEGA4: molecular evolutionary genetics analysis (MEGA) software version 4.0. Mol Biol Evol 24:1596–1599
183. Brodsky LI (1992) GeneBee: the program package for biopolymer structure analysis. Dimacs 8:127–139
184. Brodsky LI (1995) GeneBee-NET: an internet-based server for analyzing biopolymers structure. Biochemist 60:1221–1230
185. Felsenstein J (1993) Phylogeny inference package. Department of Genetics, University of Washington, Seattle
186. Glazer I, Lewis EE (2000) Bioassays for entomopathogenic nematodes. In: Bioassays of entomopathogenic microbes and nematodes. CABI Publishing, Wallingford, UK, pp 229–247
187. Miller AD, Rosman GJ (1989) Improved retroviral vectors for gene transfer and expression. Biotechniques 7(9):980
188. Grewal D, Gotlieb J, Marmorstein H (1994) The moderating effects of message framing and source credibility on the price-perceived risk relationship. J Consum Res 21 (1):145–153
189. Morris DR (1995) Growth control of translation in mammalian cells. In: Progress in nucleic acid research and molecular biology, vol 51. Academic Press, London, pp 339–363
190. Somasekhar N, Grewal PS, De Nardo EA, Stinner BR (2002) Non-target effects of entomopathogenic nematodes on the soil nematode community. J Appl Ecol 39 (5):735–744
191. Shapiro-Ilan DI, Mbata GN, Nguyen KB, Peat SM, Blackburn D, Adams BJ (2009a) Characterization of biocontrol traits in the entomopathogenic nematode *Heterorhabditis georgiana* (Kesha strain), and phylogenetic analysis of the nematode's symbiotic bacteria. Biol Control 51(3):377–387
192. Shapiro-Ilan DI, Reilly CC, Hotchkiss MW (2009b) Suppressive effects of metabolites from *Photorhabdus* and *Xenorhabdus* spp. on phytopathogens of peach and pecan. *Arch. Phytopathol.* Plant Prot 42:715–728
193. Shapiro SL, Schwartz GE, Bonner G (1998) Effects of mindfulness-based stress reduction on medical and premedical students. J Behav Med 21(6):581–599
194. Kaya HK, Koppenhöfer AM (1996) Effects of microbial and other antagonistic organism and competition on entomopathogenic nematodes. Biocontrol Sci Tech 6 (3):357–372
195. Wharton R, Lewith G (1986) Complementary medicine and the general practitioner. Br Med J (Clin Res Ed) 292(6534):1498–1500
196. Koppenhöfer AM, Kaya HK (1995) Density-dependent effects on *Steinernema glaseri* (Nematoda: Steinernematidae) within an insect host. J Parasitol 81(5):797–799
197. Wouts WM (1981) Mass production of the entomogenous nematode Heterorhabditisheliothidis (Nematode: Heterorhabditidae) on artificial media. J Nematol 13:467–469
198. Dye DW (1968) A taxonomic study of the genus Erwinia I. The 'amylovora' group. N Z J Sci 11:590–607
199. Strauch O, Ehlers RU (1998) Food signal production of *Photorhabdus luminescens* inducing the recovery of entomopathogenic nematodes *Heterorhabditis* spp. in liquid culture. Appl Microbiol Biotechnol 50 (3):369–374
200. Abbott WS (1925) A method of computing the effectiveness of an insecticide. J Econ Entomol 18:265–267
201. Akhurst RJ, Boemare NE (1988) A numerical taxonomic study of the genus *Xenorhabdus* (Enterobacteriaceae) and proposed elevation of the subspecies of *X. nematophilus* to species. J Gen Microbiol 134:1835–1845. Printed in Great Britain
202. Bergey's Manual of Determinative Bacteriology (2000) Actinomycetales, 9th edn
203. Sambrook J, Fritschi EF, Maniatis T (1989) Molecular cloning: a laboratory manual. Cold Spring Harbor Laboratory Press, New York
204. Bauer AW, Kirby WMM, Sherris JC, Turck M (1966) Antibiotic susceptibility testing by a standardized single disk method. Am J Clin Pathol 45:493–496
205. Velikova N, Kavanagh K, Jerry M (2016) Evaluation of Galleria mellonella larvae for studying the virulence of Streptococcus suis. BMC Microbiol 16:291
206. Mahar AN, Munir M, Elawad S, Gowen SR, Hague NGM (2005) Pathogenicity of bacterium, *Xenorhabdus nematophila* isolated from entomopathogenic nematode (Steinernema carpocapsae) and its secretion against *Galleria mellonella* larvae. J Zhejiang Univ Sci B 6 (6):457–463
207. Lewis P, Abbeduto L, Murphy M, Richmond E, Giles N, Bruno L, Orsmond G (2006) Psychological well-being of mothers

of youth with fragile X syndrome: syndrome specificity and within-syndrome variability. J Intellect Disabil Res 50(12):894–904

208. Aliyu A, Kariim I, Abdulkareem SA (2017) Effects of aspect ratio of multi-walled carbon nanotubes on coal washery waste water treatment. J Environ Manag 202:84–93
209. Grewal SI, Elgin SC (2002) Heterochromatin: new possibilities for the inheritance of structure. Curr Opin Genet Dev 12 (2):178–187
210. Yukawa T, Pitt JM (1985) Nematode storage and transport. Int. Patent WO85/03412
211. Kaya HK, Nelson CE (1985) Encapsulation of steinernematid and heterorhabditid nematodes with calcium alginate: a new approach for insect control and other applications. Environ Entomol 14:572–574
212. Grewal PS, Peters A (2005) Formulation and quality. In: Nematodes as biocontrol agents. CABI Publishing, Wallingford, UK, pp 79–90
213. Bedding R (1990) Logistics and strategies for introducing entomopathogenic nematode technology into developing countries. In: Gaugler R, Kaya HK (eds) Entomopathogenic nematodes in biological control. CRC Press, Boca Raton, FL, pp 233–246
214. Capinera JL, Hibbard BE (1987) Bait formulations of chemical and microbial insecticides for suppression of crop-feeding grasshoppers. J Agric Entomol 4(4):337–340
215. Geoffrey J, Ilham S, Turlings T (2019) Encapsulated entomopathogenic nematodes can protect maize plants from Diabrotica balteata larvae. Insects 11:27
216. Georgis R (1990) Formulation and application technology. In: Gaugler R, Kaya HK (eds) Entomopathogenic nematodes in biological control. CRC Press, Boca Raton, FL, pp 173–194
217. Koppenhöfer AM, Brown IM, Gaugler R, Grewal PS, Kaya HK, Klein MG (2000) Synergism of entomopathogenic nematodes and imidacloprid against white grubs: greenhouse and field evaluation. Biol Control 19 (3):245–251
218. Koppenhofer AM, Grewal PS (2005) 20 compatibility and interactions with agrochemicals and other biocontrol agents. In: Nematodes as biocontrol agents. CABI Publishing, Wallingford, UK, p 363
219. Alumai A, Grewal PS (2004) Tank-mix compatibility of the entomopathogenic nematodes, *Heterorhabditis bacteriophora* and *Steinernema carpocapsae*, with selected chemical pesticides used in turfgrass. Biocontrol Sci Technol 14(7):725–730
220. Nishimatsu T, Jackson JJ (1998) Interaction of insecticides, entomopathogenic nematodes, and larvae of the western corn root worm (Coleoptera: Chrysomelidae). J Econ Entomol 91(2):410–418
221. Anes KM, Ganguly S (2016) Pesticide compatibility with entomopathogenic nematode, *Steinernema thermophilum* (Nematoda: Rhabditida). Indian J Nematol 46(1):20–26
222. Shetlar DJ, Suleman PE, Georgis R (1988) Irrigation and use of entomogenous nematodes, *Neoaplectana* spp. and *Heterorhabditis heliothidis* (Rhabditida: Steinernematidae and Heterorhabditidae), for control of Japanese beetle (Coleoptera: Scarabaeidae) grubs in turfgrass. J Econ Entomol 81(5):1318–1322
223. Georgis JF, Chauzy S, Coquillat S (1995) Computed conditions of corona emission from two interacting raindrops. Q J R Meteorol Soc 121(528):1853–1866
224. Scher HI, Yagoda A, Herr HW, Sternberg CN, Bosl G, Morse MJ, Geller N (1988) Neoadjuvant M-VAC (methotrexate, vinblastine, doxorubicin and cisplatin) effect on the primary bladder lesion. J Urol 139 (3):470–474
225. McCoy CW, Shapiro DI, Duncan LW, Nguyen K (2000a) Entomopathogenic nematodes and other natural enemies as mortality factors for larvae of *Diaprepes abbreviatus* (Coleoptera: Curculionidae). Biol Control 19:182–190
226. Gouge DH, Reaves LL, Stoltman MM, Van Berkum JR, Burke RA, Jech LJ, Henneberry TJ (1996) Control of pink bollworm Pectinophora gossypiella (Saunders) larvae in Arizona and Texas cotton fields using the entomopathogenic nematode Steinernema riobravis (Cabanillas, Poinar, & Raulston) (Rhabditida: Steinernematidae). In: Richter DA, Armour J (eds) Proceedings of' the Beltwide cotton production research conference. National Cotton Council of America, Memphis, pp 1078–1082
227. Wright RJ, Witkowski JF, Echtenkamp G, Georgis R (1993) Efficacy and persistence of *Steinernema carpocapsae* (Rhabditida: Steinernematidae) applied through a center-pivot irrigation system against larval corn rootworms (Coleoptera: Chrysomelidae). J Econ Entomol 86:1348–1354
228. Curran J (1992) Influence of application method and pest population size on weld efficacy of entomopathogenic nematodes. J Nematol 24:631–636
229. Reed DK, Reed GL, Creighton CS (1986) Introduction of entomogenous nematodes into trickle irrigation systems to control

striped cucumber beetle, *Acalymma vittatum* (Coleoptera: Chrysomelidae). J Econ Entomol 79:1330–1333

230. McCoy CW, Shapiro DI, Duncan LW (2000b) Application and evaluation of entomopatho gens for citrus pest control. In: Lacey L, Kaya HK (eds) Manual of techniques in insect pathology: field techniques. Kluwer Academic Publishers, Dordrecht, Holland, pp 577–597
231. Kaya HK (1990) Soil ecology. In: Gaugler R, Kaya HK (eds) Entomopathogenic nematodes in biological control. CRC Press, Boca Raton, FL, pp 93–116
232. Klein MG, Georgis R (1992) Persistence of control of Japanese beetle (Coleoptera: Scarabaeidae) larvae with steinernematid and heterorhabditid nematodes. J Econ Entomol 85:727–730
233. Shapiro DI, Lewis EE, Paramasivam S, McCoy CW (2000) Nitrogen partitioning in *Heterorhabditis bacteriophora*-infected hosts and the eVects of nitrogen on attraction/repulsion. J Invertebr Pathol 76:43–48
234. Shapiro-Ilan DI, Gouge DH, Koppenhöfer AM (2002) Factors affecting commercial success: case studies in cotton, turf and citrus. In: Gaugler R (ed) Entomopathogenic nematology. CABI Publishing, Wallingford, UK, pp 333–356
235. Majić I, Sarajlić A, Lakatos T, Tóth T, Raspudić E, Puškadija Z, Kanižai SG, Laznik Ž (2019) Virulence of new strain of *Heterorhabditis bacteriophora* from Croatia against *Lasioptera rubi*. Plant Protect Sci 55:134–141
236. Yuksel E, Canhilal R (2018) Evaluation of local isolates of entomopathogenic nematodes for the management of black cutworm, *Agrotis ipsilon* Hufnagel (Lepidoptera: Noctuidae). Egypt J Biol Pest Control 28(1):82
237. Begley JW (1990) Efficacy against insects in habitats other than soil. In: Gaugler R, Kaya HK (eds) Entomopathogenic nematodes in biological control. CRC Press, Boca Raton, FL, pp 215–232
238. Georgis R, Koppenhöfer AM, Lacey LA, Bélair G, Duncan LW, Grewal PS, Van Tol RWHM (2006) Successes and failures in the use of parasitic nematodes for pest control. Biol Control 38(1):103–123
239. Lacey LA, Arthurs SP, Unruh TR, Headrick H, Fritts R Jr (2006a) Entomopathogenic nematodes for control of codling moth (Lepidoptera: Tortricidae) in apple and pear orchards: effect of nematode species and seasonal temperatures, adjuvants, application equipment and post-application irrigation. Biol Control 37:214–223
240. Lacey LA, Granatstein D, Arthurs SP, Headrick H, Fritts R Jr (2006b) Use of entomopathogenic nematodes (Steinernematidae) in conjunction with mulches for control of overwintering codling moth (Lepidoptera: Tortricidae). J Entomol Sci 41:107–119
241. Mracek Z (2002) Use of entomoparasitic nematodes (EPANs) in biological control. In: Advances in microbial control of insect pests. Springer, Boston, MA, pp 235–264
242. Kaya HK, Joos JL, Falcon LA, Berlowitz A (1984) Suppression of the codling moth (Lepidoptera, Olethreutidae) with the entomogenous nematode, Steinernema feltiae (Rhabditida, Steinernematidae). J Econ Entomol 77:1240–1244
243. Unruh TR, Lacey LA (2001) Control of codling moth, Cydia pomonella (Lepidoptera: Tortricidae), with *Steinernema carpocapsae*: effects of supplemental wetting and pupation site on infection rate. Biol Control 20 (1):48–56
244. Siegel J, Lacey LA, Fritts R Jr, Higbee BS, Noble P (2004) Use of steinernematid nematodes for post-harvest control of navel orangeworm (Lepidoptera: Pyralidae, Amyelois transitella) in fallen pistachios. Biol Control 30:410–417
245. Broadbent AB, Olthof THA (1995) Foliar application of *Steinernema carpocapsae* (Rhabditida: Steinernematidae) to control *Liriomyza trifolii* (Diptera: Agromyzidae) larvae in chrysanthemums. Environ Entomol 24:431–435
246. Jagdale GB, Casey ML, Grewal PS, Lindquist RK (2004) Effects of application rate and timing, potting medium and host plant on efficacy of *Steinernema feltiae* against fungus gnat, *Bradysia coprophila* in floriculture. Biol Control 29:296–305
247. Qiu BL, Mandour NS, Xu CX, Ren SX (2008) Evaluation of the entomopathogenic nematode *Steinernema feltiae* as a biological control agent of the whitefly, *Bemisia tabaci*. Int J Pest Manag 54(3):247–253
248. Trdan S, Znidarcic D, Vidrih M (2007) Control of *Frankliniella occidentalis* on glasshouse-grown cucumbers: an efficacy comparison of foliar application of *Steinernema feltiae* and spraying with abamectin. Russ J Nematol 15(1):25–34
249. Choi WI, Lee EH, Choi BR, Park HM, Ahn YJ (2003) Toxicity of plant essential oils to *Trialeurodes vaporariorum* (Homoptera: Aleyrodidae). J Econ Entomol 96:1479–1484

250. Hamdi F, Fargues J, Ridray G, Jeannequin B, Bonato O (2011) Compatibility among entomopathogenic hyphocreales and two beneficial insects used to control *Trialeurodes vaporariorum* (Hemiptera: Aleurodidae) in Mediterranean greenhouses. J Invertebr Pathol 108:22–29
251. Quesada-Moraga E, Maranhao EAA, Valverde-Garcıa P, Santiago-Alvarez C (2006) Selection of Beauveria bassiana isolates for control of the whiteflies *Bemisia tabaci* and *Trialeurodes vaporariorum* on the basis of their virulence, thermal requirements, and toxicogenic activity. Biol Control 36:274–287
252. Rezaei N, Karimi J, Hosseini M, Goldani M, Campos-Herrera R (2015) Pathogenicity of two species of entomopathogenic nematodes against the greenhouse whitefly, *Trialeurodes vaporariorum* (Hemiptera: Aleyrodidae), in laboratory and greenhouse experiments. J Nematol 47(1):60–66
253. Cuthbertson A, Walters K, Northing P, Luo W (2007) Efficacy of the entomopathogenic nematode, *Steinernema feltiae*, against sweetpotato whitefly *Bemisia tabaci* (Homoptera: Aleyrodidae) under laboratory and glasshouse conditions. Bull Entomol Res 97:9–14
254. Cuthbertson AG, Mathers JJ, Northing P, Prickett AJ, Walters KF (2008) The integrated use of chemical insecticides and the entomopathogenic nematode, *Steinernema carpocapsae* (Nematoda: Steinernematidae), for the control of sweetpotato whitefly, *Bemisia tabaci* (Hemiptera: Aleyrodidae). Insect Sci 15:447–453
255. Ansari NA, Rasheed Z (2009) Non-enzymatic glycation of proteins: from diabetes to cancer. Biochem (Mosc) Suppl Ser B Biomed Chem 3(4):335
256. Ansari MA, Butt TM (2011) Effects of successive subculturing on stability, virulence, conidial yield, germination and shelf-life of entomopathogenic fungi. J Appl Microbiol 110(6):1460–1469
257. Bruno TJ, Svoronos PD (2020) CRC handbook of basic tables for chemical analysis: data-driven methods and interpretation. CRC Press, Boca Raton, FL
258. Acharya S, Dogra K (2020) Understanding HANK: insights from a PRANK. Econometrica 88(3):1113–1158
259. Shehata IE, Hammam MMA, El-Borai FE, Duncan LW, Abd-Elgawad MMM (2020) Traits of the entomopathogenic nematode, Heterorhabditis bacteriophora (Hb-EG strain), for potential biocontrol in strawberry fields. Egypt J Biol Pest Control 30:40
260. Skowronek M, Sajnaga E, Pleszczyńska M, Kazimierczak W, Lis M, Wiater A (2020) Bacteria from the midgut of common cockchafer (*Melolontha melolontha* L.) larvae exhibiting antagonistic activity against bacterial symbionts of entomopathogenic nematodes: isolation and molecular identification. Int J Mol Sci 21(2):580
261. Dziedziech A, Shivankar S, Theopold U (2020) *Drosophila melanogaster* responses against entomopathogenic nematodes: focus on hemolymph clots. Insects 11(1):62
262. Kaplan SC (2020) Body mass index and social anxiety: effects of implicit weight bias and body salience in undergraduate women. Doctoral dissertation, Temple University. Libraries
263. Kaya HK (2002) Natural enemies and other antagonists. In: Gaugler R (ed) Entomopathogenic nematology. CABI Publishing, Wallingford, UK, pp 189–203

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S. Sivaramakrishnan and M. Razia, *Entomopathogenic Nematodes and Their Symbiotic Bacteria*, Springer Protocols Handbooks, https://doi.org/10.1007/978-1-0716-1445-7,