



Health Canada  
Pest Management  
Regulatory Agency

Santé Canada  
Agence de réglementation  
de la lutte antiparasitaire

PRD2007-08

## PROPOSED REGISTRATION DECISION

# German Cockroach Extract

*(publié aussi en français)*

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# OVERVIEW

## Proposed Registration Decision for German Cockroach Extract

Health Canada's Pest Management Regulatory Agency (PMRA), under the authority of the *Pest Control Products Act* and in accordance with the Pest Control Products Regulations, is proposing full registration for the sale and use of German Cockroach Extract Technical, Victor Roach Magnet, Victor Roach Trap, and Victor Roach Trap and Monitor, all containing the technical grade active ingredient German Cockroach Extract, for indoor uses to control German cockroaches.

An evaluation of available scientific information found that, under the approved conditions of use, the end-use products have value and do not present an unacceptable risk to human health or the environment.

This overview describes the key points of the evaluation, while the Science Evaluation section provides detailed technical information on the human health, environmental and value assessments of German Cockroach Extract Technical as well as the end-use products Victor Roach Magnet, Victor Roach Trap, and Victor Roach Trap and Monitor.

## What Does Health Canada Consider When Making a Registration Decision?

The key objective of the *Pest Control Products Act* is to prevent unacceptable risks to people and the environment from the use of pest control products. Health or environmental risk is considered acceptable<sup>1</sup> if there is reasonable certainty that no harm to human health, future generations or the environment will result from use or exposure to the product under its proposed conditions of registration. The Act also requires that products have value<sup>2</sup> when used according to the label directions. Conditions of registration may include special precautionary measures on the product label to further reduce risk.

To reach its decisions, the PMRA applies modern, rigorous risk-assessment methods and policies. These methods consider the unique characteristics of sensitive subpopulations in humans (e.g. children) as well as organisms in the environment (e.g. those most sensitive to environmental contaminants). These methods and policies also consider the nature of the effects observed and the uncertainties present when predicting the impact of pesticides. For more information on how the PMRA regulates pesticides, the assessment process and risk reduction programs, please visit the PMRA's website at [www.pmra-arla.gc.ca](http://www.pmra-arla.gc.ca).

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<sup>1</sup> "Acceptable risks" as defined by subsection 2(2) of the *Pest Control Products Act*.

<sup>2</sup> "Value" as defined by Subsection 2(1) of the *Pest Control Products Act* "...the product's actual or potential contribution to pest management, taking into account its conditions or proposed conditions of registration, and includes the product's (a) efficacy; (b) effect on host organisms in connection with which it is intended to be used; and (c) health, safety and environmental benefits and social and economic impact".

Before making a final registration decision on German Cockroach Extract, the PMRA will consider all comments received from the public in response to this Consultation Document<sup>3</sup>. The PMRA will then publish a Registration Decision Document<sup>4</sup> on German Cockroach Extract, which will include the decision, the reasons for it, a summary of comments received on the proposed final registration decision and the PMRA's response to these comments.

For more details on the information presented in this Overview, please refer to the Science Evaluation section of this Consultation Document.

## **What Is German Cockroach Extract?**

German Cockroach Extract is a chemical extract that contains many different chemical compounds and is derived from feces-contaminated substrates in German cockroach colonies. German Cockroach Extract is used in the manufacture of impregnated lures that are installed within cockroach traps. The various cockroach traps using the German cockroach Extract lures are the end-use products.

### **❖ Health Considerations**

#### **◆ Can Approved Uses of German Cockroach Extract Affect Human Health?**

**German Cockroach Extract Technical, Victor Roach Magnet, Victor Roach Trap, and Victor Roach Trap and Monitor are unlikely to affect your health when used according to the proposed label directions.**

When assessing the health risks of German Cockroach Extract Technical, Victor Roach Magnet, Victor Roach Trap, and Victor Roach Trap and Monitor, the PMRA considers two key factors: the toxicity of the products and the levels to which people may be exposed.

The active ingredient, German Cockroach Extract, contains many substances that are produced by the German cockroach (*Blattella germanica*). These substances are present in buildings that currently have, or have recently had, a German cockroach infestation. The use of German Cockroach Extract is not expected to increase human exposure to these substances.

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<sup>3</sup> "Consultation statement" as required by subsection 28(2) of the *Pest Control Products Act*.

<sup>4</sup> "Decision statement" as required by subsection 28(5) of the *Pest Control Products Act*.

◆ **Residues in Water and Food**

**Dietary risks from food and water are not of concern.**

Because there are no uses of German Cockroach Extract on food or feed crops, the likelihood of residues contaminating food is negligible.

◆ **Occupational Risks From German Cockroach Extract**

**Occupational risks are not of concern when German Cockroach Extract Technical, Victor Roach Magnet, Victor Roach Trap, and Victor Roach Trap and Monitor are used according to the proposed label directions, which include protective measures.**

Pesticide applicators or domestic users placing traps containing German Cockroach Extract impregnated lures will not be exposed to the active ingredient. The lures are attached to the inside of the traps during manufacturing where they are not available for direct exposure to applicators or bystanders.

The postapplication exposure risks to human health are negligible because the amount of active ingredient formulated into each trap is small (0.125 mg). As well, the way in which the active ingredient is formulated into the end-use products will not allow for significant amounts of human exposure to the German Cockroach Extract.

❖ **Environmental Considerations**

◆ **What Happens When German Cockroach Extract Is Introduced Into the Environment?**

**Environmental risks associated with the use of German Cockroach Extract are of negligible concern.**

The end-use products Victor Roach Magnet, Victor Roach Trap, and Victor Roach Trap and Monitor are intended for indoor use (e.g. in kitchens, bathrooms, etc.) and contain only a small amount of the active ingredient German Cockroach Extract. Therefore, only negligible amounts of German Cockroach Extract will enter the environment. Also, German Cockroach Extract is a natural substance and is expected to readily break down in the environment.

## ❖ **Value Considerations**

### ◆ **What Is the Value of German Cockroach Extract?**

**German Cockroach Extract has value in improving trap catches of German cockroaches when incorporated as a lure into the end-use products Victor Roach Magnet, Victor Roach Trap, and Victor Roach Trap and Monitor.**

German Cockroach Extract is attractive to German cockroaches, to the extent that they tend to remain in areas where it is present. As a result of this tendency, German cockroaches are more likely to be captured in traps baited with German Cockroach Extract than in unbaited traps. Therefore, traps used to monitor or control German cockroach populations may be more effective when baited with lures containing German Cockroach Extract.

## **Measures to Minimize Risk**

Labels of registered pesticide products include specific instructions for use. Directions include risk-reduction measures to protect human and environmental health. These directions must be followed by law.

As human and environmental exposure to German Cockroach Extract is negligible due to the design of the traps and the small amount of active ingredient used, additional risk-reduction measures are not proposed on the labels of German Cockroach Extract Technical, Victor Roach Magnet, Victor Roach Trap, and Victor Roach Trap and Monitor.

## **Next Steps**

Before making a final registration decision on German Cockroach Extract, the PMRA will consider all comments received from the public in response to this Consultation Document. The PMRA will then publish a Registration Decision Document, which will include its decision, the reasons for it, a summary of comments received on the proposed final decision and the Agency's response to these comments.

## **Other Information**

At the time the PMRA makes its registration decision, it will publish a Registration Decision Document on German Cockroach Extract (based on the Science Evaluation section of this Consultation Document). In addition, the test data referenced in this Consultation Document will be available for public inspection, upon application, in the PMRA's Reading Room (located in Ottawa).

# SCIENCE EVALUATION

## German Cockroach Extract

### 1.0 The Active Ingredient, Its Properties and Uses

#### 1.1 Identity of the Active Ingredient

Active substance	German Cockroach Extract
Function	Insecticide
Chemical name	
1. International Union of Pure and Applied Chemistry (IUPAC)	N/A
2. Chemical Abstracts Service (CAS)	N/A
CAS number	N/A
Molecular formula	N/A
Molecular weight	N/A
Structural formula	N/A
Purity of the active ingredient	100% nominal (limits 97.0% - 100%)

#### 1.2 Physical and Chemical Properties of the Active Ingredients and End-Use Product

##### Technical Product—German Cockroach Extract Technical

The technical product is a dark gray/brown solid. The submission of all other physical and chemical properties have been waived.

##### End-Use Products—Victor Roach Magnet, Victor Roach Trap and Victor Roach Trap and Monitor

All three end-use products are guaranteed to contain German Cockroach Extract at 0.03% nominal with the lower and upper certified limits of 0.027% and 0.033%. The submission of all physical and chemical properties have been waived.

#### 1.3 Directions for Use

The end-use products consist of German Cockroach Extract impregnated lures incorporated into three different trap designs, one for domestic use and two for commercial use. The traps are

simply opened and placed in areas where German cockroaches are likely to be found, such as in corners, in cabinets, behind appliances, near drainpipes, etc. Traps should be replaced when full or at intervals of no more than 35 days.

#### **1.4 Mode of Action**

German Cockroach Extract acts as a weak attractant and may be more appropriately termed an “arrestant”. That is, it has not been demonstrated to attract German cockroaches from any appreciable distance, but it does induce German cockroaches to remain in the vicinity once they come into close proximity with the source. Thus, in the context of the proposed end-use products, German cockroaches are more likely to enter, and be captured in, traps baited with German Cockroach Extract lures than unbaited traps.

### **2.0 Methods of Analysis**

The requirement for submitting analytical methods for the analysis of the technical and end-use products was waived by the PMRA.

### **3.0 Impact on Human and Animal Health**

#### **3.1 Toxicology Summary**

German Cockroach Extract is a mixture of approximately 150 compounds obtained from the feces, and possibly other body parts or secretions, of the German cockroach (*Blattella germanica*). Since the extract is made from naturally occurring substances that can be commonly found in areas of human occupation that are, or have recently been, infested with the German cockroach, the risk to human health from the use of this product is negligible.

Body parts, saliva and feces of certain species of cockroach, including German cockroach, are known to contain human allergens that can cause asthma and/or rhinitis in sensitive subjects. However, the potential to cause an allergic reaction in humans from the use of these products is negligible because the allergens are not expected to become airborne due to the manufacturing method and therefore would not be available for considerable human exposure.

The applicant provided a rationale that requested all of the toxicological data requirements be waived because of the nature of the active ingredient. Also, impurities and formulants contained in these pest control products are not of toxicological concern. The applicant’s rationale is acceptable and no further toxicological information or data are required.

Based on all of the available data for German Cockroach Extract, there is no evidence of increased susceptibility of infants and children in comparison to adults that may result from exposure to German Cockroach Extract. Furthermore, there is no evidence that German Cockroach Extract has a potential to disrupt endocrine activity in humans.

### **3.2 Occupational and Bystander Exposure Assessment**

The proposed end-use products have the active ingredient, German Cockroach Extract, formulated onto lures that are affixed to the inside of traps. The user will not have to directly handle the lure while deploying the traps. Traps are to be placed in buildings in areas where German cockroaches are likely to be found (i.e. the corners of kitchens, behind appliances, under sinks and other dark and humid places).

Based on the toxicological profile of the active ingredient and the proposed use pattern, a quantitative estimate of exposure was not required for German Cockroach Extract. Since the lures are already contained inside the trap during manufacture and the traps are placed in areas of low human traffic, the bystander and applicator exposures to these products are negligible. In the event that an accidental direct exposure to the lure were to occur, due to the low toxicity and small amount of active ingredient per lure (0.125 mg) the potential for adverse health effects are negligible. The label precautions are adequate to protect applicators and bystanders from exposure.

Although the active ingredient could contain some known allergens, the potential for exposure to cockroach allergens from the use of these end-use products is negligible due to the manner in which the products are formulated. The post-application exposure to the active ingredient from the use of these products is negligible.

Based on the toxicological profile of the active ingredient and the proposed use pattern, it is concluded that the use of the proposed end-use products is not likely to present a risk to workers or bystanders when they are used according to label directions.

### **3.3 Food Residues Exposure Assessment**

German Cockroach Extract is not to be applied in or around food or feed crops. A food residue assessment was not required.

## **4.0 Impact on the Environment**

As the end-use products Victor Roach Magnet, Victor Roach Trap, and Victor Roach Trap and Monitor are intended for indoor use and contain only a small amount of German Cockroach Extract, exposure of non-target species is expected to be negligible. Furthermore, German Cockroach Extract is a substance that is naturally produced by cockroaches and released with cockroach fecal material. This substance is expected to break down in the environment and poses negligible environmental concern.

## **5.0 Value**

### **5.1 Effectiveness Against Pests**

Submitted efficacy trial data demonstrated that traps containing German Cockroach Extract impregnated lures captured significantly greater numbers of German cockroaches than traps without the lure under laboratory conditions. Data indicates that the lures remained effective up to 35 days.

#### **5.1.1 Acceptable Efficacy Claims**

The submitted efficacy data support the use of traps containing German Cockroach Extract impregnated lures to monitor or control populations of German cockroaches, with a maximum use period before trap replacement of 35 days.

### **5.2 Adverse Effects on Use Site**

As German Cockroach Extract is impregnated into a lure that is contained within a trap and is not applied directly to any substrate in the use site, no adverse effects on the use site are expected.

### **5.3 Economics**

No economic analysis was conducted for German Cockroach Extract Technical or the associated end-use products.

### **5.4 Sustainability**

#### **5.4.1 Survey of Alternatives**

More than 30 pest control products are currently registered in Canada for use against cockroaches, approximately two-thirds for domestic use and one-third for commercial use (see Table 1 in Appendix I). Fully one-third of these registered products contain the active ingredient silicon dioxide in the form of diatomaceous earth, the mode of action of which is physical abrasion of the insect cuticle. The remaining two-thirds of the registered products include various chemical insecticides, mostly formulated into various types of baits, but with a few formulated as pressurized spray products.

#### **5.4.2 Compatibility with Current Management Practices Including Integrated Pest Management**

Traps containing German Cockroach Extract impregnated lures are compatible with all aspects of integrated pest management except the use of chemical insecticides, which may reduce the numbers of cockroaches captured. Traps are commonly used to monitor or help control German cockroach populations, and the German Cockroach Extract impregnated lure provides an alternative to the current cockroach control methods.

### 5.4.3 Information on the Possible Occurrence of the Development of Resistance

The development of resistance to pest management strategies involving the use of attractant-baited traps is not considered likely.

### 5.4.4 Contribution to Risk Reduction and Sustainability

German Cockroach Extract and the associated end-use products provide an alternative for monitoring and control of German cockroach populations. This alternative is sustainable and compatible with other strategies used in integrated pest management except the application of chemical insecticides, which should be avoided in order to maximize the effectiveness of traps baited with German Cockroach Extract impregnated lures.

German Cockroach Extract is a substance naturally produced by cockroaches which will not bioaccumulate and is expected to readily breakdown in the environment. Therefore, German Cockroach Extract has a low potential to harm the environment.

## 6.0 Toxic Substances Management Policy Considerations

The management of toxic substances is guided by the federal government's Toxic Substances Management Policy, which puts forward a preventive and precautionary approach to deal with substances that enter the environment and could harm the environment or human health. The policy provides decision makers with direction and sets out a science-based management framework to ensure that federal programs are consistent with its objectives. One of the key management objectives is virtual elimination from the environment of toxic substances that result predominantly from human activity and that are persistent and bioaccumulative. These substances are referred to in the policy as Track 1 substances.

During the review process, German Cockroach Extract was assessed in accordance with the PMRA Regulatory Directive [DIR99-03](#), *The Pest Management Regulatory Agency's Strategy for Implementing the Toxic Substances Management Policy*. Substances associated with the use of German Cockroach Extract were also considered, including major transformation products formed in the environment, microcontaminants in the technical product and formulants in the end-use products. The PMRA has reached the following conclusions:

- German Cockroach Extract does not meet the Track 1 criteria. This is a naturally occurring substance and is not expected to be persistent or bioaccumulative in the environment.
- The German Cockroach Extract active ingredient does not contain any contaminants of health or environmental concern identified in the *Canada Gazette*, Part II, Volume 139, Number 24, pages 2641–2643: *List of Pest Control Product Formulants and Contaminants of Health or Environmental Concern*.

- The end-use products Victor Roach Magnet, Victor Roach Trap, and Victor Roach Trap and Monitor do not contain any formulants of health or environmental concern identified in the *Canada Gazette*, Part II, Volume 139, Number 24, pages 2641–2643: *List of Pest Control Product Formulants and Contaminants of Health or Environmental Concern*.

Therefore, the use of German Cockroach Extract in the end-use products Victor Roach Magnet, Victor Roach Trap, and Victor Roach Trap and Monitor is not expected to result in the entry of Track 1 substances into the environment.

## **7.0 Summary**

### **7.1 Human Health and Safety**

German Cockroach Extract is a mixture of approximately 150 compounds obtained from the faeces, and possibly other body parts or secretions, of the German cockroach (*Blattella germanica*). Although body parts, saliva and faeces of certain species of cockroach, including German cockroach, are known to contain human allergens that can cause asthma and/or rhinitis in sensitive subjects, the exposure to these allergens from the use of this product is negligible. Since the extract is made from a naturally occurring substance that can be commonly found in areas of human occupation that are or have recently been infested with the German cockroach, the risk to human health from the use of this product is negligible.

Applicators are not expected to be exposed to levels of German Cockroach Extract that will result in unacceptable risk when the end-use products Victor Roach Magnet, Victor Roach Trap, and Victor Roach Trap and Monitor are used according to label directions. The precaution statements on the labels are adequate to protect workers and no additional precautionary statements are required.

Residues of German Cockroach Extract are not expected to occur on food or feed.

### **7.2 Environmental Risk**

The end-use products Victor Roach Magnet, Victor Roach Trap, and Victor Roach Trap and Monitor are intended for indoor use and contain only a small amount of German Cockroach Extract. As such, only negligible amounts of German Cockroach Extract may enter the environment and risk to non-target species is expected to be negligible.

### **7.3 Value**

The efficacy data submitted in support of registration of these end-use products demonstrate that German Cockroach Extract used in impregnated lures has value in increasing trap catches of German cockroaches.

## **7.4 Unsupported Uses**

Proposed label directions included only the general term “roach” which would imply that the end-use products are effective for all species of cockroaches. Due to the specific nature of the German Cockroach Extract, all references to the pest on the label must specify “German cockroach”. Proposed label directions specified replacement of traps after 60 days, but no efficacy trial data were submitted to support a trap replacement interval longer than 35 days.

## **8.0 Proposed Regulatory Decision**

Health Canada’s PMRA, under the authority of the *Pest Control Products Act*, is proposing full registration for the sale and use of the technical grade active ingredient German Cockroach Extract as well as the end-use products Victor Roach Magnet, Victor Roach Trap, and Victor Roach Trap and Monitor for indoor uses for the control of German cockroaches. An evaluation of available scientific data found that, under the proposed conditions of use, the end-use products have value and do not present an unacceptable risk to human health or the environment.

## List of Abbreviations

mg	milligram
N/A	not applicable
PMRA	Pest Management Regulatory Agency

## Appendix I Tables and Figures

**Table 1 Alternative Pest Control Products Registered in Canada for Cockroaches**

Class and Type of Product	Active Ingredient(s)	Comments
Domestic bait station	Chlorpyrifos	1 product
	Boric Acid	1 product
	Abamectin	3 products
Domestic powder	Silicon Dioxide	11 products
Domestic pressurized spray	d-trans Allethrin N-Octyl Bicycloheptene Dicarboximide Permethrin	1 product
	d-trans Allethrin	1 product
	Permethrin	2 products
	Pyrethrin N-Octyl Bicycloheptene Dicarboximide Permethrin	1 product
Domestic pump spray	Permethrin	1 product
Commercial bait station	Abamectin	1 product
Commercial paste bait	Boric Acid	1 product
Commercial gel bait	Hydramethylnon	2 products
	Abamectin	2 products
	Imidacloprid	1 product
Commercial dry flowable bait	Abamectin	1 product
Commercial pressurized spray	Pyrethrins Piperonyl Butoxide	1 product
Commercial powder	Orthoboric Acid	1 product

**Table 2      Unsupported Use Claims Proposed by Applicant**

<b>Applicant-Proposed Claims</b>	<b>Acceptable Claims</b>	<b>Comments on Unsupported Claims</b>
roach / roaches	German cockroach / German cockroaches	German cockroach extract is a species-specific active ingredient.
<p>LURES ROACHES FROM ALL DIRECTIONS.            Powerful roach pheromone attracts and lures roaches out from where they hide or nest.            PLACE TRAPS - In corners approximately x m apart            [sic]</p>	Not acceptable.	The submitted efficacy trial data did not demonstrate attraction from any distance.
For best results, discard trap when full, or replace after 60 days.	For best results, discard trap when full, or replace after 35 days.	The submitted efficacy trial data did not include lures more than 35 days old.

## List of References

### A. LIST OF STUDIES/INFORMATION SUBMITTED BY REGISTRANT

#### 1.0 Chemistry Assessment

PMRA Identification number	Reference
Technical Grade Active Ingredient	
1268801	Product Identification, DACO: 2.1, 2.2
1268802	2003, Cockroach Pheromone Lure: Product Identity and Composition, Beginning Materials, Production Process, Formation of Impurities, none, DACO: 2.11.1,2.11.2,2.11.3,2.11.4,2.3,2.3.1,2.4,2.5,2.6,2.7,2.8,2.9
1268803	2003, Confidential Attachment to Cockroach Pheromone Lure: Product Identity and Composition, Beginning Materials, Production Process, Formation of Impurities, none, DACO:2.11.1, 2.11.2, 2.11.3, 2.11.4, 2.3, 2.3.1, 2.4, 2.5, 2.6, 2.7, 2.8,2.9
1268804	2003, Cockroach Pheromone Lure: Analysis and Certification of Product Ingredients, Certification of Limits, Analytical Method to Certified Limits, none, DACO: 2.12.1,2.13.1,2.13.2,2.13.3,2.13.4
1268805	2003, Confidential Attached to Cockroach Pheromone Lure: Analysis and Certification of Product Ingredients, Certification of Limits, Analytical Method to Certified Limits, none, DACO: 2.12.1,2.13.1,2.13.2,2.13.3,2.13.4
1268806	2003, Cockroach Pheromone Lure: Request to Waive the Requirements for Information on Certain Physical and Chemical Properties of the German Cockroach Pheromone, none, DACO: 2.14.1, 2.14.10, 2.14.11, 2.14.12, 2.14.13, 2.14.14, 2.14.2, 2.14.3, 2.14.4, 2.14.5, 2.14.6
1268807	Sample (Batch Data), DACO: 2.15
End-use Products	
1050822	2003, Cockroach Pheromone Lure: Product Identity and Composition, Beginning Materials, Production Process, Formation of Impurities., DACO: 3.2
1050823	2003, Confidential Attachment to Cockroach Pheromone Lure: Product Identity and Composition, Beginning Materials, Production Process, Formation of Impurities., DACO: 3.2
1050824	2003, Cockroach Pheromone Lure: Analysis and Certification of Product Ingredients, Certification of Limits, Analytical Method to Certified Limits., DACO: 3.3

1050825	2003, Confidential Attached to Cockroach Pheromone Lure: Analysis and Certification of Product Ingredients, Certification of Limits, Analytical Method to Certified Limits., DACO: 3.3
1050826	2003, Cockroach Pheromone Lure: Request to Waive the Requirements for Information on Certain Physical and Chemical Properties of the German Cockroach Pheromone., DACO: 3.5
1050828	Product Identification., DACO: 3.1

## 2.0 Impact on Human and Animal Health

PMRA Identification number	Reference
1324828	2006, CBI Reference Document - Response for DACO 4.1, N/A, MRID: N/A, DACO: 4.1
1324877	2006, CBI Reference Document - Response for DACO 5.1, N/A, MRID: N/A, DACO: 5.1

## 3.0 Impact on the Environment

PMRA Identification number	Reference
1051535	Cockroach pheromone lure: Request to waive the requirements for ecological effects testing on the German cockroach pheromone. Report Date: 12-December-2003. 5 pages. DACO 9.1.
1051536	Comprehensive data summary for German cockroach pheromone technical. 5 pages. DACO 12.7.

## 4.0 Value

PMRA Identification number	Reference
1229913	2005. The effectiveness of German cockroach pheromone lure aged 0, 7, 14, 21, 28 & 35 days. WSL-GCPL003. 12 pp. DACO: 10.2.3.3

**B. ADDITIONAL INFORMATION CONSIDERED****i) Published Information****1.0 Impact on Human and Animal Health**

PMRA Identification number	Reference
1418445	Gore, J.C., Schal, C., Cockroach Allergen Biology and Mitigation in the Indoor Environment. <i>Annu. Rev. Entomol.</i> 2007. 52:439-463, DACO: 5.7
1419601	P. A. Eggleston et al., 2001, P. A. Eggleston et al., Ecology and elimination of cockroaches and allergens in the home. <i>J. Allergy Clin. Immunol.</i> 2001; Vol. 107 (3): p.S422-S429, MRID: N/A, DACO: 5.7