

## CURRICULUM VITAE

### Kenneth F. Haynes

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#### Education:

- University of California, Davis, Ph. D. in Entomology, 1982
- State University of New York at Binghamton, B.S. in Biological Science, 1976

#### Employment

- Professor of Entomology, Department of Entomology, University of Kentucky (July 1, 1995–Present)
- Bobby C. Pass Research Professor, University of Kentucky (July 1, 2012– June 30, 2016)
- Associate Professor of Entomology, University of Kentucky (July 1, 1991–June 30, 1995)
- Assistant Professor of Entomology, University of Kentucky (September 1, 1986–June 30, 1991)
- Postdoctoral Research Associate, University of California, Riverside (August 1982–August 1986)

#### Awards and Honors:

- Phi Beta Kappa (Elected 1976)
- University of California Regents Fellowship (1977–1978)
- Distinguished Scholar Research Award (1977)
- Earl C. Anthony Fellowship (1978–Declined to accept NSF award)
- National Science Foundation Graduate Fellowship (1978–1981)
- Teaching Award for Outstanding Graduate Student (U. C. Davis, 1982)
- Thomas Poe Cooper Research Award, College of Agriculture (1993)
- Wethington Award for Grantsmanship, University of Kentucky (2009–2010)
- High Impact Research/Extension Program Award (2011 with M. Potter and R. Palli)
- Fellow, American Association for the Advancement of Science (2011)
- Paul Catts Memorial Lecture, Washington State University (2011)
- GGE Scudder Lecture, University of British Columbia (2012)
- Vince Parman Memorial Lecture, North Carolina State University (2012)
- C. V. Riley Award, North Central Branch, ESA (2012)
- Thomas and Nina Leigh Distinguished Alumni Seminar, UC Davis (2013)

#### Refereed Journal Articles

1. Pollak EI, Becker LR, **Haynes K.** 1978. Sensory control of mating in the blue gourami, *Trichogaster trichopterus* (Pisces, Belontiidae). *Behavioral Biology* 22:92–103.
2. **Haynes KF**, Birch MC, Klun JA. 1981. Sex pheromone offers promise for control of the artichoke plume moth. *California Agriculture* 35:13–14.
3. Klun JA, **Haynes KF**, Bierl–Leonhardt BA, Birch MC, Plimmer JR. 1981. Sex pheromone of the female artichoke plume moth, *Platyptilia carduidactyla*. *Environ Entomol* 10:763–765.

4. **Haynes KF**, Gaston LK, Pope MM, Baker TC. 1983. Rate and periodicity of pheromone release from individual female artichoke plume moths. *Environ Entomol* 12:1597–1600.
5. **Haynes KF**, Birch MC. 1984a. Mate locating and courtship behaviors of the artichoke plume moth, *Platyptilia carduidactyla*. *Environ Entomol* 13:399–408.
6. **Haynes KF**, Birch MC. 1984b. The periodicity of pheromone release and male responsiveness in the artichoke plume moth, *Platyptilia carduidactyla*. *Physiol Entomol* 9:287–295.
7. **Haynes KF**, Gaston LK, Pope MM, Baker TC. 1984. Potential for evolution of resistance to pheromones: interindividual and interpopulational variation in chemical communication system of pink bollworm moth. *J Chem Ecol* 10:1551–1565.
8. Baker TC, Willis MA, **Haynes KF**, Phelan PL. 1985. A pulsed cloud of sex pheromone elicits upwind flight in male moths. *Physiol Entomol* 10:257–265.
9. **Haynes KF**, Baker TC. 1985. Sublethal effects of permethrin on the chemical communication system of the pink bollworm moth. *Arch Insect Biochem Physiol* 2:283–293.
10. **Haynes KF**, Birch MC. 1986. Temporal reproductive isolation between two species of plume moths. *Ann Entomol Soc Amer* 79:210–215.
11. **Haynes KF**, Li WG, Baker TC. 1986a. Control of pink bollworm moth with insecticides and pheromones (attracticide): Lethal and sublethal effects. *J Econ Entomol* 79:1466–1471.
12. **Haynes KF**, Miller TA, Staten RT, Li WG, Baker TC. 1986b. Monitoring insecticide resistance with insect pheromones. *Experientia* 42:1293–1295.
13. **Haynes KF**, Parrella MP, Miller TA, Trumble J. 1986c. Monitoring insecticide resistance with yellow sticky cards. *California Agriculture* 40:11–12.
14. Li W, **Haynes KF**, Baker TC. 1986. Sensory and behavioral effects of gossypure alcohol on the sex pheromone response of male pink bollworm moths. *J Chem Ecol* 12:25–38.
15. Baker TC, **Haynes KF**. 1987. Manuevers used by flying male oriental fruit moths to relocate a sex pheromone plume in an experimentally shifted wind field. *Physiol Entomol* 12:263–279.
16. **Haynes KF**. 1987. Identification of the sex pheromone of the calendula plume moth, *Platyptilia williamsii*. *J Chem Ecol* 13:907–916.
17. **Haynes KF**, Miller TA, Staten RT, Li WG, Baker TC. 1987. Pheromone trap for monitoring insecticide resistance in the pink bollworm moth, *Pectinophora gossypiella*: New tool for resistance management. *Environ Entomol* 16(1):84–89.
18. **Haynes KF**, Baker TC. 1988. Potential for evolution of resistance to pheromones: World wide and local variation in the chemical communication system of the pink bollworm moth, *Pectinophora gossypiella*. *J Chem Ecol* 14:1547–1560.
19. Baker TC, **Haynes KF**. 1989. Field and laboratory electroantennographic measurements of pheromone plume structure. *Physiol Entomol* 14:1–12.
20. **Haynes KF**, Baker TC. 1989. An analysis of anemotactic flight in female moths stimulated by host odour and comparison to the males' response to sex pheromone. *Physiol Entomol* 14:279–289.
21. Campero DM, **Haynes KF**. 1990. Effects of methoprene on chemical communication, courtship and oviposition in the cabbage looper moth. *J Econ Entomol* 83:2263–2268.
22. Clark JD, **Haynes KF**. 1990. Sex attractant for the bluegrass webworm. *J Econ Entomol* 83:856–859.
23. **Haynes KF**. 1990. Identification of the sex pheromone of the bristly cutworm, *Lacinipolia renigera* (Stephens). *J Chem Ecol* 16:2615–2621.
24. **Haynes KF**, Hunt RE. 1990a. Interpopulational variation in the six component pheromone blend of the cabbage looper moth, *Trichoplusia ni*. *J Chem Ecol* 16:509–519.
25. **Haynes KF**, Hunt RE. 1990b. A mutation in the pheromonal communication system of the cabbage looper moth, *Trichoplusia ni*. *J Chem Ecol* 16:1249–1257.

26. Hunt RE, **Haynes KF**. 1990. Periodicity in the quantity and blend ratios of pheromone components emitted by mutant and normal cabbage looper moths. *J Insect Physiol* 36:769–774.
27. Hunt RE, Zhao BG, **Haynes KF**. 1990. Genetic aspects of interpopulational differences in the pheromone blend of the cabbage looper moth, *Trichoplusia ni*. *J Chem Ecol* 16:2935–2946.
28. **Haynes KF**, Zhao JZ, Latif A. 1991. Identification of floral compounds from *Abelia grandiflora* that stimulate upwind flight in cabbage looper moths, *Trichoplusia ni*. *J Chem Ecol* 17:637–646.
29. McLellan KAM, Nordin GL, **Haynes KF**. 1991. Chemical communication and reproductive isolation in two types of the fall webworm. *Ann Entomol Soc Amer* 84:118–123.
30. Clark DC, **Haynes KF**. 1992a. Sublethal effects of cypermethrin on chemical communication, courtship and oviposition in the cabbage looper moth. *J Econ Entomol* 85:1771–1778.
31. Clark DC, **Haynes KF**. 1992b. Sublethal effects of chlordimeform on chemical communication and other reproductive behaviors in the cabbage looper moth. *Arch Insect Biochem Physiol* 19:105–117.
32. ElAgamy FM, **Haynes KF**. 1992. Susceptibility of the pea aphid to a predator and an insecticide in the presence of synthetic alarm pheromone. *J Econ Entomol* 85:794–798.
33. **Haynes KF**, Potter DA, Collins JT. 1992. Attraction of male beetles to grubs: Evidence for the evolution of a sex pheromone from larval odor. *J Chem Ecol* 18:1117–1124.
34. Hunt RE, Fox JP, **Haynes KF**. 1992. Behavioral response of *Graminella nigrifrons* to experimentally manipulated vibrational signals. *J Insect Behavior* 5:1–13.
35. Liu YB, **Haynes KF**. 1992. Filamentous nature of pheromone plumes protects integrity of signal from background noise in cabbage looper moths, *Trichoplusia ni*. *J Chem Ecol* 18:299–307.
36. Todd JL, **Haynes KF**, Baker TC. 1992. Antennal neurones specific for redundant pheromone components in normal and mutant *Trichoplusia ni* males. *Physiol Entomol* 17:183–192.
37. Hunt RE, Parr JC, **Haynes KF**. 1993. Influence of leafhopper gender and female mating status on plant disease dynamics within a simple habitat. *Environ Entomol* 22:109–115.
38. Liu YB, **Haynes KF**. 1993a. Impact of (*Z*) 7 dodecenol and turbulence on pheromone mediated flight manoeuvres of male *Trichoplusia ni*. *Physiol Entomol* 18:363–371.
39. Liu YB, **Haynes KF**. 1993b. Pheromone mediated responses of male cabbage looper moths following various exposures to sex pheromone or (*Z*)-7 dodecenol. *J Chem Ecol* 19:503–515.
40. Potter DA, **Haynes KF**. 1993. Field testing pheromone traps for predicting masked chafer (*Scarabaeidae*) grub density in golf course turf and home lawns. *J Entomol Sci* 28:205–212.
41. Jurenka RA, **Haynes KF**, Adlof R, Bengtsson M, Roelofs WL. 1994. Sex pheromone component ratio in the cabbage looper moth altered by a mutation affecting the fatty acid chain shortening reactions in the pheromone biosynthetic pathway. *Insect Biochem Mol Biol* 24:373–381.
42. Liu YB, **Haynes KF**. 1994a. Temporal and temperature-induced changes in emission rates and blend ratios of sex pheromone components in *Trichoplusia ni*. *J Insect Physiol* 40:341–346.
43. Liu YB, **Haynes KF**. 1994b. Evolution of behavioral responses to sex pheromone in mutant laboratory colonies of *Trichoplusia ni*. *J Chem Ecol* 20:231–238.
44. **Haynes KF**, Potter DA. 1995. Chemically mediated sexual attraction of male *Cyclocephala lurida* and other *Scarabaeid* beetles to immature stages. *Environ Entomol* 24:1302–1306.
45. Moore AJ, Reagan NL, **Haynes KF**. 1995. Conditional signaling strategies: Effects of ontogeny, social experience and social status on the pheromonal signal of male cockroaches. *Anim Behav* 50:191–202.
46. Baker TC, **Haynes KF**. 1996. Pheromone-mediated optomotor anemotaxis and altitude control exhibited by male oriental fruit moths in the field. *Physiol Entomol* 21:20–32.
47. **Haynes KF**, Yeagan KV, Millar JG, Chastain BB. 1996. Identification of sex pheromone of *Tetanolita mynesalis*, a prey species of bolas spider, *Mastophora hutchinsoni*. *J Chem Ecol* 22:75–89.

48. Moore PJ, ReaganWallin NL, **Haynes KF**, Moore AJ. 1997. Odour conveys status on cockroaches. *Nature* 389:25–25.
49. Zhao JZ, **Haynes KF**. 1997. Does PBAN play an alternative role of controlling pheromone emission in the cabbage looper moth, *Trichoplusia ni*? *J Insect Physiol* 43:695–700.
50. Zhu JW, Chastain BB, Spohn BG, **Haynes KF**. 1997. Assortative mating in two pheromone strains of the cabbage looper moth, *Trichoplusia ni*. *J Insect Behavior* 10:805–817.
51. Gemeno C, Anton S, Zhu JW, **Haynes KF**. 1998. Morphology of the reproductive system and antennal lobes of gynandromorphic and normal black cutworm moths, *Agrotis ipsilon*. *International J Insect Morph Embryol* 27:185–191.
52. Gemeno C, **Haynes KF**. 1998. Chemical and behavioral evidence for a third pheromone component in a North American population of the black cutworm moth, *Agrotis ipsilon*. *J Chem Ecol* 24:999–1011.
53. Bauernfeind RJ, **Haynes KF**, Potter DA. 1999. Responses of three *Cyclocephala* (Coleoptera: Scarabaeidae) species to hexane extracts of *Cyclocephala lurida* sex pheromone. *J Kansas Entomol Soc* 72:246–247.
54. **Haynes KF**, Yeargan KV. 1999. Exploitation of intraspecific communication systems: Illicit signalers and receivers. *Ann Entomol Soc Amer* 92:960–970.
55. Gemeno C, **Haynes KF**. 2000. Periodical and age-related variation in chemical communication system of black cutworm moth, *Agrotis ipsilon*. *J Chem Ecol* 26:329–342.
56. Gemeno C, Lutfallah AF, **Haynes KF**. 2000a. Pheromone blend variation and cross-attraction among populations of the black cutworm moth. *Ann Entomol Soc Amer* 93:1322–1328.
57. Gemeno C, Yeargan KV, **Haynes KF**. 2000b. Aggressive chemical mimicry by the bolas spider *Mastophora hutchinsoni*: Identification and quantification of a major prey's sex pheromone components in the spider's volatile emissions. *J Chem Ecol* 26:1235–1243.
58. Evenden ML, **Haynes KF**. 2001. Potential for the evolution of resistance to pheromone-based mating disruption tested using two pheromone strains of the cabbage looper, *Trichoplusia ni*. *Entomologia Experimentalis et Applicata* 100(1):131–134.
59. Gemeno C, **Haynes KF**. 2001. Impact of photoperiod on the sexual behavior of the black cutworm moth. *Environ Entomol* 30:189–195.
60. Gemeno C, Moore AJ, Preziosi RF, **Haynes KF**. 2001. Quantitative genetics of signal evolution: A comparison of the pheromonal signal in two populations of the cabbage looper, *Trichoplusia ni*. *Behavior Genetics* 31:157–165.
61. **Haynes KF**, Yeargan KV, Gemeno C. 2001. Detection of prey by a spider that aggressively mimics pheromone blends. *J Insect Behavior* 14:535–544.
62. Evenden ML, Spohn BG, Moore AJ, Preziosi RF, **Haynes KF**. 2002. Inheritance and evolution of male response to sex pheromone in *Trichoplusia ni*. *Chemoecology* 12:53–59.
63. **Haynes KF**, Gemeno C, Yeargan KV, Millar JG, Johnson KM. 2002. Aggressive chemical mimicry of moth pheromones by a bolas spider: how does this specialist predator attract more than one species of prey? *Chemoecology* 12:99–105.
64. Moore AJ, **Haynes KF**, Preziosi RF, Moore PJ. 2002. The evolution of interacting phenotypes: Genetics and evolution of social dominance. *American Naturalist* 160:S186–S197.
65. Spohn BC, Zhu JW, Chastain BB, **Haynes KF**. 2003. Influence of mating disruptants on the mating success of two strains of cabbage loopers, *Trichoplusia ni*. *Environ Entomol* 32:736–741.
66. Rucker CN, **Haynes KF**. 2004. Impairment of optomotor anemotaxis in yellow-eyed mutant cabbage looper moths, *Trichoplusia ni*. *J Insect Behavior* 17:437–442.
67. Zhu JW, **Haynes KF**. 2004. Sex pheromone components of the bronzed cutworm, *Nephelodes minians*, a prey species of a bolas spider, *Mastophora hutchinsoni*. *J Chem Ecol* 30:2047–2056.

68. Kolliker M, Chuckalovcak JP, **Haynes KF**, Brodie ED. 2006. Maternal food provisioning in relation to condition-dependent offspring odours in burrower bugs (*Sehirus cinctus*). Proceedings of the Royal Society B-Biological Sciences 273:1523–1528.
69. **Haynes KF**, McLaughlin J, Stamper S, Rucker C, Webster FX, Czokajlo D, Kirsch P. 2007. Pheromone trap for the eastern tent caterpillar moth. Environ Entomol 36:1199–1205.
70. Romero A, Potter MF, Potter DA, **Haynes KF**. 2007b. Insecticide resistance in the bed bug: A factor in the pest's sudden resurgence? J Med Entomol 44:175–178.
71. Hemmann DJ, Allison JD, **Haynes KF**. 2008. Trade-off between sensitivity and specificity in the cabbage looper moth response to sex pheromone. J Chem Ecol 34:1476–1486.
72. Seagraves BL, **Haynes KF**, Redmond CT, Tittle S, Potter DA. 2008. Seasonal biology and management of the maple shoot borer, *Proteoteras aesculana*, in production nurseries. Pest Management Science 64:1040–1049.
73. Domingue MJ, **Haynes KF**, Todd JL, Baker TC. 2009. Altered olfactory receptor neuron responsiveness is correlated with a shift in behavioral response in an evolved colony of the cabbage looper moth, *Trichoplusia ni*. J Chem Ecol 35:405–415.
74. Mas F, **Haynes KF**, Kolliker M. 2009. A chemical signal of offspring quality affects maternal care in a social insect. Proc RoySociety B 276:2847–2853.
75. Romero A, Potter MF, **Haynes KF**. 2009a. Evaluation of piperonyl butoxide as a deltamethrin synergist for pyrethroid-resistant bed bugs. J Econ Entomol 102:2310–2315.
76. Romero A, Potter MF, **Haynes KF**. 2009b. Behavioral responses of the bed bug to insecticide residues. J Med Entomol 46:51–57.
77. Sloggett JJ, **Haynes KF**, Obrycki JJ. 2009a. Hidden costs to an invasive intraguild predator from chemically defended native prey. Oikos 118:1396–1404.
78. Sloggett JJ, Obrycki JJ, **Haynes KF**. 2009b. Identification and quantification of predation: novel use of gas chromatography–mass spectrometric analysis of prey alkaloid markers. Funct Ecol 23:416–426.
79. Kajita Y, Obrycki JJ, Sloggett JJ, **Haynes KF**. 2010. Intraspecific alkaloid variation in ladybird eggs and its effects on con- and hetero-specific intraguild predators. Oecologia 163:313–322.
80. Moser SE, **Haynes KF**, Obrycki JJ. 2010. Behavioral response to larval tracks and the influence of tracks on intraguild scavenging by coccinellid larvae. J Insect Behavior 23:45–58.
81. Romero A, Potter MF, **Haynes KF**. 2010a. Circadian rhythm of spontaneous locomotor activity in the bed bug, *Cimex lectularius* L. J Insect Physiol 56:1516–1522.
82. Romero A, Potter MF, **Haynes KF**. 2010b. Evaluation of chlorfenapyr for control of the bed bug, *Cimex lectularius* L. Pest Management Science 66:1243–1248.
83. Schwartzberg EG, **Haynes KF**, Johnson DW, Brown GC. 2010. Wax structures of the ladybird beetle *Scymnus louisianae* attenuate aggression from aphid-tending ants. Environ Entomol 39:1309–1314.
84. Zhu F, Wigginton J, Romero A, Moore A, Ferguson K, Palli R, Potter MF, **Haynes KF**, Palli SR. 2010. Widespread distribution of knockdown resistance mutations in the bed bug, *Cimex lectularius* populations in the United States. Arch Insect Biochem Physiol 73:245–257.
85. Zhu F, Sams S, Moural T, **Haynes KF**, Potter MF, Palli SR. 2012. RNA interference of NADPH-Cytochrome P450 reductase results in reduced insecticide resistance in the bed bug, *Cimex lectularius*. Plos One 7.
86. Goodman MH, Potter MF, **Haynes KF**. 2013. Effects of juvenile hormone analog formulations on development and reproduction in the bed bug *Cimex lectularius*. Pest Managt Sci 69:240–244.
87. Welch KD, **Haynes KF**, Harwood JD. 2013. Microhabitat evaluation and utilization by a foraging predator. Anim Behav 85:419–425.

88. Zhu F, Gujar H, Gordon JR, **Haynes KF**, Potter MF, and Palli SR. 2013. Bed bugs evolved unique adaptive strategy to resist pyrethroid insecticides. *Scientific Reports* 3: srep01456.
89. Sun, Q, **Haynes KF**, and Zhou XG. 2013. Differential undertaking response of a lower termite to congeneric and conspecific corpses. *Scientific Reports* 3: srep01650.
90. Kajita, Y, Obrycki, JJ, Sloggett JJ, Evans EW, **Haynes, KF**. 2014. Do defensive chemicals facilitate intraguild predation and influence invasion success in ladybird beetles? *J Chem Ecol* 40: 1212–1219.
91. Liu F, **Haynes KF**, Appel AG, Liu N. 2014. Antennal olfactory sensilla responses to insect chemical repellents in the common bed bug, *Cimex lectularius*. *J Chem Ecol* 40: 522–533.
92. Gordon JR, Goodman MH, Potter MF, **Haynes KF**. 2014. Population variation in and selection for resistance to pyrethroid–neonicotinoid insecticides in the bed bug. *Scientific Reports* 4, srep03836.
93. Gordon JR, Potter MF, **Haynes KF**. 2015. Insecticide resistance in the bed bug comes with a cost. *Scientific Reports* 5, srep10807.
94. Liu YB, **Haynes KF**. 2016. Effects of ultralow oxygen and vacuum treatments on bed bug (Heteroptera: Cimicidae) survival. *J Econ Entomol.* 109: 1310–1316.
95. Millar, JG., **KF Haynes**, AT Dossey, JS. McElfresh, and JD. Allison. 2016. Sex Attractant Pheromone of the Luna Moth, *Actias luna*. *J Chem Ecol* 42: 869–876.
96. Crawley, SE, KA Kowles, JR Gordon, MF Potter, and **KF Haynes**. 2017. Behavioral effects of sublethal exposure to a combination of beta–cyfluthrin and imidacloprid in the bed bug, *Cimex lectularius* L. *Pest Manag Sci* 73: 598–603.
97. Crawley, SE, JR Gordon, KA Kowles, MF Potter, and **KF Haynes**. 2017. Impact of sublethal exposure to a pyrethroid–neonicotinoid insecticide on mating, fecundity and development in the bed bug *Cimex lectularius* L. *Plos One* 12.
98. Sun, Q, **KF Haynes**, and XG Zhou. 2017. Dynamic changes in death cues modulate risks and rewards of corpse management in a social insect. *Functional Ecology* 31: 697–706.
99. Tian, L, EL Preisser, **KF Haynes**, and XG Zhou. 2017. Social buffering in a eusocial invertebrate: termite soldiers reduce the lethal impact of competitor cues on workers. *Ecology* 98: 952–960.
100. Sun, Q, **KF Haynes**, JD Hampton, and XG Zhou. 2017. Sex–specific inhibition and stimulation of worker–reproductive transition in a termite. *Science of Nature* 104: 13. (10.1007/s00114–017–1501–5)
101. Dye–Braumuller, K. C., **KF Haynes**, and GC Brown. 2017. Quantitative analysis of *Aedes albopictus* movement behavior following sublethal exposure to prallethrin. *J American Mosquito Control Association.* 33: 282–292.

## Books

1. Birch MC, **Haynes KF**. 1982. *Insect Pheromones*. London: Edward Arnold. 60 p.
2. Millar JG, **Haynes KF**. 1998. *Methods in Chemical Ecology*. Volume 1. Chemical Methods. New York: Kluwer Academic.
3. **Haynes KF**, Millar JG. 1998. *Methods in Chemical Ecology*. Volume 2. Bioassay Methods. New York: Kluwer Academic.

## Book Chapters and Review Articles

1. **Haynes KF**, Birch MC. 1985. The role of other pheromones, allomones and kairomones in the behavioral responses of insects. In: Kerkut GA, Gilbert LI, editors. *Comprehensive Insect*

- Physiology, Biochemistry and Pharmacology. Volume 9. Behaviour. Oxford: Pergamon Pres. p 225–255.
2. **Haynes KF**. 1988. Sublethal effects of insecticides on the behavioral responses of insects. *Annual Review of Entomology* 33:149–168.
  3. **Haynes KF**. 1997. Genetics of pheromone communication in the cabbage looper moth, *Trichoplusia ni*. In: Carde RT, Minks AK, editors. *Insect pheromone research: new directions*. p 525–534.
  4. Potter DA, Williamson RC, **Haynes KF**, Powell AJ. 2000. Cultural control, risk assessment, and environmentally responsible management of scarab grubs and cutworms in turfgrass. In: Clark JM, Kenna MP, editors. *Fate and Management of Turfgrass Chemicals*. p 383–396.
  5. Cardé RT, **Haynes KF**. 2004. Structure of pheromone communication in moths. In: Cardé RT, Millar JG, editors. *Advances in Insect Chemical Ecology*. Cambridge: Cambridge University. p 283–332.
  6. **Haynes KF**. 2004. Chemical mimicry. In: Hardege J, editor. *Chemical Ecology: EOLSS, UNESCO*.
  7. Sloggett JJ, **Haynes KF**, Obrycki JJ, Davis AJ. 2010. *Harmonia axyridis* as a model for predator adaptation to chemically defended prey. In: Roy HE, Babendreier D, editors. *Benefits and Risks of Exotic Biological Control Agents: IOBC/wprs*.
  8. **Haynes, KF**, Potter MF. 2012. Recent progress in bed bug management. In: Ishaaya I, Palli R, Horowitz AR, editors. *Advanced Technologies for Managing Insect Pests*. Dordrecht: Springer. p 269–278.
  9. **Haynes, KF**. 2012. Sleeping with the enemy. *Scientific American* 306:50–55.
  10. **Haynes, KF**. 2016. Genetic control of moth sex pheromone signal and response. pp. 89–100. In: Allison, J D, Cardé, RT. *Pheromone Communication in Moths: Evolution, Behavior, and Application*. University of California Press.

### Other Publications

- **Haynes KF**. 2002. Review: Signalers and receivers: mechanisms and evolution of arthropod communication. *Quarterly Review of Biology* 77:483.
- **Haynes, KF** 2017. Editorial overview: Insect pheromones: making sense of a rapidly diversifying field of study. *Current Opinion Insect Science*. 24: VII–IX.
- **Twenty trade journal articles with MF Potter and my students.**

### Patents, Patent Applications

- Liu YB, **Haynes, KF**. 1994. Automated adjustable interval insect trap. Patent number 5,325,625.
- Wu TT, **Haynes K**, Hope J. 2011. Identification of insect attractant, arresting and or aggregation compounds and methods thereof. US2011/0293553 A1.
- Loudon C, Corn R, Szyndler M, **Haynes K**, Potter MF. 2015. Microfabricated surfaces for the physical capture of insects US 20150013213 A1.
- Liu YB, **Haynes KF**. 2014. Method for bed bug control. USDA and University of Kentucky Research Foundation, Assignees. U.S. Patent Application Serial No. 14/309,045.

**Invited Presentations:** Over 95 invited presentations in 24 states and 8 countries

### Summary of Extramural Grants Funded:

- “Redundancy in chemical communication as a buffer against environmental noise” and “Evolution sex pheromone blends. Four grants covering 15 years of funding. 1987–2002.

- USDA–Competitive Research Grant. **KF Haynes** (PI) \$568,000
- “Leafhopper mating behavior: Impact on habitat selection and plant disease spread” and “Leafhopper mating behavior: acoustical signals in mate finding and selection.” Two grants covering 6 years of funding. 1989–1995. USDA–Competitive Research Grants. R. E. Hunt (PI, Postdoc). **KF Haynes** (Scientific advisor or Co-PI). \$201,000
  - “Development of a pheromone–based decision–making system for managing white grub problems in turfgrass.” and “Damage thresholds, risk assessment and environmentally–compatible management tactics for white grub pests of turfgrass.” 1990–1997. O J Noer Research Foundation and US Golf Association. D. A. Potter (PI) and **KF Haynes** Co-PI. \$156,000
  - “The genetics of sexual selection in *Nauphoeta cinerea*” and “Sexual selection and plasticity in social behavior and signals.” 1991–1999. Two grants from NSF covering eight years, Population Biology and Physiological Ecology Program then NSF, Animal Behavior. A J Moore (PI), **KF Haynes** (Co-PI). \$386,000.
  - “Aggressive chemical mimicry of prey pheromones”. Covers research on bolas spiders. 1997–2002. NSF–IBN, Animal Behavior Program. **KF Haynes** (PI) and KV Yeorgan (Co-PI). \$155,000.
  - Isolation and identification of chemical compounds from volatiles emitted by bed bugs. Bayer CropScience. 2007–2009. **KF Haynes**, PI. \$130,000 .
  - Intraguild predation between aphidophagous lady beetles: Chemical perspective on community effects. 2008–2011. USDA National Research Initiative Competitive Grants Program. Obrycki JJ (PI) and **Haynes KF** (Co-PI), \$211,000
  - “Talk to the dead: Chemical communication in corpse management in termites.” Kentucky Science and Education Foundation. 2013–2015. Zhou X (PI) and **Haynes KF** (Co-PI) \$30,000.
  - “Sublethal effects of neurotoxic insecticides on insect behavior.” CAMTech (NSF–Industry–University Cooperative Research Center). 2017–2018. **KF Haynes** (PI), MF Potter (Co-PI), \$140,000.
  - Other grants from various sources, \$157,947 (\$74,292 as PI).

#### **Unrestricted Gifts to Support Research:**

- Since 2005 the **Haynes** laboratory has received just over one million dollars in unrestricted gifts to support its bed bug research program. These funds have come from pest management associations (KPMA, NPMA) and the pest management and chemical industries.

#### **Professional Status and Activities:**

- Guest Editor, Current Opinions in Insect Science, Issue on Pheromones. 2017
- Counselor, International Society of Chemical Ecology, 2017–2020
- Past–President, International Society of Chemical Ecology, 2016–2017.
- President–Elect, International Society of Chemical Ecology, 2014–2015.
- Treasurer, International Society of Chemical Ecology, 2005–2011.
- Counselor, International Society of Chemical Ecology, 2003–2005.
- Scientific Committee for Asian–Pacific Association of Chemical Ecology, 2015
- Editorial Board, Ann Entomol Soc Amer, 1992–1996.
- Subject Editor, Environ Entomol, 2003–2008
- Reviewer for *Am Nat*, *Anim Behav*, **Ann Entomol Soc Amer**, *Behav Ecol and Sociobiol*, *Biol Bull*, *Biological J the Linnean Soc*, *BMC Biology*, *Canadian Entomol*, *Canadian J Zool*, *Chemoecology*, *Ecology Letters*, *Entomol Experimentalis et Appl*, **Environ Entomol**,



*Evolution, Florida Entomol, J Agricultural Entomol, J Asia–Pacific Entomol, J Chem Ecol, J Comp Neurol, J Comp Physiol A, J Econ Entomol, J Exper Biol; J Insect Behavior, J Insect Physiol, J Med Entomol, J Theoretical Biol, Naturwissenschaften, Oecologia, Pest Management Science, Plant Physiol, PlosOne, PNAS, Scientific Reports, Bold indicates many reviews.*

- Grant Review Panel, USDA Competitive Research Grant Program 1988, 1989, 1992, 1998.
- Ad Hoc Grant Reviews for USDA–NRI, USDA–SBIR, NSF, Israel Science Foundation

#### **Professional Societies:**

- International Society of Chemical Ecology
- American Association for the Advancement of Science
- Entomological Society of America
- Phi Beta Kappa

#### **Teaching:**

- **Insect Biology** (ENT 110), Taught 8 times between 1996 — 2007.
- **Agricultural Pest and Disease Management** (GEN 103), Taught 6 times , 1987 —1994.
- **Insect Behavior** (ENT/BIO 568), Taught 15 times, 1989–present.
- **Entomology Graduate Seminar** (ENT 770), Taught 9 times,1988–present.

#### **Summary of Professional Accomplishments:**

**Research and Impact.** Over my career I have had the great opportunity to explore fascinating and important aspects of insect behavior and chemical ecology. My students, postdoctoral scholars, colleagues, and I have studied the evolution of chemical communication in moths using the cabbage looper moth, *Trichoplusia ni*, as our focal species. In order for communication systems to diversify and still be effective the signaler and responder must co–evolve. In arthropods signaling and response are almost always distinctly different. For example, production of unique pheromone blends has no obvious linkage to sensory and behavioral processing of these signals. If we could solve the problem of how signal and response become functional in a species, then we could help solve the puzzle for a broad range of communication modalities, and insect–plant interactions. Our studies have revealed that single gene mutations can have a dramatic impact on the pheromone blend (e.g., a trace component becomes the major component). Then gradual changes in the specificity (or tuning) of the male’s behavioral response can lead to adaptations to the new blend. In addition, the evolutionary history of how moths adapt to maintain the specificity of their signaling system generates predictions about how they will adapt to mating interference with synthetic pheromone. We can use this information to follow “pheromone resistance” in the field, and modify the pheromone blend used to optimize mating disruption.

In recent years my program has expanded to include a focus on bed bug biology, behavior and control. We were the first to discover that insecticide resistance was widespread in resurgent U.S. populations. While other factors certainly contribute to the resurgence, it is likely that pyrethroid resistance is the major factor. My students, colleagues (especially Mike Potter and S. Reddy Palli) and I continue to study the mechanisms of insecticide resistance, but my program has expanded to include other studies in bed bugs, including the role endosymbiotic bacteria in digestion of blood, pheromones that are involved in mating and aggregation, synthetic repellents that could help to prevent human–dependent spread of populations, and sublethal effect of insecticides on bed bug behavior.

Another dimension of professional accomplishment is my effort to broaden the impact of my work beyond that of peer reviewed publications. For example, I co-edited two books (bioassays and chemistry) on *Methods in Chemical Ecology* that are unique in providing a starting point for this complex area of study. In a book review published in *Ecology*, Anurag Agrawal stated “beginning graduate students as well as established researchers will benefit from using individual chapters from this volume as a springboard for interdisciplinary research that will link an understanding of the chemical basis of interactions with real processes in the field.” I also wrote with Martin Birch a book on *Insect Pheromones* for teachers and students in general biology. David Wood wrote in the *J Chem Ecol* that “this book will perhaps recruit new students trained in both the biological as well as physical sciences to continue the exploration of this fascinating and important area of biology.” Individual research projects can have a broader impact too. For example, Ken Yeaman and I have studied the bolas spider for years. This spider changes the pheromone mimic blend that she produces to attract two species of moths (males only) at different times of night. Thomas Eisner said to *Nature News* “To specialize on different moths at different times of the night is amazing.” Our publication of this result led to Sir David Attenborough visiting Lexington to film the bolas spider for his program on *Life in the Undergrowth*. Conducting research that has an impact on the public’s appreciation of nature is as important as the work that I have done that has an impact on pest management. When these two goals merge, as they have with an ongoing project on the evolutionary origin of sex pheromones in white grubs (with Dan Potter, Athula Attygalle, Walter Leal and Jerrold Meinwald), it is doubly rewarding. Similarly, my paper in *Scientific American* (February 2012) on bed bugs will bring some of the important work that we have been doing with bed bugs to the public’s attention.

When it comes to insect behavior and chemical ecology, diversity is the spice of life. I have always enjoyed working on diverse projects in which my perspective on and expertise with behavior and chemical ecology can be useful to answering questions raised by colleagues. This collaborative research includes research on maternal care (earwigs and burrowing bugs), dominance hierarchies in cockroaches, aggression and undertaking behavior in termites, intraguild impact of defensive alkaloids in lady beetles, vibrational communication in leafhoppers and many others.

**Teaching and Mentoring.** I have had the privilege of teaching diverse classes with diverse audiences. Insect Behavior (ENT/BIO 568) is an inherently exciting class that serves both upper level undergraduates and graduate students. In this class I provide a substantive framework of information that is supplemented with demonstrations and video clips that reinforce principles. I attempt to engage the students with contemporary issues in insect behavior by having them analyze the key papers of recent years. From my perspective the class is successful when students learn an evolutionary approach to asking questions about behavior, when they can use their knowledge base to identify strengths and weakness of published work, when they can present their ideas and knowledge to others (both written and oral), and when they come out of the class with renewed excitement about the diverse behaviors of insects. At least 400 students have taken this class over the last 30 years.

Insect Biology (ENT 110) is a science class for students outside of the biological sciences. I designed the class to be engaging and to stimulate a group of students where this may be the only classroom experience that they will have in science. Sure they learn about this wonderfully diverse group of animals, but they also learn something about the scientific method, an evolutionary perspective, and critical thinking and writing. I think that most of the materials that I prepared for this class have been useful to other instructors that taught it subsequently. Over 500 students have taken this class with me.

I think my professional impact has been amplified by the accomplishments of individuals whom I have mentored. I have advised 13 graduate students and advised or co-advised 11 postdoctoral scholars. Nine of these individuals have gone on to academic positions, three to Ph.D. level research positions in government agencies. Others have gone on to work in industry, teach in community colleges or high schools, or work with

state agencies. I also was actively involved in the advisory committees of 60 other graduate students, and advised dozens of undergraduates (either as an employer or research mentor).