



Something To SNEEZE *At*

German cockroaches and allergen-laden fecal smears in a cabinet corner of an infested home.

The first-place winner of Bayer and NPMA's Young Scientist of the Year contest discusses German cockroaches as a public health pest. *By J. Chad Gore and Coby Schal*

Editor's note: The following is the second in a series of three stories by the winners of the Young Scientist of the Year contest, sponsored by Bayer and the National Pest Management Association. The first story appeared in the February issue of PCT; watch for the other remaining story in an upcoming issue.

The German cockroach, with its long history of close association with humans, is most often regarded as merely an unpleasant pest with the potential to transmit disease-causing microbes. However, recent research has demonstrated that this insidious pest has a much greater impact on public health than was once thought. German cockroaches, first implicated in allergic disease nearly 40 years ago, produce several proteins that exacerbate allergic responses and asthma in sensitive individuals, especially among children and the elderly.

The overall goal of our research is to reduce these allergens in homes below harmful levels. Toward this goal, we integrate fundamental and applied research to 1) develop innovative strategies to control cockroaches; 2) understand the basic biology of German cockroach allergens; and 3) devise practical approaches to reduce allergens in cockroach-infested homes.

ALTERNATIVE CONTROL STRATEGIES. Although insecticide baits have largely displaced other formulations for German cockroach control — especially as components of IPM programs — cockroach management in some commercial settings continues to rely heavily on calendar-based applications of broad-spectrum insecticides. Our research in confinement swine production aims to forestall the develop-



Boric acid liquid bait treatments reduced cockroach populations by 90 to 99 percent with sustained reduction over a 10-month period at this pig farm nursery.

ment of insecticide resistance and to reduce risk to workers, animals, consumers and the environment. We examined two alternative strategies to conventional cockroach control.

Boric acid dust has a long history of use against cockroaches, in part due to its favorable safety record, low cost and lack of resistance. In a recent study, we showed that boric acid dust was as effective as a pyrethroid insecticide for cockroach control in infested swine farms (Zurek et al. 2003). However, dust formulations have their share of practical limitations. In the laboratory, we showed that liquid formulations of boric acid and sugar provided excellent control of the German cockroach (Gore and Schal 2004a). This formulation was evaluated in an infested nursery of a pig farm using a prototype J-shaped bait feeding station (see photo at right). The results of this two-year field study showed that the cockroach population was

reduced by more than 90 percent within one to two months. When baits were used continuously for about 10 months (see chart below), the cockroach populations declined by 90 to 99 percent and were maintained at low levels (Gore et al. 2004).

Insect growth regulators, although not as fast acting as conventional insecticides, can result in substantial reductions in German cockroach populations. To counter this delay, insecticides can be mixed with IGRs, resulting in enduring reductions in populations. We are currently examining the efficacy of IGRs (hydroprene and pyriproxifen) mixed with the pyrethroid cyfluthrin for cockroach control in farrowing barns of an infested pig farm. The study's preliminary results show that while populations in rooms treated only with cyfluthrin began increasing seven to eight months after the start of the study, populations in IGR-treated rooms continued to decline. Even after a year, populations in IGR-treated rooms remain low.

ALLERGEN BIOLOGY. Bla g 1 (*Blattella germanica* allergen 1) is one of six known human allergens produced by the German cockroach. Using molecular approaches, we showed that it is made only in the midgut of the digestive system, and ultimately secreted into the feces in large amounts and expelled into the environment (Gore and Schal 2004b). Because more Bla g 1 is produced when cockroaches feed, and adult females eat much more than nymphs and adult males, adult females make and excrete in their feces much more Bla g 1 than other cockroaches. Nevertheless, adult males tend to forage over

larger distances and therefore may spread their allergen-laden feces over a broader area in the home. Small nymphs produce small amounts of allergen, but because they produce much smaller fecal pellets the allergen may more easily become airborne and taken into the lungs. We plan to determine the contribution of each life-stage of the cockroach to the total allergen load in homes.

Using similar molecular approaches, we showed that unlike Bla g 1, Bla g 4, another human allergen, is found only in the adult male's reproductive system, and is transferred with the sperm package to the female during mating (Fan et al. 2005). Such limited production and dissemination of this allergen might imply that it would be less pervasive in the environment. However, 40 to 60 percent of asthmatics who are allergic to cockroaches react to Bla g 4, suggesting extensive exposure to this protein. Although adult males constitute a relatively small fraction of a cockroach population, they tend to be more mobile than other stages. Therefore, adult males are more likely to encounter pesticides and die, disseminating their Bla g 4 contents in the household environment.

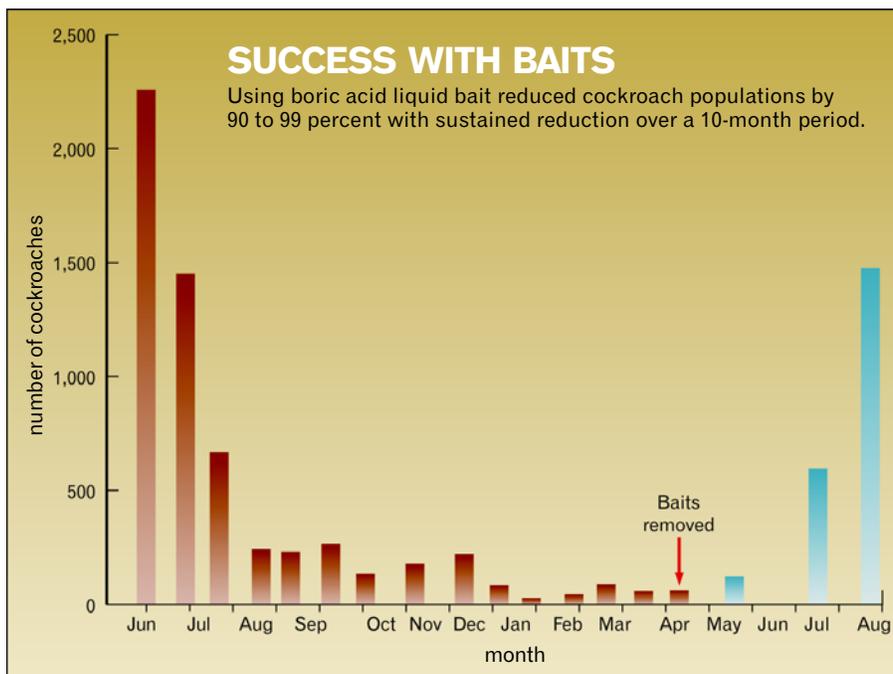
Further research is needed to allow us to not only identify the biological functions of allergens in the German cockroach, but also to provide insight into how current pest management approaches might affect allergen accumulation in infested structures. For example, our research indicates that both Bla g 1 and 4 increase with greater exposure to juvenile hormone. It is plausible that IGRs that mimic the action of juvenile hormone (e.g., methoprene, hydroprene, pyriproxifen) might also stimulate allergen production. This hypothesis can be tested by determining whether different cockroach-produced allergens accumulate disproportionately in the environment in response to different pest control treatments.

MITIGATION EFFECTS ON ALLERGENS.

Exposure to cockroach allergens in homes has received much attention from the medical community. Clinical research has shown that very low levels of cockroach allergen are needed to sensitize and exacerbate existing asthmatic conditions. Allergen mitigation is a reasonable goal, but several studies have seen only limited success. In collaboration with the National Institute of Environmen-



The J-shaped liquid bait feeding station.





German cockroaches feeding at bait station.

tal Health Sciences (NIEHS), we evaluated the efficacy of an intensive and targeted mitigation program to reduce levels of German cockroach allergens in infested homes.

In the first half of our year-long study, we used a three-pronged approach to reducing

allergens. Infested homes were treated with gel bait to reduce (and hopefully eliminate) cockroach populations and then professionally cleaned to remove allergens. Also, residents were provided educational material outlining ways to improve sanitation and prevent infestations. Our results showed that this combined — but costly — approach resulted in 96 percent reduction in trapped cockroaches and dramatic reductions in household allergen levels (Arbes et al. 2003).

We next wanted to determine whether allergen reductions could be sustained for another six months with cockroach management alone, and whether using only baits, instead of the combined approach, could reduce allergen levels. The results of the second half of our study were very surprising and contrary to previously published reports. In short, we found that clinically relevant reductions, similar to those when using the combined approach, occurred with insecticide bait use only (Arbes et al. 2004). This study also showed that keeping an apartment essentially cockroach-free could sustain the allergen reductions.

BENEFITS TO THE INDUSTRY. The goal of our research with boric acid and IGRs was to reduce the dependence upon conventional insecticides for pest management while providing safe, effective means for the control of German cockroaches. We demonstrated that large-scale reductions of German cockroach infestations could be achieved using inexpensive, reduced-risk, targeted approaches. These tactics not only reduce cockroach populations and allergens they disseminate, but also have the direct benefit of dramatically reducing the amount of active ingredient needed for effective control, thereby reducing the risk of exposure to humans, animals and the environment. Furthermore, these approaches require little labor input, resulting in a labor savings for the end-user. This technology can be extremely valuable in sensitive environments, such as schools, nursing homes, pet shops and even homes, where conventional insecticides may not be an option.

In recent years we have seen a renewed interest in public health in the pest management industry. Our research on German cockroach allergens highlights the impor-

[continued on page 117]

How to stay ahead of the competition.

“Being one of the first partners in the Symbiot Pest Management Network, Knockout has had the opportunity to truly experience the full benefit of being a part of the unique Symbiot concept. Symbiot provides us with the ability to offer coverage on a national basis, but also enables us to work at the local level where relationships are so critical. We highly recommend Symbiot to any organization that is serious about becoming a major player in the pest control industry.”

Arthur Katz,
Knockout Pest Control
SPMN Sales Partner,
New York City and
Long Island



Become a
Partner Today!

www.symbiot.biz/pest
888.233.5518 x1010

DOES YOUR INSURANCE POLICY EXPIRE SOON?



If so CALL George C. Olden President of
Warner-Lane Associates, Inc at:
1-877-286-9154 or Fax 1-631-981-2233

And let me do your insurance shopping for you.
I represent many of the current insurance programs
available for Pest Control Operators. Allow me & my full
service staff to find the one that works best for you!

YOUR SAVINGS COULD BE HUGE!
CALL TODAY.

Available in the following states,
AZ, CA, CO, CT, DE, IL, IN, KS, KY, LA, MO, NC, NJ,
NV, NY, OH, OK, PA, RI, SC, TX, UT, VA, WV, WI



ALLERGENS

[continued from page 94]

tance of this ubiquitous insect as a public health pest, and provides pest management professionals a better understanding of its biology as it relates to the health of consumers. These data, combined with results from our collaborative study with the NIEHS, which showed that cockroach population management alone can reduce allergen levels in infested homes, allows the pest management professional to better educate clients. Our research emphasizes the need for an informed pest management professional workforce familiar with both the biology of target pests and the technology that reduces pest populations and their public health impact with minimal pesticide input. 🐜

Authors' Acknowledgements:

This work was supported in part by the Blanton J. Whitmire Endowment at North Carolina State University. Chad Gore also received scholarships from the North Carolina Pest Control Association and Pi Chi Omega, and the 2004 Bayer Young Scientist Award.

The authors are at the Department of Entomology, North Carolina State University. Gore can be reached at cgore@giemedia.com.

References:

Arbes, S.J. Jr., M. Sever, J. Archer, E.H. Long, J.C. Gore, C. Schal, M. Walter, B. Nuebler, B. Vaughn, H. Mitchell, E. Liu, N. Collette, P. Adler, and D.C. Zeldin. 2003. Abatement of cockroach allergen (Bla g 1) in low-income, urban housing—a randomized controlled trial. *Journal of Allergy and Clinical Immunology* 112: 339–345.

Arbes, S. J. Jr., M. Sever, J. Mehta, J.C. Gore, C. Schal, B. Vaughn, H. Mitchell, and D.C. Zeldin. 2004. Abatement of cockroach allergen (Bla g 1 and Bla g 2) in low-income, urban housing: 12-month continuation results. *Journal of Allergy and Clinical Immunology* 113:109–114.

Fan, Y., J.C. Gore, K.O. Redding, L.D. Vailes, M.D. Chapman and C. Schal. 2005. Tissue localization and regulation by juvenile hormone of German cockroach, *Blattella germanica* (L.), allergen Bla g 4. *Insect Molecular Biology* 14: 45–53.

Gore, J.C. and C. Schal. 2004a. Evaluation of boric acid-sugar solutions as baits for management of German cockroach infestations. *Journal of Economic Entomology* 97:581–587.

Gore, J.C. and C. Schal. 2004b. Gene expression and tissue distribution of the major human allergen Bla g 1 in the German cockroach, *Blattella germanica* (L.) (Dictyoptera: Blattellidae). *Journal of Medical Entomology* 41: 953–960.

Gore, J.C., L. Zurek, M. Stringham, D.W. Watson, M. Waldvogel and C. Schal. 2004. Water solutions of boric acid and sugar for management of German cockroach populations in livestock production systems. *Journal of Economic Entomology* 97:715–720.

Zurek, L., J.C. Gore, M. Stringham, W. Watson, M. Waldvogel, and C. Schal. 2003. Boric acid dust as a component of the integrated cockroach management in confined swine production. *Journal of Economic Entomology* 96: 1362–1366.

AD INDEX

To inquire about our advertisers' products, turn to page 101.

Company	Page	RS#	Company	Page	RS#
Air-Scent www.airscent.com	100	80	Liphatech www.liphatech.com	119	91
American Bio-Systems www.bio-systems.com	110	88	MGK www.mgk.com	47,59	39,48
Anstar www.anstarproducts.com	109	85	Microbyte www.apicide.com	22	19
Ant-Fix www.antfix.com	109	86	Mystic Chemical www.newimagesoftware.net	113	89
Arrow Exterminators www.arrowexterminators.com	14	14	New Image Software www.nisuscorp.com	14	63
Atlantic Paste & Glue www.catchmaster.com	23,91	20,71	Nisus www.nixalite.com	56-57	47
Avitrol www.avitrol.com	82	67	Nixalite www.sterifab.com	62	29
Basement Systems www.basementsystems.com	24	22	Noble Pine www.novaguard.com	78	62
B&G Equipment Company www.bgequip.com	61	50	Novaguard www.oldhamchem.com	75	60
BASF www.pestcontrolfacts.com	2-3,53		Oldham Chemicals www.orkin.com	13	12
Bayer ES www.bayerprocentral.com	4-5,42,43,68,69		Orkin www.paraclipse.com	44	35
Bell Laboratories www.belllabs.com	31,79	24,64	Paraclipse www.pestmaster.com	15	15
Bird-X www.bird-x.com/pct	44	36	Pestmaster Services www.rdfsoftware.com	22	18
Bird Barrier www.birdbarrier.com	72	58	RDF Software www.rockwelllabs.com	54	45
Browyard Group www.browyard.com	34	27	Rockwell Labs www.speckoz.com	95	75
Caltex www.caltexinternational.com	36	52	Specialty Products www.symbiot.biz/pest	46	38
Cintas www.cintas.com	65	55	Speckoz www.syngentaprofessionalproducts.com	16-17	17
Cleary Chemical www.roachterminal.com	105	82	Temp-Vent www.tempvent.com	113	90
Control Solutions www.controlsolutionsinc.com	67	56	Terminix www.terminix.com	97	76
Curtis Dyna-Fog www.dynafog.com	24	21	The Service Pro.Net www.theservicepro.net	98	78
Dr. T's Nature Products www.animalrepellents.com	40	33	Trece www.trece.com	60	26
Dupont www.proproducts.dupont.com	85	69	Truly Nolen www.trulynolen.com	110	87
EcoSmart www.ecosmart.com	76	61	Univar www.pestweb.com	9	10
Ehrlich Distribution www.ehrlichdistribution.com	54	44	UPMA Labs www.upmalabs.com	100	81
Ensystem www.ensystem.com	120	92	Vanguard Computer Systems www.camelotsoftware.com	78	
Executive Pest Control www.fmc-apgspec.com	62	30	VM Products www.vmproducts.com	50	41
FMC www.flybye.com	41	34	Warner Lane Associates www.watco.com	94	74
Fly Bye www.forshawonline.com	98	77	Waterbury www.weedman.com	11	11
Forshaw Distribution www.gremarinc.com	82	66	Weedman www.weisburger.com	72	57
Gremer www.pestdefense.com	36	51	Weisburger Insurance Brokerage www.wellmarkinternational.com	45,55	37,46
Hometeam Pest Defense www.igeba.de	64	54	Wellmark www.whitmiremicrogen.com	63	53
IGEBA www.innovativepestcontrol.com	15	16	Whitmire Micro-Gen www.wmmg.com	63	53
Innovative Pest Control Products www.antcafe.com	73-74	59	Woodstream www.woodstreampro.com	49,80-81,89	40,65,70
Insect-O-Cutor www.insect-o-cutor.com	33	49	XT 2000 www.XT2000.com	92,99,107	72,79,83
J.F. Oakes www.jfoakes.com	35	28			
Kness www.kness.com	108	84			

PROBLEMS & SOLUTIONS

[continued from page 113]

mite activity in wood.” Then, I guess we’d also have to say there was previous activity in the wood, when live termites are not found.

This brings us to another term: “activity.” To me, determining “activity” means finding live insects. The rest is “evidence of activity.” Yes, I am splitting hairs but that’s what attorneys do.

This brings us back to the comments by the attorney, which I mentioned previously. While I guess I can appreciate his opinion, I sure want a guide from him as to what we should say. We cannot just walk

away from the term “damage.” “Damage” is a part of our industry’s jargon. Should we change it? Yes. And we should start now!

This means changing a few things like those Xs and Ts with circles around them on diagrams and field worksheets. I believe every WDI inspection or treatment report I have looked at over the years had an X to denote “damage.” I’ve never been involved in a lawsuit where someone was suing the PCO because he explained where the damage and evidence was visible. 🐜

The author is president of George Rambo Consulting Services, Central, S.C. Fax questions to him at 864/654-2447 or via e-mail at grambo@giemedia.com.