

Summary of Creative Works of Dr. John A. Byers www.chemical-ecology.net/h.htm

Dr. John Byers has been creative in a broad range of subject areas, including **chemical ecology** (subtractive bioassays, laboratory and field methods, and concepts EAR, MAD, IDP), **ecological modeling** (3D flight, dispersal, territorial, and encounter rate models), **electronic devices** (integrated CMOS fraction collectors, dusk-dawn dimmer, thermometers, vibration detectors, vapor dispensers), and **entomological methods** (flight distribution analysis, mass trapping, mating disruption, RGB color and image analysis, and IPM methods), among other projects (www.chemical-ecology.net/methods.htm).

Dr. Byers was first to show that insect plant galls have higher amounts of plant growth hormones, auxin and gibberellins, which suggests plant growth hormones either cause galls or are a result of the galling (1). He found that two pest bark beetle species avoid pheromone components of each other and was the first to suggest that this behavior was for avoiding inter-specific competition (3). In team research published in *Nature*, host tree monoterpene myrcene was radio-labeled and converted by a pest bark beetle into its two aggregation pheromone components (5). In Ph.D. work published in *Science*, *Ips* bark beetles fed an artificial diet with antibiotic streptomycin and then exposed to host tree myrcene were unable to produce aggregation pheromones ipsenol and ipsdienol, while beetles in the control diet without streptomycin did produce pheromones, suggesting microbes may biosynthesize pheromone (9). Dr. Byers designed and built an electronic timer for synchronous control of multiple electronic devices on circadian and non-circadian cycles (8). He dissected the mid-hindgut of two species of bark beetle feeding in host pine and was first to quantify the amounts of several aggregation pheromone components in various areas of the intestine (13). He showed that male bark beetles in the host tree, when experimentally provided several females, turned off production of their aggregation pheromones ipsenol and ipsdienol; this mechanism was physiological rather than behavioral because the males provided with females and exposed to myrcene precursor vapors did not produce aggregation pheromone as did the control males feeding alone (7). He designed and built a sensitive electronic thermometer to measure aggregation responses of insect-killing nematodes to minute temperature differences of only 0.01° C above ambient. This was the first study to show how a heat-seeking mechanism would aid nematodes in search of “cold-blooded” insects in the soil (12). He used four lines of 15 sticky screens to monitor flight approach of bark

beetles attracted to a 50-male log releasing aggregation pheromone and found that males approaching the source were less attracted while females were undeterred. Similarly, sticky screens along a tree baited initially at the top with a male-infested log showed that flying males avoided densely colonized areas while females were attracted - the first evidence of how males can avoid intra-specific competition (15).

Dr. Byers published a second article in *Science* when a trap composed of sticky screen below a closed container with beetle-sized holes and a sticky floor inside demonstrated that females rarely entered the container with inhibitor (-)-*trans*-verbenol plus attractive pheromones, even though an equal sex ratio arrived at the sticky screen. In addition, both sexes could produce the inhibitor (-)- α -pinene from host tree (14). He designed and built a 24-hour electronic fraction collector and was first to show bark beetle circadian rhythms of emergence from brood logs (16). He designed and built several thermometers that multiplexed to a chart recorder in order to continuously monitor soil temperatures of over-wintering bark beetles emerging during the spring dispersal and host-seeking flight (18). He was first to program software to simulate bark beetle attack patterns on tree bark and to analyze these patterns compared to natural attack patterns using nearest neighbor analysis. These results led to his coining the term MAD (minimum allowed distance), which is a species characteristic and is the average minimum distance that territorial organisms will place nests (or attack holes) near others (19). Dr. Byers used pulley and rope to rapidly dissect and extract bark beetles feeding in a large ponderosa pine in order to quantify amounts of aggregation (*exo*-brevicommin, frontalin) and attack spacing pheromones (verbenone, *trans*-verbenol) over a week period. The results indicated how intra-specific competition and termination of colonization is regulated (20). In Sweden, he led research showing that *Tomicus* pine shoot beetles are primarily attracted by monoterpenes from host trees and first proposed that the beetles in flight can determine the susceptibility of weakened hosts by the release of monoterpene volatiles since healthy trees have much lower release rates (21). He was first to separate two synergistic pheromone components both vertically and horizontally at various distances to show how attraction is decreased by an increase in distance, and used mathematical models to show how two Gaussian plumes of the components interact (22). He designed and built an electronic digitally-controlled fraction collector that revealed a circadian rhythm of oviposition in the turnip moth (23). He designed a sticky trap that was rotated by a wind-vane to show that bark beetles fly upwind to pheromone sources in the field

(29). He proposed a method for release of semiochemicals based on solvent dilution and by adjusting for molecular weights (mole percentages) so that precise amounts can be released based on a known release rate of a neat chemical. He was first to test this method by varying the ratios of two synergistic aggregation pheromone components on bark beetle attraction (30).

Dr. Byers showed that entry of bark beetles into holes in pipe traps with aggregation pheromone was enhanced by host monoterpenes, indicating insect recognition of hosts (31). He used an environmental chamber and a vibration sensor to show for the first time under which conditions of light, humidity and temperature bark beetles initiate flight (35). He proposed a new idea that he coined the “effective attraction radius” (EAR) and tested it in the field to estimate densities of insects and the relative strengths of attractants among species (36). He was first to develop software that draws Dirichlet cells for territorial analysis of animals, and showed that several bark beetle species have characteristic MAD resulting in uniform attack patterns to reduce competition (49). He allowed *Ips paraconfusus* males to feed in 5 host pine species resulting in equal attraction in the field, and found that these males produced similar amounts of ipsenol/ipsdienol, suggesting a *de novo* route (confirmed subsequently) (41). Dr. Byers was first to develop the subtractive-combination bioassay method and used this to identify a new aggregation pheromone component for bark beetles [methyl (*E,Z*)-2,4-decadienoate] (42). He designed and built a mechanical slow-rotating pair of traps for the first time and used this to identify another new pheromone component for bark beetles (*E*-myrcenol); this device evens the normal variation in catch due to fixed positions of traps (43). Dr. Byers used combinatorial theory to show that the subtractive-combination method requires far fewer tests to elucidate synergists from a complex mixture than does the additive-combination method (the subtractive method has now been widely adopted) (50). He developed software programs on treatment randomization and random sampling in three papers (46, 59, 67). He designed and programmed a universal taxonomic key similar to the linking system of the Internet (independently developed) (68). He helped develop a piezoelectric sprayer and portable syringe pump for exact release of semiochemicals that was tested in a slow-rotating trap pair to show that monoterpenes inhibit orientation of a bark beetle to aggregation pheromone (76). He showed that bark beetles avoid non-host monoterpenes as a means of finding aging and appropriate host pines (69, 75, 81). He developed new dispersal equations for animals that better predicted mean dispersal distance (74, 78).

In a Forum article, he developed simulation models showing that IPM can be more effective by using synchronous treatments over an area instead of the traditional asynchronous treatments (85). Of over 100 papers on aphid alarm pheromone (*E*- β -farnesene), Dr. Byers was the first to report this pheromone in all instars of an aphid, and he provided the first conclusive evidence of a cost of pheromone production in insects (83). He computer data-mined the Internet *Pherolist* (86) to explore evolutionary constraints on speciation in moth families due to limited numbers of pheromone structures (84). He developed algorithms and Java software for RGB analysis of colors in digital images, replacing subjective descriptions of colors with objective measurements in research reports (87). Dr. Byers showed that *Lygus* plant bugs produce defensive compounds and coined the term “initial discharge percentage” (IDP) for glandular semiochemical discharges (88). He developed software for using pheromone dispensers (as EAR) to simulate mass trapping and mating disruption at various realistic parameters, which allows predictive development of more efficient control programs (91). He developed algorithms for maintaining simulated insects in 3D about a specified mean flight height and normal distribution with SD (96) to realistically simulate flight dispersal. He tested these algorithms with EAR of attractive traps to estimate for the first time flight densities in the field (107). He also used 3D simulation methods for analyzing mean flight height and SD of insect vertical flight distributions (and analyzed many previous trap height studies)(103). In collaborative research, Dr. Byers found that males of three species of *Lygus* plant bugs transfer myristyl acetate in spermatophores and this inhibits males from mating with the female for several days (102). Byers recently constructed a genetic population model of bark beetle evolution relating to host finding and competition that shows how insecticide resistance could take hundreds of generations to manifest (106). Image analysis of honeybee frames was developed for Mark Carroll, USDA, Tucson. Dr. Byers he has received four patents on bark beetle semiochemicals, one patent was commercialized by BASF (24, 34, 39, 61).

The above papers are cited in the List of Publications and can be downloaded at www.chemical-ecology.net/byerspub.htm. Most models above are demonstrated as Java applets at www.chemical-ecology.net/java2/java.htm. This is one of the most popular websites in Entomology with 153,702 unique visitors in 2011 (awstats.sourceforge.net), and was presented in *Science* 2000, 288:767 (5 May 2000).

List of Peer-Reviewed Journal Articles and Patents - John A. Byers

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96. Byers, J. A. 2009. Modeling distributions of flying insects: Effective attraction radius of pheromone in two and three dimensions. *Journal of Theoretical Biology* 256:81-89.
97. Blackmer, J. L., and **Byers, J. A.** 2009. *Lygus* spp. (Heteroptera: Miridae) host-plant interactions with *Lesquerella fendleri* (Brassicaceae), a new crop in the arid southwest. *Environmental Entomology* 38:159-167.
98. El-Sayed, A. M, Suckling, D. M, **Byers, J. A.**, Jang, E. B., and Wearing, C. H. 2009. Potential of 'lure and kill' in long-term pest management and eradication of invasive species. *Journal of Economic Entomology* 102:815-835.
99. Huang, C. H., Yan, F. M., **Byers, J. A.**, Wang, R. J., and Xu, C. R. 2009. Volatiles induced by the larvae of the Asian corn borer (*Ostrinia furnacalis*) in maize plants affect behavior of conspecific larvae and female adults. *Insect Science* 16: 311-320.
100. Zada, A., Falach, L., and **Byers, J. A.** 2009. Development of sol-gel formulations for slow release of pheromones. *Chemoecology* 19:37-45.
101. Salvucci, M. E., Barta, C., **Byers, J. A.**, and Canarini, A. 2010. Photosynthesis and assimilate partitioning between carbohydrates and isoprenoid products in vegetatively active and dormant guayule: physiological and environmental constraints on rubber accumulation in a semiarid shrub. *Physiologia Plantarum* 140:368-379.
102. Brent, C. S. and **Byers, J. A.** 2011. Female attractiveness modulated by a male-derived antiaphrodisiac pheromone in a plant bug. *Animal Behaviour* 82:937-943.
103. Byers, J. A. 2011. Analysis of vertical distributions and effective flight layers of insects: Three-dimensional simulation of flying insects and catch at trap heights. *Environmental Entomology* 40:1210-1222.
104. **Byers, J. A.** and Levi-Zada, A. 2011. Variation of (*S*)-4-methyl-3-heptanone in heads of braconid wasp, *Leiophron uniformis*, and *Pogonomyrmex* ants indicates costs of semiochemical production. *Chemoecology* 21:35-44.
105. Zhang, Q. H., Ma, J. H., Yang, Q. Q., **Byers, J. A.**, Klein, M. G., Zhao, F. Y., and Luo, Y. Q. 2011. Olfactory and visual responses of the long-legged chafer *Hoplia spectabilis* Medvedev (Coleoptera: Scarabaeidae) in Qinghai province, China. *Pest Management Science* 67:162-169.
106. Byers, J. A. 2012. A population genetic model of evolution of host-mate attraction and nonhost repulsion in a bark beetle *Pityogenes bidentatus*. *Psyche* vol. 2012, ID 529573, pp. 1-9.
107. Byers, J. A. 2012. Estimating insect flight densities from attractive trap catches and flight height distributions. *Journal of Chemical Ecology* in press
108. Byers, J. A. 2012. Bark beetles, *Pityogenes bidentatus*, orienting to aggregation pheromone avoid conifer monoterpene odors when flying but not when walking. *Psyche* vol. 2012, ID 940962, pp. 1-10.
109. **Byers, J. A.** and G. Birgersson. 2012. Host-tree monoterpenes and biosynthesis of aggregation pheromones in the bark beetle *Ips paraconfusus*. *Psyche* vol. 2012, ID 539624, pp. 1-10.
110. Han, B., Zhang, Q. H., and **Byers, J. A.** 2012. Attraction of the tea aphid, *Toxoptera aurantii*, to combinations of volatiles and colors related to tea plants. *Entomologia Experimentalis et Applicata* in press
111. Lu, R. C., Wang, H. B., Zhang, Z., **Byers, J. A.**, Jin, Y. J., Wen, H. F., Shi, W. J. 2012. Coexistence and competition between *Tomicus yunnanensis* and *T. minor* (Coleoptera: Scolytinae) in Yunnan pine. *Psyche* vol. 2012, ID 185312, pp. 1-6.
112. Lu, R. C., Wang, H. B., Zhang, Z., **Byers, J. A.**, Jin, Y. J., Wen, H. F., Shi, W. J. 2012. Attraction of *Tomicus yunnanensis* (Coleoptera: Scolytinae) to Yunnan pine logs with and without periderm or phloem: an effective monitoring bait. *Psyche* vol. 2012, ID 794683, pp. 1-5.

113. Rodriguez-Saona, C., **Byers, J. A.**, and Schiffhauer, D. 2012. Effect of trap color and height on captures of blunt-nosed and sharp-nosed leafhoppers (Hemiptera: Cicadellidae) and non-target arthropods in cranberry bogs. *Crop Protection* in press

Additional Publications

114. Byers, J. A. Plant growth hormones in pinyon insect galls. M.S. Thesis, Department of Entomology, Colorado State University, Fort Collins, Colorado, U.S.A. 113 pp. 1973. (M.S. Thesis)
115. Byers, J. A. Mutual inhibition of the attractive response to pheromones of *Dendroctonus brevicomis* and *Ips paraconfusus*, and the physiology of pheromone production in *Ips paraconfusus*. Ph.D. Dissertation, Department of Entomological Sciences, University of California, Berkeley, California, U.S.A. 113 pp. 1978. (Ph.D. Thesis)
116. Byers, J. A. ESA (Entomological Society of America) Newsletter 6(10):1. 1983. Proposes new journal called "Entomology". (Published Letter)
117. Byers, J. A. ESA Newsletter 7(8):6. 1984. Proposal to rename 'Ann. Entomol. Soc. Am.' to 'Entomology', and proposes free page charges to increase competition and quality in ESA journals. (Published Letter)
118. Byers, J. A. ESA Newsletter 8(10):3. 1985. Discussion of international membership, a recent questionnaire, 'Entomology' journal, and the need for having national meetings in different regions. (Published Letter)
119. Byers, J. A. What's in a name? *Bulletin of the Entomological Society of America* 33:208. 1987. (Published Letter)
120. Schlyter, F., **Byers, J. A.**, Löfqvist, J., Leufvén, A., and Birgersson, G. Reduction of attack density of the bark beetles *Ips typographus* and *Tomicus piniperda* on host bark by verbenone inhibition of attraction to pheromone and host kairomone. pp. 53-68. In: Payne, T.L. and Saarenmaa, H. (eds.), *Integrated Control of Scolytid Bark Beetles*, Virginia Tech. Press, Blacksburg. 355 pp. 1988. (Book Chapter)
121. Byers, J. A. Host tree chemistry affecting colonization in bark beetles, in R.T. Cardé and W.J. Bell (eds.). *Chemical Ecology of Insects 2*. Chapman and Hall, New York, pp. 154-213. 1995. (Book Chapter)
122. Byers, J. A. Chemical Ecology of Bark Beetles <http://www.vsv.slu.se/cec/h.htm>. Plant Protection Science, Swedish University of Agricultural Science. 1996. (Internet Website)
123. Vinson, S. B., O'Keefe, S., and **Byers, J. A.** Vinson Lab – People, Ants, Parasitoids, Bees <http://vinsonlab.tamu.edu/index.htm>. Department of Entomology, Texas A&M University. 2001. (Internet Website)
124. Byers, J. A. Chemical ecology of bark beetles in a complex olfactory landscape. pp. 89-134. In, *Bark and Wood Boring Insects in Living Trees in Europe, a Synthesis*, F. Lieutier, K.R. Day, A. Battisti, J.C. Grégoire, H.F. Evans (Eds). Kluwer Academic Publishers, Dordrecht, The Netherlands. 2004. (Book Chapter)
125. Byers, J. A. *Ips paraconfusus*. In: *Crop Protection Compendium*, 2004 edition. Wallingford, UK: CAB International. 2004. (CD-R disk)
126. Blackmer, J. L., **Byers, J. A.**, and Rodriguez-Saona, C. R. Visual and volatile preferences of the generalist herbivore, *Lygus hesperus* (Heteroptera: Miridae). pp. 1048-1052. National Cotton Council Beltwide Cotton Conference, San Antonio, TX. 2006. (Proceedings)
127. Byers, J. A. Book Review: *Aphids as Crop Pests* (Edited by H.F. van Emden and R. Harrington, CABI, London, UK, Nosworthy Way, Wallingford, Oxfordshire OX10 8DE, UK, 2007). *Crop Science* 48:823-824. 2008. (Book Review)

128. **Byers, J. A.** and Zhang, Q.H. 2010. Chemical Ecology of Bark Beetles in regard to search and selection of host trees, pp. 88-111. In, Recent Advances in Entomological Research: From Molecular Biology to Pest Management (eds.) T.-X. Liu and L. Kang. The Higher Education Press (Beijing) (Book Chapter)
129. <http://news.sciencemag.org/sciencenow/2011/10/scienceshot-an-anti-aphrodisiac.html?ref=hp#.TqIjFpFQcW.email> (Science; news web page)
130. Byers, J. A. Chemical Ecology of Insects <http://www.chemical-ecology.net>. 2013. (Internet Website)

Curriculum Vitae – John A. Byers

Nominee's/Applicant's Name:

Dr. John Allen Byers

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Maricopa, Arizona 85138
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520-316-6339 (lab 520-316-6410)

Affiliation: USDA-ARS

Profession Title: Research Entomologist

Educational Background:

B.S. Entomology, Department of Entomology, Colorado State University, 1971.
M.S. Entomology, Department of Entomology, Colorado State University, 1973.
Ph.D. Entomology, Department of Entomological Sciences, University of California, Berkeley, 1978.

Relevant Employment:

USDA Forest Service, Western Range and Forest Experiment Station, Fort Collins, CO., GS-4 Research Technician, 1970.
Department of Entomology, Colorado State University, Fort Collins, CO, Graduate Research Assistant (M.S.), 1971-1972.
Department of Entomology, Colorado State University, Fort Collins, CO, Research Technician (toxicology), 1972.
Department of Entomological Sciences (Forest Entomology), University of California, Berkeley, CA, Graduate Research Assistant (Ph.D.), 1973-1978.
Department of Entomological Sciences (Forest Entomology), University of California, Berkeley, CA, Postdoctoral Researcher, 1978.
Cooperative Extension Entomology, University of California, Berkeley, CA, Postdoctoral Researcher, 1979-1980.
Department of Entomological Sciences (Nematology), University of California, Berkeley, CA, Postdoctoral Researcher, 1980.
Department of Animal Ecology (Dr. Löfqvist), Lund University, Lund, Sweden, Postdoctoral Researcher, 1981-1985.
Department of Entomological Sciences, University of California, Berkeley, CA, Research Fellow, 1985-1987.
Department of Animal Ecology, Lund University, Lund, Sweden, Researcher (Stipendium), 1987-1988.
Department of Animal Ecology, Lund, Sweden, Assistant Professor (non-tenure track, Docent), 1989-1991.
Department of Animal Ecology, Lund University, Lund, Sweden, Associate Professor (non-tenure track, Högskolelektor), 1991-1993.

Department of Plant Science, Swedish University of Agricultural Sciences, Alnarp, Sweden, Associate Professor (non-tenure track), 1994-2001.

Department of Entomology, Texas A&M University, College Station, TX, Research Scientist, 2001. USDA-ARS, Western Cotton Research Laboratory, Phoenix, AZ, GS-12 Research Entomologist, 2002-2005.

USDA-ARS, U.S. Arid-Land Agricultural Research Center, Maricopa, AZ, GS-13 Research Entomologist, 2005-2009; USDA-ARS, U.S. Arid-Land Agricultural Research Center, Maricopa, AZ, GS-14 Research Entomologist, 2009-present.

Memberships and Affiliations:

- Member of Entomological Society of America
- Member of International Society of Chemical Ecology
- Member of Asian-Pacific Association of Chemical Ecologists
- Member Nordic Ecological Society (1989-1996)
- Center for Insect Science
- Elected as Adjunct Faculty in Department of Entomology, University of Arizona - 2008

Awards and Honors:

- Inducted into Gamma Sigma Delta (Honor Society of Agriculture, 1971, USA)
- Inducted into Phi Kappa Phi (National Honor Society, 1971, USA)
- Inducted into Sigma Xi (The Scientific Research Society, 1979, USA)
- Research Fellow - 1985-1988, Univ. of California, Berkeley, USA.
- Research Stipend, Hildur och Sven Wingqvists Stiftelse: (3/1989 to 3/1990, Sweden)
- Swedish Docent title in Ecology (title of research accomplishment) - 1989, Lund University, Sweden
- *Science* Editor's recommendation for Internet site on Insect Chemical Ecology in *Science* 288:767. 2000.
- Elected to The New York Academy of Sciences, 2004

Research

Please refer to the 113 peer-reviewed journal articles (includes four patents) and additional book chapters and other articles in the preceding section. Note that three articles in journals refer to education (papers 71-73).

Research Support:

- 1) Byers, J.A. 1985-1987. Bark beetle pheromone systems in California and Sweden. USA(NSF)/Sweden(STU) Cooperative Research Grant, \$30,000 for travel and equipment at Lund University, Sweden, and University of California, Berkeley, USA.
- 2) Byers, J.A. 1988-1989. Spruce bark beetle olfactory systems. STU (Styrelsen för Teknisk Utveckling = Council for Technological Development) and the Wingqvist stipendium for salary and equipment at Lund University, Sweden (\$25,000).
- 3) Byers, J.A. and Löfqvist, J. 1989-1990. Pheromones and chemical ecology of locusts. SAREC of Sweden (Swedish Agency for Research Cooperation with Developing Countries) for salary at Lund University, Sweden, \$10,000.
- 4) Byers, J.A. 1991-1994. *Density regulating mechanisms limiting competition in bark beetles*. SJFR (Swedish Council for Forestry and Agricultural Research) for salary, travel, and equipment at Lund University, Sweden (\$250,000).
- 5) Byers, J.A. 1995-1998. *Attack spacing and repellency among bark beetles colonizing trees*. SJFR (Swedish Council for Forestry and Agricultural Research) for salary, travel, and equipment at Lund University and Swedish University of Agricultural Sciences (\$300,000).
- 6) Byers, J.A. 1998-2001. *Natural feeding deterrents and toxins in trees resistant to bark beetles*. SJFR (Swedish Council for Forestry and Agricultural Research) for salary, travel, and equipment at Swedish University of Agricultural Sciences (\$350,000).

Graduate Students and Postdoctoral Associates Trained:

Dr. Byers has advised many Ph.D. candidates in entomology and/or insect chemical ecology at several universities and edited both English and scientific content of their manuscripts. Below is a summary of these Ph.D. student-authors that specifically mention **J. Byers** in the *Acknowledgements* of their journal articles:

- Lund University, Sweden: O. A. (9 papers); C. L. (3 papers); F. S. (5 papers); B.S.H. (1 paper); H. L. (1 paper); A.M.O. (1 paper); F. Ö. (1 paper); B. T. (1 paper); J. Z. (2 papers)
- Swedish University of Agricultural Sciences, Uppsala: Å.L. (2 papers); J. W. (1 paper); G. N. (1 paper); L. M. S. (2 papers); E. F. (1 paper); M. L. (1 paper); M. C. (1 paper)
- Göteborg University: G. B. (4 papers); A. L. (2 papers); E. P. (2 papers)
- Royal Institute of Technology, Stockholm: K. S. (1 paper)
- Royal Veterinary and Agricultural University, Copenhagen: S. H. (1 paper); H. P. R. (1 paper)

Dr. Byers edited manuscripts of eight Animal Ecology Ph.D. students at Lund University, Sweden. Dr. Byers help was specifically acknowledged in the Ph.D. theses of seven Ph.D. students at the Swedish University of Agricultural Sciences, Sweden.

Research Talks and Posters Presented:

- Entomological Society of America (1984-present). Attended 9 meetings in USA and gave poster or presentation at 7 of meetings
- Nordic Ecological Society (1989-1996). Attended 5 meetings in Sweden/Norway and gave presentation at each
- European Ecological Symposium (1983, Lund). Poster
- International Congress of Entomology (1988-present). Attended 5 meetings and gave poster and/or presentations at each
- International Society of Chemical Ecology (1989-present). Attended 10 International meetings and gave presentations at each
- European Symposium on Insect Taste and Olfaction (1995, Lund) – presentation
- IUFRO Symposium on physiology and genetics of tree-phytophage interactions, Arcachon, France, 1997
- International Symposium on Insect Pheromones (1998, Wageningen) – presentation
- Workshop on dispersal of insects, Department of Entomology, Swedish University of Agriculture, Uppsala, 1998.
- FLAD conference on "Integrated Forest Protection in the USA and Europe: an Environmental Perspective" (1998, Lisbon) – presentation
- BAWBILT (bark and wood boring insects in living trees) – 2 meetings (Cracow, Poland, 2000 and Brussels, Belgium, 2000)
- 3rd Management Committee and Working Group Meeting of COST ACTION E16: BAWBILT - Bark and wood boring insects in living trees, Cracow, Poland, 2000
- Asian-Pacific conference on Invasive Species (2005, Beijing).
- Entomological Society of America – Pacific Branch (2006, Maui). Invited presentation at Symposium.
- Entomological Society of America – Pacific Branch meeting (2009, San Diego): invited speaker at symposium on “Chemical Ecology Based Pest Management – 50 years after the first pheromone synthesis” and present talk on “Simulation of Mating Disruption and Mass Trapping using the Effective Attraction Radius”.
- Asian-Pacific Association of Chemical Ecologists (2011, Beijing, China) – invited speaker at Symposium “Emerging Technology and Research Methodology in Applied Chemical Ecology” and presented talk on “Models for Monitoring Invasive Insect Species”.

Special Invitations:

- Department of Evolution and Ecology, University of California, Irvine, 1978. Invited to present seminar on “Mutual inhibition of the behavioral response to pheromone by pheromone of competing bark beetles”;
- Department of Entomology, University of Maryland, College Park, 1980. Invited to present seminar on “Chemical Ecology and physiology of the bark beetle *Ips paraconfusus* in relation to pheromones”;
- Department of Entomology, University of California, Davis, 1982. Invited to present seminar on “Behavioral ecology of California bark beetles involving pheromones”;
- Department of Entomology, Mississippi State University, Starkville, 1982. Invited to present seminar on “Plant-Insect Interactions involving pheromones in California bark beetles”;
- 4th Annual Insect Pheromone Conference, Rockefeller Foundation, Palm Springs, CA, USA, 1974. Invited to present seminar on “Bioassay results with optically active isomers of exo-brevicommin”;
- Department of Endocrinology, Medical College of Georgia, Augusta, 1983. Invited to present seminar on “Pheromonal regulation of intra- and interspecific competition in bark beetles”;
- Department of Entomology, Montana State University, Bozeman, 1987. Invited to present seminar on “Bark beetle research in Sweden, Norway and Denmark”;
- Department of Forest Entomology,

- Frieborg, Germany, 1989. Invited to present seminar on "Isolation of chalcogran and methyl (*E,Z*)-2,4-decadienoate, aggregation pheromone components of *Pityogenes chalcographus*"
- b. Department of Entomology, Swedish University of Agricultural Sciences, Uppsala, Sweden, 1995. Invited to present seminar on "Behavioral and chemical ecology of bark beetles in California and Scandinavia"
 - c. Department of Chemical Ecology, Gothenburg University, Sweden, 1995. Invited to present seminar on "Biosynthesis of pheromones in bark beetles"
 - d. Department of Southern Swedish Forest Science, Swedish University of Agricultural Sciences, Alnarp, Sweden, 1997. Invited to present seminar on "Bark beetle chemical ecology: mate/host-tree finding and spatial analysis of competition"
 - e. Workshop in Advances in Insect Chemical Ecology. Faculty of Sciences and Technology, Monte de Caparica, Portugal, 1998. Invited to present seminar on "Models of bark beetle chemical ecology"
 - f. HortResearch, Canterbury Research Centre, Lincoln, 8152, New Zealand, 2005. Invited to present seminar on "Chemical ecology of bark beetles"; travel and expenses paid by New Zealand over two weeks.
 - g. Chinese Academy of Forestry in Beijing, Kunming, and Xian; and Beijing University, China, 2005. Invited to present four seminars each at respective facility on "Chemical ecology of bark beetles and some cotton insects"; all expenses and travel paid by China during two weeks.
 - h. Entomological Society of America annual meeting, Fort Lauderdale, Florida, 2005. Invited to present seminar at Student Symposium on "Semiochemicals in pest management"
 - i. Entomological Society of America, Pacific Branch meeting, Maui, Hawaii, 2006. Invited to present seminar in Chemical Ecology Symposium on "Models and methods in chemical ecology"
 - j. Department of Entomology, University of Arizona, Tucson, 2007. Invited to present seminar on "Chemical ecology of insects in California, Sweden, and Arizona: Methods and Models"
 - k. The Volcani Center, Bet Dagan, Israel, 2007. Invited to present seminar on "Methods and models for studying the chemical ecology of insects"
 - l. Israeli Entomological Society, Tel Aviv, Israel, 2007. Invited to present Plenary Lecture on "Chemical ecology of bark beetles in western USA and Europe"; travel and expenses paid by Israel (10 days).
 - m. International Congress of Entomology, Durban, South Africa, 2008. Invited to present talk in Symposium: Semiochemicals in IPM on perennial crops on "Simulation in mating disruption and mass trapping with competitive attraction and camouflage"
 - n. Chinese Forestry in Xining, Qinghai province; and Beijing Forestry University, China, 2009. Invited as consultant on bark beetles and to participate in field work on *Hoplia* pasture pest species; Gave 3 presentations during 2-week visit paid for by Chinese

Patents:

Swedish and European patents that Dr. Byers has received (publication list #24, #34, #39 and #61), can be verified in the database of the Swedish patent office: <http://se.espacenet.com>. Click on English, then Quick Search, then Select patent database as "Worldwide", radio button "Words in title or abstract", then enter search terms of Genus species (e.g., *Pityogenes chalcographus*, *Tomicus piniperda*, or *Ips typographus*).

Teaching

Formal Courses:

1. 1973 Teaching Assistant, undergraduate students, Colo. State Univ.; Lecturer: Zoology 101, "Man and the Animal World", two 1-hr classes each week for 10 weeks (30 students), Colo. State Univ., Supervisor: Dr. S. G. Martin; Entomology 461, "Medical Entomology"; Colo. State Univ., Supervisor: Dr. T. O. Thatcher. Laboratory (once weekly for 3 hours for 10 weeks; 20 students).
2. 1982–1994 Dr. Byers presented one or two lectures per year to beginning animal ecology students at Lund University (usually on bark beetle research and on writing scientific manuscripts and reference management; 15 students).
3. 1991 Dr. Byers solely taught a 10-week course (90 min/lecture/week) to graduate Ph.D. students on "Ecological Research with the Personal Computer" in the Department of Ecology, Lund University (official course offering; 10 students).
4. 1993–1994 Dr. Byers taught solely a 10-week course (90 min/lecture/week) to graduate students of Ecology entitled "Simulation of Ecological Models by Personal Computer" in cooperation with the department of Theoretical Ecology, Lund University (10 students).
5. 1997 Dr. Byers participated in the undergraduate course Vp 22a (Grundkurs i växtskyddsvetenskap - Basic course in Plant Protection Science) with responsibility for the bacteriology part of plant diseases, Swedish University of Agricultural Sciences;

6. Dr. Byers taught "How to write scientific papers in English", Swedish University of Agricultural Sciences (10 students).
7. 1998 Dr. Byers participated in the undergraduate course Vp 22a (Grundkurs i växtskyddsvetenskap - Basic course in Plant Protection Science) 10 points, presenting lectures in Nematology ("Insect-killing nematodes"), Virology ("Viral reproduction and biochemistry"), Plant Resistance ("Host-tree resistance to bark beetles"), and Mycology ("Dutch elm disease") – 20 students.
8. 1999-2000 Dr. Byers gave several 1-hr lectures in a graduate biostatistics course at Swedish University of Agricultural Sciences, Alnarp (10 students);
9. 2000 Dr. Byers taught in Vs1 (Plant Protection course) on "insect and plant collection methods and entomology on the Internet" (SLU) – Dr. Byers gave out a course evaluation to 20 students and was rated 4.9 out of 5 for his teaching.
10. 2003-2005 Dr. Byers taught 1-h lectures on chemical ecology each year to students of Grand Canyon University, Phoenix, AZ (30 students).

Other Teaching Activities:

- a. Assignment for planning of course work for common Danish-Swedish horticultural education program between Swedish University of Agricultural Sciences, Alnarp, and the Royal Veterinary and Agricultural University, Copenhagen, 2000.

Publications Relevant to Teaching:

- Byers, J. A. 1999. Database program to manage slides and images for teaching and presentations. *Educational Media International* 36:77-80.
- Byers, J. A. 1999. Flash cards and animation software for education. *Educational Media International* 36:164-167.
- Byers, J. A. 1999. Interactive learning using expert system quizzes on the Internet. *Educational Media International* 36:191-194.

Extension/Outreach

Additional Extension Educational Products:

Very popular web site in Entomology, www.chemical-ecology.net/h.htm with 153,702 unique visitors in 2011 (awstats.sourceforge.net)

Presentations at Extension Meetings, Workshops, and Field Days:

1. Dr. Byers showed powerpoint presentations of insects in various habitats to 4th grade students at Casa Grande Elementary, Casa Grande, AZ, 2006.
2. Dr. Byers showed a slide show of over 4000 images of insects and natural landscapes of Southwestern USA at Maricopa Agricultural Center Day, Maricopa, AZ, 2008.
3. Byers, J. A. *Ips paraconfusus*. In: Crop Protection Compendium, 2004 edition. Wallingford, UK: CAB International. 2004. (CD-R disk)

Media Contact:

<http://news.sciencemag.org/sciencenow/2011/10/scienceshot-an-anti-aphrodisiac.html?ref=hp#.TqIjFpFQcCw.email> (Science; news web page)

Service

Professional Societies:

- a. Member of expert group on "Mass outbreak of *Ips typographus* in Nationalpark Bayerischer Wald, Germany" (4 Dec., Munich, Germany and 4-5 Feb., St. Oswald, Germany), 1997-1998.
- b. Entomological Society of America – Pacific Branch meeting: organized symposium with Jack Jenkins on "Chemical Ecology Based Pest Management – 50 years after the first pheromone synthesis" (2009, San Diego) – also gave presentation.
- c. International Society of Chemical Ecology – Annual meeting: organized symposium on "Invasive species and Climate Change in Chemical Ecology" (2012, Vilnius, Lithuania) – also gave presentation.
- d. Peer-reviewed dozens of manuscripts. Some of the journals he has reviewed manuscripts for include: *Annals of the Entomological Society of America*, *Environmental Entomology*, *Entomologia Experimentalis et Applicata*, *Journal of Chemical Ecology*, *Chemoecology*, *Animal Behaviour*, *Canadian Entomologist*, *American Naturalist*, *Phytochemical Analysis*, *Canadian Journal of Forest*

Research, Biocontrol, Naturwissenschaften, Journal of Animal Ecology, and Ecology, Insect Science, Journal of Insect Science, Pest Management Science, 1985-present.

- e. Reviewed numerous competitive grants for the following agencies: USDA National Research Initiative Competitive Grants Program; USDA-CSREES Small Business Innovation Research Program; Biotechnology and Biological Sciences Research Council grant (U.K.), 2002-present.

State, National, and International Agencies:

- 1) Sweden's representative (1999-2001) on COST ACTION E16 for computerized databases in BAWBILT (Bark and Wood Boring Insects in Living Trees) – coordination sponsored by European Union
- 2) Scientist at USDA-ARS

Nominee's Institution:

- A. Graduate Education Committee, Department of Plant Science, Swedish University of Agricultural Sciences, Alnarp, Sweden, 1999-2000.
- B. Visions and Planning Committee, Department of Plant Science, Swedish University of Agricultural Sciences, Alnarp, Sweden, 1999-2000.
- C. Internet Advisory Committee, Swedish University of Agricultural Sciences, Sweden, 1997-2000.
- D. Elected as Adjunct Faculty in Department of Entomology, University of Arizona – 2008
- E. Member committee for coordinating the U.S. Arid Land Agricultural Research Center seminars – 2011-2012