RING T. CARDÉ

a. Professional Preparation

Tufts University	B.S. (Biology), 1966
Cornell University	M.S. (Entomology) 1968, Ph.D. (Entomology) 1971
New York State Agricultural Experiment Station at Geneva (Cornell University)	Postdoctoral Associate, 1971-1975

b. Appointments and Professional Activities

Positions Held

1996-present Distinguished Professor & Alfred M. Boyce Endowed Chair in Entomology, University of California, Riverside
2011 Visiting Professor, Swedish Agricultural University (SLU), Alnarp
2003-2009 Chair, Department of Entomology, University of California, Riverside
1989-1996 Distinguished University Professor, University of Massachusetts
1988 Visiting Scientist, Wageningen University
1984-1989 Professor of Entomology, University of Massachusetts
1981-1987; 1993-1995 Head, Department of Entomology, University of Massachusetts
1981-1984 Associate Professor of Entomology, University of Massachusetts
1978-1981 Associate Professor of Entomology, Michigan State University
1975-1978 Assistant Professor of Entomology, Michigan State University

Honors and Awards (selected)

Fellow, California Academy of Sciences, 2017
Certificate of Distinction for Outstanding Achievements, International Congress of Entomology, 2016
President, International Society of Chemical Ecology, 2012-2013
Jan Löfqvist Grant, Royal Academy of Natural Sciences, Medicine and Technology, Sweden, 2011
Jerry Graves Distinguished Seminar, Department of Entomology, Louisiana State University 2010
Silver Medal, International Society of Chemical Ecology, 2009
Awards for "Encyclopedia of Insects" include:
- "Most Outstanding Single-Volume Reference in Science", Association of American Publishers 2003
- "Outstanding Academic Title", CHOICE 2003
- "Best of Reference", New York Public Library 2003 and American Library Journal 2003
- "Outstanding Book" Association of College and Research Libraries 2010 (2nd edition)

E.H. Strickland Memorial Lecture, University of Alberta, 2006
Distinguished Lecturer, Louisiana State University, 2004
Fellow, Entomological Society of America, 1998
Fellow, American Association for the Advancement of Science, 1997
Kenneth Roeder Memorial Lecture, Tufts University, 1994
Fellow, Entomological Society of Canada, 1992
Fellow, Royal Entomological Society, 1992
Chancellor's Medal, University of Massachusetts, 1988
Distinguished Faculty Lecturer, University of Massachusetts, 1988
International Agricultural Centre Fellowship, Agricultural University, Wageningen, The Netherlands, 1988
Recognition Award in Entomology, Entomological Society of America,1980.

Editorial

Editor-in-Chief, Journal of Insect Behavior, 2018-; Editorial Board, Insects, 2018-; Associate Editor, Annual Review of Entomology 1998-2018; Editorial Committee, Annual Review of Entomology 1989-1994; 1998-2018; Editorial Board, Journal of Chemical Ecology, 1980-2002; Editorial Board, Journal of Insect Behavior, 1987-1994; Editorial Board, Annals of the Entomological Society of America, 1982-1986; Chair 1985-1986; Subject Editor for Behavior, Journal of Economic Entomology, 2002-2004.

Principal Professional Activities (selected)

Program Manager, USDA Competitive Grants-Pest Science, 1988-1989; Chair, Section C, Entomological Society of America, 1987; Governing Board, Entomological Society of America, 1988-1991; Awards Committee, Entomological Society of America, 1988-1991; Fellows Committee, Entomological Society of America, 1999-2002, Chair 2002; NSF Sensory Systems and Computational Neuroscience Panel, 2002-2003; Co-Organizer of the 1st, 2nd & 3rd International Symposia on Insect Pheromones (Wageningen, The Netherlands, 1990 & 1994, Bäckaskog, Sweden, 2003); Scientific Program Co-Chair, Joint Meeting of the International Society of Chemical Ecology and the Asia Pacific Association of Chemical Ecologists, Melbourne, Australia, 2013; Scientific Organizing Committee, International Society of Chemical Ecology meeting, 2014; Councilor, International Society of Chemical Ecology, 2014-2017.

Teaching (last 3 years)

Insect Behavior (BIOL/ENTM 162); Core Graduate Curriculum, section on Insect Behavior (ENTM 203); Seminar on Insect Behavior (ENTM 252), Biology, Section on Evolution (BIOL 5C).

Program Review Panels (selected)

Departments of Entomology at: University of Massachusetts, 1980; Mississippi State University, 1984; Oregon State University, l985; University of Wisconsin, 1991; University of Arizona (Panel Chair), 1995; Cornell University (Ithaca and Geneva) (Panel Chair), 2006; University of Arizona, 2009; University of Illinois (Panel Chair), 2017; Graduate Program in Organismic and Evolutionary Biology, University of Massachusetts (Panel Chair), 2000. Plant Protection, Swedish Agricultural University (SLU), 2009. USDA Asian Gypsy Moth Scientific Advisory Panel 1996-; USDA Light Brown Apple Moth Technical Working Group 2007-2010; European Grapevine Moth Technical Working Group 2009-2017; Gypsy Moth Technical Working Group 2017-; Navel Orangeworm Technical Working Group 2017-2018.

c. **BOOKS:**

1. Bell, W.J. and R.T. Cardé, eds. 1984. Chemical Ecology of Insects. Chapman & Hall, London. 524 p.
   1a. 1990. Chemical Ecology of Insects. Chinese edition, Beijing. 654 p.

2. Cardé, R.T. and W.J. Bell, eds. 1995. Chemical Ecology of Insects 2. Chapman & Hall, New York. 433 p.

3. Cardé, R.T. and A. K. Minks, eds. 1996. Insect Pheromone Research. New Directions. Chapman & Hall, New York. 684 p. (also in electronic format)

4. Resh, V.H. and R.T. Cardé, eds. 2003. Encyclopedia of Insects, Academic Press, San Diego. 1266 p.

5. Cardé, R.T. and J.G. Millar, eds. 2004. Advances in the Chemical Ecology of Insects. Cambridge University Press. 341 p. (also in electronic format).

6. Resh, V.H. and R.T. Cardé, eds. 2009. Encyclopedia of Insects, 2nd edn. Academic Press, San Diego. 1132 p. (also in electronic format)

7. Cardé, R.T. and V.H. Resh, eds. 2012. A World of Insects. The Harvard University Reader. Harvard University Press, Cambridge. 404 p.

8. Allison, J.D. and R.T. Cardé, eds. 2016. Pheromone Communication in Moths. Evolution, Behavior and Application. University of California Press, Berkeley, 401 p (also in electronic format).

Berenbaum, M.R., R.T. Cardé and G.E. Robinson, eds. 1998-2018. Annual Review of Entomology (volumes 43-63).

d**. Publications (excludes patents, abstracts, technical reports, obituaries and book reviews)**

1. Cardé, R.T. 1965. Some taxonomic notes on the nearctic *Holomelina* (Arctiidae), with a partial key to the species. J. Lepid. Soc. 19:69-76.

2. Shapiro, A.M. and R.T. Cardé. 1970. Habitat selection and competition among sibling species of satyrid butterflies. Evolution 4:48-54.

3. Cardé, R.T., A.M. Shapiro and H.K. Clench. 1970. Sibling species in the *eurydice* group of *Lethe* (Lepidoptera: Satyridae). Psyche 77:70-103.

4. Roelofs, W.L. and R.T. Cardé. 1971. Hydrocarbon sex pheromone in tiger moths (Arctiidae). Science 171:684-686.

5. Roelofs, W.L., R.T. Cardé, G. Benz and G. von Salis. 1971. Sex attractant of the larch bud moth found by electroantennogram method. Experientia 27:1438-1439.

6. Roelofs, W.L., R. Bartell, A. Hill, R. Cardé, and W.L. Waters. 1972. Codling moth attractant--field trials with geometrical isomers. J. Econ. Entomol. 65:1276-1277.

7. Roelofs, W.L., R.T. Cardé, R.J. Bartell and P.G. Tierney. 1972. Sex attractant trapping of the European corn borer in New York. Environ. Entomol. 1:606-8.

8. Roelofs, W.L., R. Cardé, and J. Tette. 1973. Oriental fruit moth attractant synergists. Environ. Entomol. 2:252-254.

9. Doane, C.C. and R.T. Cardé. 1973. Competition of gypsy moth males at sex pheromone source and a mechanism for terminating search behavior. Environ. Entomol. 2:603-605.

10. Cardé, R.T., W.L. Roelofs and C.C. Doane. 1973. Natural inhibitor of the gypsy moth sex attractant. Nature 241:474-475.

11. Cardé, R.T. and W.L. Roelofs. 1973. Temperature modification of male sex pheromone response and factors affecting female calling *Holomelina immaculata* (Lepidoptera: Arctiidae). Can. Entomol. 105:1505-1512.

12. Roelofs, W.L., J. Kochansky, R. Cardé, H. Arn and S. Reuscher. 1973. Sex attractant of the grape berry moth, *Lobesia botrana*. Mitt. Schw. Entomol. Ges. 46:71-73.

13. Taschenberg, E.F., R.T. Cardé, A. Hill, J. Tette and W.L. Roelofs. 1974. Sex pheromone trapping of the grape berry moth. Environ. Entomol. 3:192-194.

14. Hill, A., R. Cardé, A. Comeau, W. Bode and W. Roelofs. 1974. Sex pheromones of the tufted apple bud moth (*Platynota ideausalis*). Environ. Entomol. 3:249-252.

15. Taschenberg, E.F., R.T. Cardé, and W.L. Roelofs. 1974. Sex pheromone mass trapping and mating disruption of the redbanded leafroller and grape berry moth in vineyards. Environ. Entomol. 3:239-242.

16. Roelofs, W.L., A.S. Hill, R.T. Cardé and T.C. Baker. 1974. Two sex pheromone components of the tobacco budworm moth. Life Sciences 14:1555-1562.

17. Cardé, R.T., C.C. Doane and W.L. Roelofs. 1974. Diel rhythms of male sex pheromone response and female attractiveness in the gypsy moth. Can. Entomol. 106:479-484.

18. Cardé, R.T. 1974. Diel periodicities of female calling and male pheromone attraction in *Holomelina aurantiaca* (Lepidoptera: Arctiidae). Can. Entomol. 106:933-934.

19. Roelofs, W.L. and R.T. Cardé. 1974. Oriental fruit moth and lesser appleworm attractant mixtures redefined. Environ. Entomol. 3:586-588.

20. Roelofs, W.L. and R.T. Cardé. 1974. Sex pheromones in the reproductive isolation of lepidopterous species. In: Pheromones, Birch, M.C. (ed.). North Holland Publ. pp. 96-114.

21. Roelofs, W.L., A. Hill, R.T. Cardé, J. Tette, H. Madsen and J. Vakenti. 1974. Sex pheromones of the fruit tree leafroller moth, *Archips argyrospilus*. Environ. Entomol. 3:747-751.

22. Hill, A.S., R.T. Cardé, H. Kodo and W.L. Roelofs. 1975. Sex pheromone of the orange tortrix moth, *Argyrotaenia citrana*. J. Chem. Ecol. 1:215-224.

23. Roelofs, W.L., A.S. Hill and R.T. Cardé. 1975. Sex pheromone components of the redbanded leafroller moth, *Argyrotaenia velutinana* (Lepidoptera: Tortricidae). J. Chem. Ecol. 1:83-89.

24. Kochansky, J., R.T. Cardé, J. Liebherr and W.L. Roelofs. 1975. Sex pheromone of the European corn borer, *Ostrinia nubilalis* (Lepidoptera: Pyralidae), in New York. J. Chem. Ecol. 1:225-231.

25. Baker, J.L., A.S. Hill, R.T. Cardé, A. Kurokawa and W.L. Roelofs. 1975. Sex pheromone field trapping of the omnivorous leaf-roller, *Platynota stultana*. Environ. Entomol. 4:91-93.

26. Cardé, R.T., A. Comeau, T.C. Baker and W.L. Roelofs. 1975. Moth mating periodicity: temperature regulates the circadian gate. Experientia 31:46-48.

27. Cardé, R.T., T.C. Baker and W.L. Roelofs. 1975. Behavioural role of individual components of a multichemical attractant system in the oriental fruit moth. Nature 253:348-349.

28. Cardé, R.T., J. Kochansky, J.F. Stimmel, A.G. Wheeler, Jr. and W.L. Roelofs. 1975. Sex pheromones of the European corn borer (*Ostrinia nubilalis*): *cis*- and *trans*-responding males in Pennsylvania. Environ. Entomol. 4:413-414.

29. Cardé, R.T., C.C. Doane, J. Granett and W.L. Roelofs. 1975. Disruption of pheromone communication in the gypsy moth: some behavioral effects of disparlure and an attractant modifier. Environ. Entomol. 4:793-796.

30. Cardé, R.T., K. Trammel and W.L. Roelofs. 1975. Disruption of sex attraction of the redbanded leafroller (*Argyrotaenia velutinana*) with microencapsulated pheromone components. Environ. Entomol. 4:448-450.

31. Roelofs, W., J. Kochansky, E. Anthon, R. Rice and R. Cardé. 1975. Sex pheromone of the peach twig borer moth (*Anarsia lineatella*). Environ. Entomol. 4:580-582.

32. Kochansky, J., J. Tette, E.F. Taschenberg, R.T. Cardé, K.-E. Kaissling and W.L. Roelofs. 1975. Sex pheromone of the moth *Antheraea polyphemus*. J. Insect Physiol. 21:1977-1983.

33. Cardé, R.T., T.C. Baker and W.L. Roelofs. 1975. Ethological function of components of a sex attractant system for oriental fruit moth males, *Grapholitha molesta* (Lepidoptera: Tortricidae). J. Chem. Ecol. 1:475-491.

34. Roelofs, W.L., J.P. Kochansky, R.T. Cardé, G.G. Kennedy, C.A. Hendrick, J.N. Laboritz and V.L. Corbin. 1975. Sex pheromone of the potato tuberworm moth, *Phthorimaea operculella*. Life Sci. 17:699-706.

35. Baker, T.C., R.T. Cardé, and W.L. Roelofs. 1976. Behavioral responses of male *Argyrotaenia velutinana* (Lepidoptera: Tortricidae) to components of its sex pheromone. J. Chem. Ecol. 2:333-352.

36. Comeau, A., R.T. Cardé, and W.L. Roelofs. 1976. Relationship of ambient temperatures to diel periodicities of sex attraction in six species of Lepidoptera. Can. Entomol. 108:415-418.

37. Roelofs, W., A. Hill, A. Cardé, R. Cardé, H. Madsen and J. Vakenti. 1976. Sex pheromones of the European leafroller, *Archips rosanus*. Environ. Entomol. 5:362-364.

38. Roelofs, W.L., A. Cardé, A. Hill and R. Cardé. 1976. Sex pheromone of the three-lined leafroller, *Pandemis limitata*. Environ. Entomol. 5:649-651.

39. Miller, J.R., T.C. Baker, R.T. Cardé and W.L. Roelofs. 1976. Re-investigation of oak leaf roller sex pheromone components and the hypothesis that they vary with diet. Science 192:140-143.

40. Cardé, R.T., T.C. Baker and W.L. Roelofs. 1976. Sex attractant responses of male oriental fruit moths to a range of component ratios: pheromone polymorphism? Experientia 32:1406-1407.

41. Doolittle, R.E., W.L. Roelofs, A.J. Solomon, R.T. Cardé, and M. Beroza. 1976. (Z,E)-3,5-Tetradecadien-1-ol acetate sex attractant for the carpenterworm moth, *Prionoxystus robiniae* (Peck) (Lepidoptera: Cossidae). J. Chem. Ecol. 2:399-410.

42. Cardé, R.T. 1976. Utilization of pheromones in the population management of moth pests. Environ. Health Persp. 14:133-144.

43. Roelofs, W.L., R.T. Cardé, E.F. Taschenberg and R.W. Weires. 1976. Pheromone research for the control of lepidopterous pests in New York. In: Pest Management with Insect Sex Attractants, M. Beroza (ed.). Amer. Chem. Soc. Sym. 23. pp. 75-87.

44. Cardé, R.T., A.M. Cardé, A.S. Hill and W.L. Roelofs. 1977. Sex pheromone specificity as a reproductive isolating mechanism among the sibling species *Archips argyrospilus* and *A. mortuanus* and other sympatric tortricine moths (Lepidoptera: Tortricidae). J. Chem. Ecol. 3:71-84.

45. Cardé, R.T. and W.L. Roelofs. 1977. Attraction of redbanded leafroller moths, *Argyrotaenia velutinana*, to blends of (Z)- and (E)-11-tridecenyl acetates. J. Chem. Ecol. 3:143-149.

46. Hill, A.S., R.T. Cardé, W.M. Bode and W.L. Roelofs. 1977. Sex pheromone components of the variegated leafroller moth, *Platynota flavedana*. J. Chem. Ecol. 3:369-376.

47. Kochansky, J.P., R.T. Cardé, E.F. Taschenberg and W.L. Roelofs. 1977. Rhythms of male *Antheraea polyphemus* attraction and female attractiveness, and an improved pheromone synthesis. J. Chem. Ecol. 3:419-427.

48. Cardé, R.T., C.C. Doane, J. Granett, A.S. Hill, J. Kochansky and W.L. Roelofs. 1977. Attractancy of racemic disparlure and certain analogues to male gypsy moths and the effect of trap placement. Environ. Entomol. 6:765-767.

49. Cardé, R.T., C.C. Doane, T.C. Baker, S. Iwaki and S. Marumo. 1977. Attractancy of optically active pheromone for male gypsy moths. Environ. Entomol. 6:768-772.

50. Cardé, R.T., T.C. Baker and P.J. Castrovillo. 1977. Disruption of sexual communication in *Laspeyresia pomonella* (codling moth), *Grapholitha molesta* (oriental fruit moth) and *G. prunivora* (lesser apple worm) with hollow fiber attractant sources. Entomol. exp. appl. 22:280-288.

51. Farnum, D.G., T. Veysoglu, A.M. Cardé, B. Duhl-Emswiler, T.A. Pancoast, T.J. Reitz and R.T. Cardé. 1977. A stereospecific synthesis of (+)- disparlure, sex attractant of the gypsy moth. Tetrahedron Letters. 46:4009-4012.

52. Roelofs, W.L. and R.T. Cardé. 1977. Responses of Lepidoptera to synthetic sex pheromone chemicals and their analogues. Annu. Rev. Entomol. 22:377-405.

53. Cardé, R.T., W.L. Roelofs, R.G. Harrison, A.T. Vawter, P.F. Brussard, A. Mutuura and E. Monroe. 1978. European corn borer: pheromone polymorphism or sibling species? Science 199:555-556.

54. Baker, T.C. and R.T. Cardé. 1978. Disruption of gypsy moth male sex pheromone behavior by high frequency sound. Environ. Entomol. 7:45-52.

55. Cardé, R.T., C.C. Doane and D.G. Farnum. 1978. Attractancy to male gypsy moths of (+)-disparlures synthesized by different procedures. Environ. Entomol. 7:815-816.

56. Cardé, A.M., T.C. Baker and R.T. Cardé. 1979. Identification of a four component sex pheromone of the female oriental fruit moth, *Grapholitha molesta* (Lepidoptera: Tortricidae). J. Chem. Ecol. 5:423-427.

57. Baker, T.C. and R.T. Cardé. 1979. Courtship behavior of the oriental fruit moth (*Grapholitha molesta*): experimental analysis and consideration of the role of sexual selection in the evolution of courtship pheromones in the Lepidoptera. Ann. Entomol. Soc. Amer. 72:173-188.

58. Cardé, R.T. and T.E. Hagaman. 1979. Behavioral responses of the gypsy moth in a wind tunnel to air-borne enantiomers of disparlure. Environ. Entomol. 8:475-484.

59. Cardé, R.T. and R.P. Webster. 1979. Variation in attraction of individual gypsy moths to (+) and (±)-disparlure. J. Chem. Ecol. 5:935-939.

60. Castrovillo, P.J. and R.T. Cardé. 1979. Environmental regulation of female calling and male pheromone response periodicities in the codling moth (*Laspeyresia pomonella*). J. Insect Physiol. 25:659-667.

61. Baker, T.C. and R.T. Cardé. 1979. Endogenous and exogenous factors affecting periodicities of female calling and male sex pheromone responses in *Grapholitha molesta*. J. Insect Physiol. 25:943-950.

62. Baker, T.C. and R.T. Cardé. 1979. Analysis of pheromone-mediated behavior in male Grapholitha molesta, the oriental fruit moth (Lepidoptera: Tortricidae). Environ. Entomol. 8:956-968.

63. Cardé, R.T. 1979. Behavioral responses of moths to female-produced pheromones and the utilization of attractant-baited traps for population monitoring. In: Movement of highly mobile insects: Concepts and methodology in research, R.L. Rabb and G.G. Kennedy (eds.). North Carolina St. Univ. pp. 286-315.

64. Baker, T.C., R.T. Cardé and B.A. Croft. 1980. Relationship between pheromone trap capture and emergence of adult oriental fruit moths, *Grapholitha molesta* (Busck). Can. Entomol. 112:11-15.

65. Castrovillo, P.J. and R.T. Cardé. 1980. Male codling moth (*Laspeyresia pomonella*) orientation to visual cues in the presence of pheromone and sequences of courtship behaviors. Ann. Entomol. Soc. Amer. 73:100-105.

66. Baker, T.C., R.T. Cardé and J.R. Miller. 1980. Oriental fruit moth pheromone component release rates measured after collection by glass surface adsorption. J. Chem. Ecol. 6:749-758.

67. Kovalev, B.G., V.D. Bedny and R.T. Cardé. 1980. Attractancy of disparlure enantiomers for the gypsy and nun moths. Insect Chemoreception. 5:109-112. (In Russian)

68. Elkinton, J.S. and R.T. Cardé. 1980. Distribution, dispersal and apparent survival of male gypsy moth as determined by capture in pheromone-baited traps. Environ. Entomol. 9:729-737.

68. Alberts, S.A., M.K. Kennedy and R.T. Cardé. 1981. Pheromone-mediated anemotactic flight and mating behavior of the sciarid fly *Bradysia impatiens*. Environ. Entomol. 10:10-15.

70. Charlton, R.E. and R.T. Cardé. 1981. Comparing the effectiveness of sexual communication disruption in the Oriental fruit moth (*Grapholitha molesta*) using different combinations and dosages of its pheromone blend. J. Chem. Ecol. 7:501-508.

71. Cardé, R.T. 1981. Precopulatory behavior of the adult gypsy moth. Chap. 6.4 In: The gypsy moth: Research toward integrated pest management, C.C. Doane and M.L. McManus (eds.). US Dept. Agric. Tech. Bull. 1584:572-587.

72. Cardé, R.T. and R.P. Webster. 1981. Endogenous and exogenous factors controlling sex pheromone production and responsiveness, particularly among the Lepidoptera. In: Chemicals controlling insect development and behavior, M. Kloza (ed.). Wroclaw Tech. Univ. Papers No. 22. pp. 977-991.

73. Cardé, R.T. 1981. Disruption of long-distance pheromone communication in the Oriental fruit moth: camouflaging the natural aerial trials from the females? In: Management of insect pests with semiochemicals: Concepts and practice, E.R. Mitchell (ed.). Plenum Publ. pp. 385-398.

74. Elkinton, J.S. and R.T. Cardé. 1981. The use of pheromone traps to monitor distribution and population trends of the gypsy moth. In: Management of insect pests with semiochemicals: Concepts and practice, E.R. Mitchell (ed.). Plenum Publ. pp. 41-55.

75. Webster, R.P. and R.T. Cardé. 1982. Influence of relative humidity on calling behaviour of female European corn borer moth (*Ostrinia nubilalis*). Entomol. exp. appl. 32:181-185.

76. Ramaswamy, S.B. and R.T. Cardé. 1982. Nonsaturating traps and long-life attractant lures for monitoring spruce budworm males. J. Econ. Entomol. 75:126-129.

77. Charlton, R.E. and R.T. Cardé. 1982. Rate and diel periodicity of pheromone emission from female gypsy moths (*Lymantria dispar*) determined with a glass-adsorption collection system. J. Insect Physiol. 28:423-430.

78. Webster, R.P. and R.T. Cardé. 1982. Relationship between pheromone titre, calling and age in the omnivorous leafroller moth (*Platynota stultana*). J. Insect Physiol. 11:925-933.

79. Cardé, R.T. 1983. Flight periodicity in insects and the influence of atmospheric hydrocarbons. Amer. Nat. 121:746-748.

80. Cardé, R.T. and T.E. Hagaman. 1983. Influence of ambient and thoracic temperatures upon sexual behaviour of the gypsy moth, *Lymantria dispar*. Physiol. Entomol. 8:7-14.

81. Ramaswamy, S.B., R.T. Cardé and J.A. Witter. 1983. Relationships between catch in pheromone-baited traps and larval population density of the spruce budworm (Lepidoptera: Tortricidae). Can. Entomol. 115:1437-1443.

82. Elkinton, J.S. and R.T. Cardé. 1983. Appetitive flight behavior of male gypsy moths (Lepidoptera: Lymantriidae). Environ. Entomol. 12:1702-1707.

83. Ramaswamy, S.B. and R.T. Cardé. 1984. Rate of release of spruce budworm pheromone from virgin females and synthetic lures. J. Chem. Ecol. 10:1-7.

84. Cardé, R.T. and T.E. Hagaman. 1984. Mate location strategies of gypsy moths in dense populations. J. Chem. Ecol. 10:25-31.

85. Hagaman, T.E. and R.T. Cardé. 1984. Sequence of preflight reactions to synthetic attractant in *Lymantria dispar*. J. Chem. Ecol. 10:17-23.

86. Webster, R.P. and R.T. Cardé. 1984. Role of (*Z*)- and (*E*)-11-tetradecenyl acetate pheromone components in the sexual behavior of the (*Z*)-strain European corn borer, *Ostrinia nubilalis* (Lepidoptera: Pyralidae). J. Chem. Ecol. 10:9-15.

87. Cardé, R.T., L.L. Dindonis, B. Agar and J. Foss. 1984. Apparency of pulsed and continuous pheromone to male gypsy moths. J. Chem. Ecol. 10:335-348.

88. Webster, R.P. and R.T. Cardé. 1984. The effects of mating, exogenous juvenile hormone, and a juvenile hormone analogue on pheromone titre, calling, and oviposition in the omnivorous leafroller moth (*Platynota stultana*). J. Insect Physiol. 30:113-118.

89. Cardé, R.T. and E.F. Taschenberg. 1984. A reinvestigation of the role of (E)-2-hexenal in female calling behaviour of the polyphemus moth (*Antheraea polyphemus*). J. Insect Physiol. 30:109-112.

90. Wallner, W.E., R.T. Cardé, Xu-Chonghua, R.M. Weseloh, S. Xilin, Y. Jingjun and P.W. Schaefer. 1984. Gypsy moth (Lymantria dispar L.) attraction to disparlure enantiomers and the olefin precursor in the People's Republic of China. J. Chem. Ecol. 10:753-757.

91. Elkinton, J.S., R.T. Cardé and C.J. Mason. 1984. Evaluation of time-average dispersion models for estimating pheromone concentration in a deciduous forest. J. Chem. Ecol. 10:1081-1108.

92. Elkinton, J.S. and R.T. Cardé. 1984. Effect of wild and laboratory-reared female gypsy moths (Lepidoptera: Lymantriidae) on the capture of males in pheromone-baited traps. Environ. Entomol. 13:1377-1385.

93. Baker, T.C. and R.T. Cardé. 1984. Techniques for behavioral bioassays. In: Techniques in pheromone research, T.A. Miller and H.E. Hummel (eds.). Springer-Verlag pp. 45-73.

94. Cardé, R.T. and J.S. Elkinton. 1984. Field trapping with attractants: Methods and Interpretation. In: Techniques in pheromone research, T.A. Miller and H.E. Hummel (eds.). Springer-Verlag pp. 111-129.

95. Elkinton, J.S. and R.T. Cardé. 1984. Odor dispersion. In: Chemical Ecology of Insects, W.J. Bell and R.T. Cardé, (eds.). Chapman and Hall. pp. 73-91.

96. Cardé, R.T. 1984. Chemo-orientation in flying insects. In: Chemical Ecology of Insects, W.J. Bell and R.T. Cardé (eds.). Chapman and Hall. pp. 111-124.

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224. Cardé, R.T. 2009. Orientation. In: Encyclopedia of Insects, 2nd edn. V.H. Resh and R.T. Cardé (eds.), Academic Press, San Diego, pp. 729-732.

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232. Cardé, R.T., A.M. Cardé and R.D. Girling. 2012. Observations on the flight paths of the day-flying moth *Virbia lamae* during periods of mate location: do males have a strategy for contacting the pheromone plume? J. Anim. Ecol. 81:268-276.

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239. Wheeler, C.A. and R.T. Cardé. 2014. Following in their footsteps: cuticular hydrocarbons as overwintering aggregation site markers in *Hippodamia convergens*. J. Chem. Ecol. 40:418-428.

240. Collett, M. and R.T. Cardé. 2014. Insect navigation: many senses make efficient foraging paths. Curr. Biol. 24:R362-364.

241. Cardé, R.T. 2014. Defining attraction and aggregation pheromones: teleological versus functional perspectives. J. Chem. Ecol. 40:519-520.

242. Webster, B., E.S. Lacey and R.T. Cardé. 2015. Waiting with bated breath: opportunistic orientation to human odor in the malaria mosquito, *Anopheles gambiae*, is modulated by minute changes in carbon dioxide concentration. J. Chem. Ecol. 41:59-66.

243. Wheeler, C.A., J.G. Millar and R.T. Cardé. 2015. Multimodal signal interactions in the ladybeetle, *Hippodamia convergens*, aposematic system. Chemoecology 25:123-133.

244. Bau, J. and R.T. Cardé. 2015. Modeling optimal strategies for finding a resource-linked, windborne odor plume: theories, robotics and biomimetic lessons from flying insects. Integr. Comp. Biol. 55:461-477.

245. Cardé, R.T. 2015. Multi-cue integration: how mosquitoes find a human host. Curr. Biol. 25:R793-795.

246. Allison, J.D. and R.T. Cardé. 2016. Variation in Moth Pheromones: Causes and Consequences. In: Pheromone Communication in Moths: Evolution, Behavior and Application. J.D. Allison and R.T. Cardé (eds.). University of California Press, Berkeley, pp. 11-23.

247. Allison, J.D. and R.T. Cardé. 2016. Pheromones: Reproductive Isolation and Evolution in Moths. In: Pheromone Communication in Moths: Evolution, Behavior and Application. J.D. Allison and R.T. Cardé (eds.). University of California Press, Berkeley, pp. 25-41.

248. Cardé, R.T. 2016. Moth Navigation along Pheromone Plumes. In: Pheromone Communication in Moths: Evolution, Behavior and Application. J.D. Allison and R.T. Cardé (eds.). University of California Press, Berkeley, pp. 173-189.

249. Choi, M.-Y., S.-J. Ahn, K.-C. Park, R. Vander Meer, R. T. Cardé and R. Jurenka. 2016. Tarsi of male heliothine moths contain aldehydes and butyrate esters as potential pheromone components. J. Chem. Ecol. 42:425-432.

250. Bau, J. and R.T. Cardé. 2016. Simulation modeling to interpret the captures of moths in pheromone-baited traps used for surveillance of invasive species: the gypsy moth as a model case. J. Chem. Ecol. 42:877-887.

251. Webster, B. and R.T. Cardé. 2017. Use of habitat odour by host-seeking insects. Biol. Reviews. 92:1241-1249.

252. Higbee, B.S., C.S. Burks and R.T. Cardé. 2017. Mating disruption of the navel orangeworm (Lepidoptera: Pyralidae) using widely spaced, aerosol dispensers: Is the pheromone blend the most efficacious disruptant? J. Econ. Entomol. 110:2056-2061.

253. Cardé, R. T., J. Bau and J. S. Elkinton. 2018. Comparison of attraction and trapping capabilities of bucket- and delta-style traps with different pheromone emission rates for gypsy moths (Lepidoptera: Erebidae): implications for understanding range of attraction and utility in surveillance. Environ. Entomol. 47:107-113.

254. Cardé, R. T. Mating disruption with pheromones for control of moth pests in area-wide management programmes. In: Area-wide Integrated Pest Management: Development and Field Application. J. Hendrichs, R. Pereira, and M. J. B. Vreysen (eds.) (in press).

255. Simmons, G. S., L. Varela, M. Dougherty, M. Cooper, D. Lance, V. Mastro, R. T. Cardé, A. Lucchi, R. Steinhauer, R. Broadway, B. Stone-Smith, K. Hoffman, G. Clark and R. Johnston. Area-wide programme to eradicate the European grapevine moth, *Lobesia botrana,* in California, USA. In: Area-wide Integrated Pest Management: Development and Field Application. J. Hendrichs, R. Pereira, and M. J. B. Vreysen (eds.) (in press).

LECTURES AND PAPERS PRESENTED (excludes all joint-author papers presented by others and all presentations prior to 1980)

The sex pheromone communication system of the oriental fruit moth. Invited presentation. Conrel European Pheromones Meeting, Zurich, Switzerland, Jan. 5, 1980.

Disruption of long-distance pheromone communication in the oriental fruit moth: Camouflaging the natural aerial trails from females. Invitational colloquium on management of insect pests with semiochemicals. Gainesville, FL, March 24-28, 1980.

Cardé, R.T. and J.S. Elkinton. The use of pheromone traps to monitor distribution and population trends of the gypsy moth. Invitational colloquium on management of insect pests with semiochemicals. Gainesville, FL, March 24-28, 1980.

Moth sex pheromones: Behavioral criteria for validation of structural assignments. Invitational symposium on complementary of laboratory and field studies of chemical communication. Association for Chemoreception Sciences, Sarasota, FL, May 8, 1980.

Cardé, R.T. and R.P. Webster. Endogenous and exogenous factors controlling sex pheromone production and responsiveness, particularly among Lepidoptera. Invitational symposium on regulation of insect development and behavior. Karpacz, Poland, June 23-28, 1980.

Sex attraction in Lepidoptera: Definition of the sensory inputs and behavioral mechanisms. Invitational symposium, XVI International Congress of Entomology, Kyoto, Japan, August 3-9, 1980.

Pheromone dispersal: Biological considerations. Invited symposium, Gordon Conference on Aerobiology, Meriden, NH, August 11-15, 1980.

The oriental fruit moth pheromone communication system. Invited Symposium. USSR-USA Environmental Agreement, Tashkent, USSR, September 22-24, 1980.

Cardé, R.T., J.S. Elkinton and C.J. Mason. Active space of the gypsy moth pheromone. ESA, Atlanta, GA. December 2, 1980.

Moth pheromone communication systems: From basic principles to pest control. Invitational symposium, AAAS, Toronto, Canada, January 7, 1981.

The future of gypsy moth research. Invited lecture. NE Forest Insect Workshop, Portland, ME, Feb., 1982.

The management of the gypsy moth. Invited lecture. Mass. Arborists Association, Danvers, MA, Feb., 1982.

Decision making and the use of insecticides on forest insects. Keynote address in NE Section of Society of American Foresters, Amherst, MA, Aug., 1982.

Use of pheromone for survey, sampling and management of the gypsy moth. Invited symposium speaker on an update on gypsy moth research, Toronto, Canada, Dec., 1982.

Pheromone attraction and dimension of the active space. Invited speaker in Symposium on "Biochemical and biophysical control of insect behavior" at the Eastern Branch of the Entomological Society of America, Hartford, CT, Sept., 1982.

Speaker and moderator in a presentation on gypsy moths to legislative Agriculture and National Resources Committee, Amherst, MA, Feb., 1983.

The sex pheromone communication system of the gypsy moth. Invited speaker, Leiden University, The Netherlands, August, 1983.

Sensitivity, selectivity and strategy in olfactory communication. Invited Symposium, Royal Entomological Society of London Symposium on Insect Communication. London, U.K. September, 1983.

The sex pheromone communication system of the gypsy moth. Dept. of Biology, Univ. of Massachusetts, Boston, MA, Nov., 1983.

Epilogue: Behavioral mechanisms. Invited summary lecture. NSF-NATO Symposium on Mechanisms of Insect Olfaction and Orientation. Oxford, U.K., August 1984.

Orientation of gypsy moths to pheromone: manipulation of cues in a wind tunnel. Invitational Symposium. XVII Int. Cong. Entomol. Hamburg, August 1984.

Orientation of flying and walking insects to pheromone. Invitational Symposium, Canadian Congress of Biology. London, Ontario, June l985.

Cardé, R.T., C. Schal and R. Charlton. Role of pheromone gland pulsing in an arctiid moth, Holomelina lamae. ESA, Hollywood, FL, Dec. l985.

Orientation of gypsy moths to pheromone. Strategies of Chemical communication in insects. Two invited presentations. Laval University, Quebec City, March, l986.

Beyond IPM. Legislative Agriculture and Natural Resources Committee, Amherst, MA, April l986.

Role of experience in host foraging of Brachymeria intermedia. ESA, December l986.

Role of experience in host-finding and recognition in Brachymeria intermedia. International Entomophagous Insects Workshop, College Park, MD, April l987.

Future of pheromones in pest management. Invited Symposium. Eastern Branch, Entomological Society of America, Philadelphia, October l987.

Methods based on gases: ordinating odor or sampling with stench. Invited Symposium. Eastern Branch, Entomological Society of America, Philadelphia, October l987.

Mate location maneuvers of the male gypsy moth: Finding a point source of pheromone in a turbulent environment. United States-Japan Cooperative Science Program on Semiochemicals: Their Chemistry and Function in Behavior. Invited Symposium, Kyoto, Japan, July l987.

Pheromone navigation in the gypsy moth. Nagoya University, July l987.

Mate location of pheromone by flying and walking gypsy moths. University of Maryland, October l987.

Finding a point source of pheromone in a turbulent world. University of Wageningen, May 1988.

Finding a point source of pheromone in a turbulent world. Laboratory of Comparative Invertebrate Neurobiology. Bures Sur Yvette, France, June, 1988.

Finding a point source of pheromone in a turbulent world. University of Oxford, June 1988.

Insects and the language of smell. Distinguished Faculty Lecture Series. University of Massachusetts, November 1988.

Orientation Mechanisms used by flying insects in locating pheromone sources. Boston University, November 1988.

Temporal and spatial distribution of a pheromone signal: cues for orientation of flying moths. Invited Symposium. Association for Chemoreception Sciences, Sarasota, April 1989.

Strategies and constraints in chemical signaling. Invited speaker to ARS Planning Workshop on "Insect Semiochemicals: Opportunities and constraints for development and use." Atlanta, May 7-10, 1990.

How does a male gypsy moth find a female in the forest? Swedish Agricultural Science University, Uppsala, March, 1991.

How does a male gypsy moth find a female in the forest? Lund University, March, 1991.

How does a male gypsy moth find a female in the forest? International Centre for Insect Physiology and Ecology, Nairobi, Kenya, March 1991.

Finding a point source of pheromone in a turbulent world. Department of Entomology, University of Delaware, October 1991.

Finding a point source of pheromone in a turbulent world. Connecticut Entomological Society, February 1992.

Finding a point source of pheromone in a turbulent world. Invited Symposium. XIX International Congress of Entomology, Beijing. June, 1992.

Successful control of insect pests by mating disruption. Invited symposium. '92 Agricultural BioTechnology Symposium, Suwon, Korea, September, 1992.

Mate-finding strategies of gypsy moths. Department of Entomology, University of Manitoba, October 1992.

Successful management of moth pests with pheromones. Faculty of Agriculture, University of Manitoba, October 1992.

Moth communication by pheromones. Sigma Xi, University of Manitoba, October 1992.

Use of attractant pheromones in area-wide suppression programs. Invited lecture at the World Food Prize Symposium, Ames, Iowa, October 1992.

Evaluation of communication disruption in the pink bollworm in field wind tunnels. (with 5 co-authors). Entomological Society of America Annual Meeting, Baltimore, December 1992.

Adult behavior and its relationship to North American Programs. Interagency Gypsy Moth Research Forum, Annapolis, January 1993.

Finding a point source of pheromone in a turbulent world. Cambridge Entomological Society, March 1993.

Evaluation of communication disruption in the pink bollworm in field wind tunnels, Invited Symposium, IOBC/WPRS Working Group "Use of Pheromones and other Semiochemicals in Integrated Control." Chatham, England, May 1993.

Dispersal behavior of the Asian gypsy moth. USDA Interagency Gypsy Moth Research Forum. Annapolis, Maryland, January, 1994.

Effect of pheromone plume structure on upwind flight of male gypsy moths. Invited Symposium on Insect Pheromones, Wageningen, the Netherlands, March, 1994.

Flying to a point source of odor: moth strategies for finding a mate. Hexapodium Lecture, Center for Insect Science, Phoenix, Arizona, April, 1994.

Moths find their mates in a turbulent world. Roeder Memorial Lecture. Tufts University, April 14, 1994.

Using an electroantennogram system to measure airborne concentrations of pheromone. Invited Symposium. XI International Society for Chemical Ecology Meeting, Syracuse, June 1994.

The importance of fine-scale plume structure in moth orientation to pheromone. ETH, Zurich, September 9, 1994.

Female flight dispersal of Asian gypsy moth. USDA Interagency Gypsy Moth Research Forum. Annapolis, Maryland, January 19, 1995.

Using attractant pheromones to manipulate mate finding in insects. Invited Topical Lecture. AAAS, Atlanta, February 21, 1995.

Strategies of mate finding in moths and approaches to understanding its disruption. Department of Entomology, University of California, Riverside, February 27, 1995.

Moth strategies for finding a point source of pheromone in wind. Neuroscience and Behavior Program, University of Massachusetts, April 19, 1995.

Odour plumes and odour-mediated control of flight in insects. CIBA Foundation Symposium on Olfaction in Mosquito-Host Interactions, London, October 31, 1995.

Overview of odour-plume following. Odour Plume Workshop III, Imperial College, London, November 6, 1995.

How do male moths find a mate?: the role of the pheromone plume's fine-scale structure. Marine Biological Laboratory, Woods Hole, November 29, 1995.

Pheromone communication in the gypsy moth. 7th USDA Interagency Gypsy Moth Research Forum, Annapolis, January 18, 1996.

Pheromones in insect control. Commercializing Biopesticides: Applied Products and Transgenic Plants, Invited Presentation. International Business Communications Conference, Washington, January 22, 1996.

Adult reproductive behavior of Asian gypsy moths, Lymantria dispar L. (LEPIDOPTERA: LYMANTRIIDAE). Invited Symposium. XX International Congress of Entomology, Florence, August 26, 1996

Flying upwind toward odor plumes. Invited Symposium. XX International Congress of Entomology, Florence, August 27, 1996

Understanding mating disruption in the pink bollworm moth. Technology Transfer in Mating Disruption. Invited Symposium. IOBC/WPRS Working Group "Use of Pheromones and other Semiochemicals in Integrated Control." Montpellier, France, September 10, 1996

Moth mate finding: Mechanisms of orientation and their disruption. Department of Entomology, University of California, Davis, November 13, 1996.

Flying to a point source of odor: Moth strategies for finding a mate. Department of Biology, University of California, Riverside, January 31, 1997.

Finding an odor's source in wind: Mechanisms used by flying male moths to locate a pheromone-emitting female. Cognitive Science Seminar, University of California, Los Angeles, May 12, 1997.

Location of small odor sources in wind: Mechanisms for mate finding in moths. Departments of Zoology and Entomology, Oregon State University, November 10, 1997.

History of Pheromone use in Pest Control Tools: Constraints and Promise. Invited Symposium. Entomological Society of America, December 16, 1997.

Effects of light levels on the orientation maneuvers of male gypsy moths flying along pheromone plumes of differing structures. International Society of Chemical Ecology, Ithaca, June 21, 1998.

Mating disruption in the pink bollworm: Insight into mechanisms of mating disruption using field wind tunnels. Scents in Orchards - Invited Symposium. Plant Insect Semiochemicals from Orchard Environments. IOBC Working Group Meeting, Dachau, Germany, September 22, 1998.

Insights into mechanisms of mating disruption using field wind tunnels. Invited Symposium, Pacific Branch, Entomological Society of America, Eugene, Oregon, June 22, 1999.

How does the structure of odor plumes influence the orientation of mosquitoes? Invited Symposium, First Asia-Pacific Conference on Chemical Ecology, Shanghai, China, November 2, 1999.

Foundations of Behavioral Response to Pheromones. Invited Symposium. Entomological Society of America, Atlanta, December 15, 1999.

Location of Small Odor Source in Wind: Mechanisms for Mate Finding in Moths. Department of Biology, Vanderbilt University, February 10, 2000.

How Do Moths Find a Point Source of Pheromone in Wind? Keck Program for Behavioral Biology and the Department of Entomology, North Carolina State University, April 3, 2000.

Finding a Point Source of Pheromone: Orientation of Male Moths to Females and its Disruption, Department of Entomology, University of California, Davis, May 3, 2000.

Mechanisms of Orientation of Moths Flying to Pheromone, Invited Keynote Lecture, 17th Annual Meeting, International Society of Chemical Ecology, Pocos de Caldas, Brazil, August 16, 2000.

Sensory Inputs Governing Upwind Flight of Male Moths Along Pheromone Plumes, Invited Symposium, XXI International Congress of Entomology, Iguassu Falls, Brazil, August 23, 2000.

Attractants and Trapping. Invited Presentation. Plant Health Conference 2000—Detecting and Monitoring Invasive Species. APHIS. Raleigh, NC, October 24, 2000.

Historical Background and Overview of the Mating Disruption Technique. Invited Presentation. Annual Gypsy Moth Review 2000. Norfolk, VA, October 31, 2000.

Using Plume Structure and Visual Feedback—How to Find Pheromone Source in Wind, Department of Entomology, Michigan State University, February 26, 2001.

Mechanisms of Disrupting Pheromone Communication in Moths, Department of Entomology, Michigan State University, February 27, 2001.

Plume Structure and Visual Feedback--Mechanisms for Finding a Source of Wind-Borne Pheromone. Invited Student Speaker for 2000-2001, Department of Entomology, Kansas State University, April 26, 2001.

Disrupting Pheromone Communication in Moths: Mechanisms and Successes. Invited Student Speaker for 2000-2001. Department of Entomology, Kansas State University, April 27, 2001.

Chemical Signals in the Environment: Influences of Patterns of Encounter on Insects' Behavioral Responses. Invited Symposium. 18th Annual Meeting, International Society of Chemical Ecology, Lake Tahoe, California, July 8, 2001.

Video Methods for Behavioral Bioassays and Analyses. Invited Symposium. 18th Annual Meeting, International Society of Chemical Ecology, Lake Tahoe, California, July 10, 2001.

Flight of Mosquitoes in Odor Plumes. Invited Symposium. 3rd International Congress of Vector Ecology, Barcelona, Spain, September 21, 2001.

Finding Odor-Linked Resources: Defining and Testing Orientation Mechanisms. Invited Symposium. Entomological Society of America, December 12, 2001.

Resolution of Plume Structure: Importance to Orientation and its Disruption. IOBC Meeting, Erice, Sicily, September 25, 2002.

Using the structure of odor plumes, wind, and visual feedback to locate an odor source. Invited Symposium. 3rd International Pheromone Symposium, Bäckaskog, Sweden, May 27, 2003.

Orientation of Flying Insects to Chaotic Chemical Signals. Invited Seminar. Department of Organismic Biology, Ecology, and Evolution. UCLA, October 15, 2003.

Orientation of Flying Insects to Chaotic Chemical Signals. Distinguished Lecturer. Department of Entomology. Louisiana State University, February 20, 2004.

Orientation of Flying Insects to Chaotic Chemical Signals. Invited Seminar, Department of Entomology, University of Minnesota, May 11, 2004.

Disruption of moth mating with pheromones: formulation and behavior determine efficacy. Invited Symposium, XXII International Congress of Entomology, Brisbane, Australia, August 17, 2004.

Influence of plume structure on the orientation maneuvers of flying mosquitoes. Invited Symposium, XXII International Congress of Entomology, Brisbane, Australia, August 20, 2004.

Managing moth pests with pheromones: from mechanisms of mating disruption to successful field application. Keynote Address, International Symposium on Biopesticides IV. Chiang Mai, Thailand, February 17, 2005.

From moths to mosquitoes: finding resources by following the odor plume. Invited Seminar, Department of Entomology, Cornell University, March 7, 2005.

Using the odor plume to find upwind resources. Invited Seminar. Department of Entomology, New York State Agricultural Experiment Station at Geneva (Cornell University), March 8, 2005.

Behavioral responses of *Culex* mosquitoes to oviposition attractants. Invited Symposium, XXI Annual Meeting of the International Society of Chemical Ecology, Washington, D.C., July 24, 2005.

Bioassays for attractants, to what end: aiding identification, measuring adaptive value, or verifying orientation mechanisms? Invited Symposium, Measuring Behavior 2005, Wageningen, The Netherlands, September 2, 2005.

Effects of carbon dioxide plume structure on the orientation of mosquitoes and their sensitivity to host odors. Invited Symposium, 4th International Congress of Vector Ecology, Reno, Nevada. October 7, 2005.

Mating disruption in moths: principles and application. Invited Symposium, 5th Asia-Pacific Congress of Entomology, Jeju, South Korea, October 20, 2005.

From moths to mosquitoes: how the structure of odor plumes mediates odor detection and orientation. Invited Seminar, Department of Entomology, University of California, Davis, November 3, 2005.

Improving trapping systems for gravid female *Culex* mosquitoes. Invited Symposium, Entomological Society of America, Ft. Lauderdale, Florida, December 16, 2005.

How do the patterns of temporal and spatial contact with an odorant modulate behavioral response? Invited Symposium, Pacific Branch, Entomological Society of America, Maui, Hawaii. March 7, 2006.

Pheromone communication in moths and its disruption. Invited Seminar, Department of Biological Sciences, University of Alberta, Edmonton, Canada. March 16, 2006.

Finding an odour source in a turbulent world: strategies of moths and mosquitoes. E.H. Strickland Memorial Lecture (Invited), University of Alberta, Edmonton, Canada. March 17, 2006.

From moths to mosquitoes to honeybees: how the structure of odor plumes mediates odor detection and orientation. Invited Seminar, Department of Entomology, University of Florida, Gainesville, March 23, 2006.

Evolutionary causes and consequences of variation in lepidopteran sex pheromones. Invited Symposium. XXII Annual Meeting, International Society of Chemical Ecology, Barcelona, Spain, July 18, 2006.

Patterns of temporal and spatial contact with odorant molecules modulate behavioral responses in moths and mosquitoes. Invited Symposium, VIII European Congress of Entomology, Izmir, Turkey, September 22, 2006.

From molecules to invasion biology: Challenging times for a changing discipline. Invited Symposium, Entomological Society of America, Indianapolis, December 10, 2006.

The navel orangeworm pheromone: complexity in behavior and chemistry. Invited Presentation. International Organisation for Biological Control Meeting on Pheromones and Other Semiochemicals in Integrated Production. Lund, Sweden, September 10, 2007.

Long-distance orientation to odor sources: what can we learn from flight track analysis in wind tunnels? Invited Symposium, Entomological Society of America, San Diego, December 11, 2007.

Attractants for *Culex pipiens* complex mosquitoes. Mosquito and Vector Control Association of California, Palm Springs, January 15, 2008.

Variation in moth pheromone communication: Is Stabilizing Selection at Work? Invited Seminar. Swedish Agricultural University (SLU), Alnarp, February 5, 2008.

History of mating disruption. Conference on Research Priorities for Light Brown Apple Moth. Biology, Importance, and Control. Invited Presentation. Foster City, California, July 23, 2008.

Unraveling how insects locate distant, upwind sources of odor. Invited Symposium. Entomological Society of America, Reno, November 18, 2008.

Controlling moth pests by mating disruption: Multiple paths to efficacy. Invited Symposium. Entomological Society of America, Pacific Branch. San Diego, March 30, 2009.

Control of moth pests by mating disruption. Invited Presentation. County Agricultural Commissioner Conference on Biocontrol. Davis, CA, May 12, 2009.

Finding a point source of odor in a turbulent world: Lessons from moths and mosquitoes. Silver Medal Award Lecture. International Society of Chemical Ecology. Neuchâtel, Switzerland, August 25, 2009.

Mechanisms used by female mosquitoes to find odor-linked resources. Invited Symposium. 5th International Congress of Vector Ecology, Antalya, Turkey. October 15, 2009.

The structure of wind-borne odor plumes and its importance in the navigation of insects flying to odor sources. Invited Symposium. 5th Asian Pacific Conference on Chemical Ecology, Honolulu, October 29, 2009.

Evolution of moth pheromone communication: what are the outstanding questions? Invited Symposium. 5th Asian Pacific Conference on Chemical Ecology, Honolulu, October 29, 2009.

Effects of odor plume structure and odor salience in orientation of female *Aedes aegypti* mosquitoes to hosts. International Chemoreception Workshop on Insects, Kona, Hawaii, November 3, 2009.

Detection and finding of odor sources: lessons from insect orientation, plume modeling, and robotics. Invited Presentation. DARPA-Defense Sciences Research Council, Arlington, Virginia, March 18, 2010.

Orientation of insects to host odors. Invited Presentation. Center for Vector Disease Research Symposium, Facing the Challenges of Vector-Borne Diseases in the 21st Century, UCR, March 28, 2010.

Of moths and mosquitoes: parallel strategies for navigation to odor-linked resources. Invited Inaugural Presentation. Jerry B. Graves Distinguished Seminar Series. Department of Entomology, Louisiana State University, September 17, 2010.

Wind-borne plumes and the navigation of insects flying to odor sources. Invited Seminar. Department of Entomology, University of California, Riverside, January 3, 2011.

Strategies for finding upwind odor sources in a turbulent plume: lessons from moths and mosquitoes. Invited Presentation. Swedish University of Agricultural Sciences (SLU), Alnarp, April 19, 2011.

Finding upwind odor sources: lessons from moths and mosquitoes. Invited Presentation. Sensory Biology Group, Lund University, May 27, 2011.

Discriminating bioassays—the key to identifying semiochemicals and defining their behavioral role and ecological function. International Ph.D. Course in Insect Chemical Ecology (ICE 11). Invited Presentation. Swedish University of Agricultural Sciences (SLU), Alnarp, June 14, 2011.

Finding a point source of semiochemical in a turbulent world: do we understand the meteorological constraints and orientation strategies? Invited Presentation. International Symposium on Chemical Ecology and National Meeting, Royal Entomological Society, Chatham, UK. September 9, 2011.

Parallel mechanisms in the orientation of moths and mosquitoes to odor sources. 2011 Annual Symposium of the China-U.S.A. Center for Life Sciences—Chemical Communication in Insects. Invited Symposium, Beijing, October 11, 2011.

Navigation of moths and mosquitoes along wind-borne plumes of odor. Invited Plenary Lecture, Asian Pacific Conference on Chemical Ecology, Beijing, October 14, 2011.

Behavior of mosquitoes inside odor plumes. Invited Symposium. American Society of Tropical Medicine and Hygiene. Philadelphia, December 5, 2011.

Entomology at the University of California, Riverside: From Biological Control to Biotechnology. Chapingo Autonomous University, Texcoco, Mexico State, Mexico, May 22, 2012.

Finding a point source of odor in a turbulent world: meteorological constraints, orientation strategies, and a function of components in semiochemical blends. Invited Plenary Lecture. XXIV Brazilian Congress of Entomology, Curitiba, September 19, 2012.

Orientation to odor sources: using wind tunnels to establish maneuvers and sensory inputs by analyses of flight tracks. Invited Symposium. XXIV Brazilian Congress of Entomology, Curitiba, September 20, 2012.

Navigation of Moths and Mosquitoes to Odor Sources. Invited Symposium, Department of Entomology, University of Illinois, October 22, 2012.

Discriminating bioassays—the key to identifying semiochemicals and defining their behavioral role and ecological function. Invited Presentation. International Ph.D. Course in Insect Chemical Ecology (ICE 12). Frontiers of Chemical Ecology. Max Planck Institute for Chemical Ecology, Jena, Germany, December 6, 2012.

Finding a point source of odor in a turbulent world and functions of components in a semiochemical blend. Invited Seminar, Institute of Biodiversity and Ecosystem Dynamics. University of Amsterdam, April 4, 2013.

Invited Master Class, Institute of Biodiversity and Ecosystem Dynamics. University of Amsterdam April 5, 2013.

Mosquito orientation to host odors. Invited Seminar, Center for Insect Disease Dynamics, Pennsylvania State University. April 25, 2013.

Finding a point source of odor in a turbulent world: meteorological constraints and orientation strategies. Invited Seminar, Department of Entomology, Pennsylvania State University. April 26, 2013.

First impressions matter: early quality assessment lessens pheromone specificity in a moth. Invited Symposium. International Society of Chemical Ecology and Asia-Pacific Association of Chemical Ecologists. Melbourne, Australia. August 22, 2013.

Moth and mosquito orientation to odor sources: how the structure of the odor plume modulates navigation. Invited Presentation. 1st International Workshop on Odor Spaces, Hanover, Germany. September 7, 2013.

Biological constraints on surveillance, delimitation, and eradication of invasive insects: some lessons and prospects. Invited Presentation. 21st Century Pest Management Symposia Series. California Department of Food and Agriculture, Davis, October 19, 2013.

Finding an upwind source of odor: how an odor plume's structure modulates orientation. Invited Plenary Lecture, 10th Congress of the Chinese Association of Chemical Ecology, Nanchang, China, October 25, 2014.

Locating an upwind source of resource-linked odor. Invited Seminar. Guangdong Entomological Institute, Guangzhou, China. October 29, 2014.

Modeling optimal strategies for finding a resource-linked odor plume: theories and lessons from flying insects. Invited Symposium, Society for Integrative and Comparative Biology, West Palm Beach, Florida, January 7, 2015.

Modeling optimal strategies for finding a windborne odor plume and its source: theories, infotaxis, and biomimetic lessons from flying insects. Invited Presentation, Bio-Inspired Systems and Technologies, SOAR6 (State of the Art Research). University of Bristol, U.K., May 14, 2015.

Mosquito orientation to odorant sources: how the structure of the odor plume modulates navigation. Invited Presentation, Bio-Inspired Systems and Technologies, SOAR6 (State of the Art Research). University of Bristol, U.K., May 14, 2015.

Outstanding issues in chemical ecology: functional, evolutionary and teleological perspectives. Invited Plenary Lecture, International Society of Chemical Ecology, Stockholm, Sweden, July 3, 2015.

Mating disruption in moths: what are we disrupting and what are the mechanisms? Invited Presentation. Provivi, Santa Monica, California, August 27, 2015.

Moth pheromones: What are the known knowns, the known unknowns, and the unknown unknowns? Invited Plenary Lecture. 8th Conference of the Asia-Pacific Association of Chemical Ecologists, Anaheim, California, September 25, 2015.

Disruption of mating in the navel orangeworm: mechanisms and prospects. Invited Symposium. Pacific Branch of the Entomological Society of America, Honolulu, April 4, 2016.

Discriminating bioassays—the key to identifying semiochemicals and defining their behavioral role and ecological function. Invited Presentation. International Ph.D. Course in Insect Chemical Ecology (ICE 12). Frontiers of Chemical Ecology. Max Planck Institute for Chemical Ecology, Jena, Germany, June 28, 2016.

Finding sources of wind-borne odor in moths and mosquitoes: known mechanisms and outstanding issues. Symposium in Honor of the 2016 Recipients of Certificates of Distinction. XXV International Congress of Entomology. Orlando, Florida, September 29, 2016.

Plume structure and the integration of visual and odor inputs in modulating orientation. Invited Presentation at an Insect Navigation Workshop, Janelia Research Campus, HHMI, Ashburn, Virginia, December 7, 2016.

Use of Pheromones to Disrupt Mating of Moth Pests in Area-Wide Management Programmes. Invited Presentation. Third FAO/IAEA International Conference on Area-wide Management of Insect Pests: Integrating the Sterile Insect and Related Nuclear and Other Techniques, Vienna, Austria, May 22, 2017.

Insect strategies for finding an odor plume and navigating to its source. Invited Presentation. Department of Ecology, Environment and Plant Sciences, University of Stockholm, June 1, 2017.

Methods of studying animal behavior and strategies for finding odor-linked resources. Opponent Presentation in a Ph.D. defense, Department of Ecology, Environment and Plant Sciences, University of Stockholm, June 2, 2017.

Disruption of mating in the navel orangeworm: What do we know and what do we need to know? Invited presentation. APHIS Meeting on Area-Wide Control of the Navel Orangeworm, Fresno, CA, June 22, 2017

Interactions of carbon dioxide and human skin odor in host orientation and landing of female *Aedes* and *Anopheles* mosquitoes. XV European Symposium on Taste and Olfaction (XESITO). Villasimius, Sardinia, September 19, 2017.

PRINCIPAL NON-UNIVERSITY COMMITTEES, CONSULTANTSHIPS, PANELS, REVIEW BOARDS
(Excludes panels on page 1):

Consultant to Zoecon Corp., Palo Alto 1975, (Preparation of a report to EPA on registration guidelines for insect growth regulations and pheromones).

AIBS-EPA Panel on Pheromones (4 meetings and report). 1976-1977.

ERDA Panel on Insect Dispersal, August, 1977, Pelston, MI (meeting and report).

Expert Panel, Post-Program Evaluation of the USDA Forest Pest Research and Development Program, September, 1978.

Consultant, Albany International Corp., Phoenix, AZ. (development of pheromones for direct control of insects) 1979-1984.

USDA Gypsy Moth Panels to Determine Research Priorities, 1980, 1983 (a number of meetings and reports).

USSR-USA - Environmental Agreement - Cooperative Research on Pheromones Group, Tashkent, USSR 1980.

Organizer and Leader of a Workshop on the Guidelines for Biorationals and Behavior-Modifying Chemicals in the IR-4 Program (Meeting and Report), St. Louis, March, 1983 (Sponsored by EPA).

Consultant to A.D. Little, Cambridge, MA and UniRoyal (Development of pheromones for direct control of insects). 1984.

Consultant to Griffin Corp., Valdosta, GA (development of pheromones for direct control of insects). 1984-1986.

USDA Competitive Grants Program - Biological Stress in Plants, 1985 and 1986 Panels.

U.S.-Japan Seminar. Semiochemicals: Their Chemistry and Function in Insect Behavior. Kyoto l987.

Program Manager, Pest Science, USDA Competitive Grants Program. 1988-1989.

Review Team, Insect Attractants, Behavior and Basic Biology Laboratory (USDA) in Gainesville. March, 1989.

Reviewer of "Application of Pheromones in Management of Stem Borers in Africa" for SAREC (Swedish Agency for Research Cooperation with Developing Countries) Site visits to Lund, Uppsala, and Nairobi, March, 1991.

Consultant to Ecogen Corp., Langhorne, PA. 1993-1994.

Panelist on Biological Control, Office of Technology Assessment, Washington, 1994-1995

USDA, Office of Scientific Quality Review Panel, Beltsville, MD, January 3-5, 2005.

USDA, National Program 104 Assessment Panel, Beltsville, August 2-3, 2007.

Advisory Committee for Appointment of Professor of Chemical Ecology at the Swedish Agricultural University in Alnarp, Sweden. Meeting in Alnarp, February 5, 2008.

Evaluation Panel for Agricultural Programs, Swedish Agricultural University (SLU), Uppsala, May 4-7, 2009.

Evaluation of the Department of Entomology, Louisiana State University, January 20, 2014.

National Program Panel 304 for USDA-ARS Projects on Insect Genomics & Physiology, August 25, 2015.