Insect stings and bites
- not only hymenoptera

Prof.
Peter Schmid-Grendelmeier
Allergy Unit, Dept. Of Dermatology
University Hospital
Zuerich, Switzerland
Insect bites and stings

Most common allergens
Clinical features
Cross-reactivity
Management
Insect bites and stings

Pain / Local reaction

Allergy

Infections / Transmission

Onchozerkosis

River blindness
Spiders, Mites, Ticks, Scorpions

Centipeds, Millipeds

Crustaceae

Shrimps, Crabs, Lobster, Crabfish, Woodlice
Nocturnal asthma

Feeling of stings/bites
Bites of the European pigeon tick
(Argas reflexus): Risk of IgE-mediated sensitizations and anaphylactic reactions

Jörg Kleine-Tebbe, MD, Anja Heinatz, MD, Inken Gräser, MD, Hans Dautel, PhD, Gitte Nordskov Hansen, BSc, Sabine Kespohl, PhD, Hans-Peter Rihs, PhD, Monika Raufl-Heimsoth, PhD, Günther Vater, PhD, Manfred Rytter, MD, and Uwe-Fritjof Haustein, MD Leipzig, Berlin, and Bochum, Germany, and Hørsholm, Denmark
Allergy to pigeon tick (Argas reflexus)

Mostly local reaction
About 8% systemic

TABLE I. LRs and SRs after a bite of the pigeon tick
Argas reflexus in 148 subjects (37 atopics, 24%, and
111 nonatopics)

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local</td>
<td>146</td>
<td>99</td>
</tr>
<tr>
<td>Redness</td>
<td>142</td>
<td>96</td>
</tr>
<tr>
<td>Local itching</td>
<td>124</td>
<td>84</td>
</tr>
<tr>
<td>Inflammatory node</td>
<td>93</td>
<td>63</td>
</tr>
<tr>
<td>Lymphatic secretion</td>
<td>36</td>
<td>24</td>
</tr>
<tr>
<td>Wheal</td>
<td>25</td>
<td>17</td>
</tr>
<tr>
<td>Pruritic secretion</td>
<td>20</td>
<td>14</td>
</tr>
<tr>
<td>Lymphangitis</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>Lymph node swelling</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td>Vesicle</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td>Systemic</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>Urticaria</td>
<td>11</td>
<td>7</td>
</tr>
<tr>
<td>Angioedema</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Vascular dysregulation</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Dyspnea</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>Unconsciousness</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Gastrointestinal symptoms</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Rush with pruritus</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

J Allergy Clin Immunol 2007
Arthropods

Insects
- 6 legs
- Flies
- Mosquitos etc
- Hymenoptera
- Bee, Wasp, Ants

Arachnoidea
- 8 legs
- Spiders
- Ticks
- Scorpions
Insects

6-7 Mio Species

About 1 Mio known

> 170′000 butterflies

> 350′000 beetles

Simplified cladogram of insect groups[23] and very simplified. Note that Aplygote, Paleoptera and Exopterygota are possibly paraphyletic groups.
- Hymenoptera (ants, bees, etc.)
- Coleoptera (beetles)
- Strepsiptera (twisted-winged parasites)

Simplified cladogram of insect groups and very simplified. Note that Aptygotes, Paleoptera and Exopterygotes are possibly paraphyletic groups.
K.U, m, 29-j.

Camping holidays in Florida, USA

Feeling of „insect bites“

Suddenly Urticaria, Sweating, Dyspnoe

Hospital admission
Severity of Anaphylaxis (H.L. Muller)

Grade I  Urticaria

Grade II  Angio-Edema, Nausea, Vomiting, Diarrhoe

Grade III  Dyspnoa, Cough, Stridor, Dysphagia, Weakness, Confusion

Grade IV  Hypotension, Kollaps, Incontinence, Loss of consciousness, Cyanosis
K.U, m, 29-j.

Allergologic work up

<table>
<thead>
<tr>
<th></th>
<th>Bee</th>
<th>Wasp</th>
<th>Imported Red Fire ant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spec IgE in Serum</td>
<td>Class</td>
<td>kU/l</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>0.98</td>
<td>1.89</td>
<td></td>
</tr>
</tbody>
</table>

Intradermal skin test

<table>
<thead>
<tr>
<th></th>
<th>pos. at 1.0 ug/ml</th>
<th>Normal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.0</td>
<td>1.0</td>
</tr>
</tbody>
</table>
Red imported fire ant
Red imported fire ant
Solenopsis invicta

Originally from Brazil

Mato Grosso
Red **imported** fire ant
*Solenopsis invicta*

Originally from **Brazil**

Map of Brazil and Mato Grosso region.
Red imported fire ant
*Solenopsis invicta*

Originally from **Brazil**

Around 1940 **Southern USA**
Red imported fire ant
Solenopsis invicta

Originally from Brazil

Around 1940 Southern USA / Australia
Red imported fire ant
are not the largest ants

Comparison of ant sizes

Fire ant
*Solenopsis invicta*

Black ant
*Iridomyrmex rufoniger*

Sugar ant
*Camponotus sp.*

Bull ant
*Myrmecia sp.*

2-6 mm
Red imported fire ant
but
- spread fast
- are invasive and extinct
- are aggressive

Meet the Fire Ant: An Introduction to an Exotic Pest
Megan Bame

Pest animals

The term 'pest animal' refers to any exotic animal, which causes a detrimental impact on the environment, industry or community activities.

Pest species may come from any animal group including mammals, birds, fish, reptiles, amphibians, crustaceans, molluscs and insects.
Red Imported Fire Ant

1. Bites
2. Stings
Red Imported Fire Ant

1. Bites

2. Stings
Talk to us before you take another step.
Allergy to RFA (H.L. Muller)

Grade I  Urticaria

Grade II  Angio-Edema, Nausea, Vomiting, Diarrhöe

Grade III  Dyspnoa, Cough, Stridor, Dysphagia, Weakness, Confusion

Grade IV  Hypotension, Kollaps, Incontinence, Loss of consciousness, Cyanosis
Allergic reactions to RFA often occur at early stings
Allergens of RFA

Sol i 1

Sol i 2

Sol i 3

Sol i 4

Allergens of RFA

Sol i 1 Phospholipase
cross-reacts with
Wasps

Sol i 2 specific for Solenopsis

Sol i 3

Sol i 4 specific for Solenopsis

RFA Diagnosis of Allergy

**Specific IgE in Serum**

**ImmunoCAP Code**: i70

**Source material**: Whole body extract

**Skin tests**

**Prick test**
(Commercial extracts)

**Intradermal tests**
(Commercial extracts)

**Source material**: Whole body extract

Solley Med J Aust 2002; 176: 518

La Shell M et al J Allergy Clin Immunol 2010;125:1294-9
RFA Treatment

Grad I-II Emergency kit

Grad III- IV Spec. Immunotherapy

Source material: Whole body extract
Imported fire ant field reaction and immunotherapy safety characteristics: The IFACS study

Mark S. La Shell, MD, Christopher W. Calabria, MD, and James M. Quinn, MD  Travis Air Force Base, Calif, and Lackland Air Force Base, San Antonio, Tex

FIG 2. Total injections by phase.

FIG 3. Severity of SRs to IFA SCIT. Seven of 77 patients experienced SRs to IFA SCIT. There were no emergency department visits, hospitalizations, or fatalities. One patient experienced more than 1 SR, and she had a total of 2 SRs, each grade 1. In 2 different patients 2 SRs were delayed (one presented at 35 minutes and the other at 60 minutes).
Imported fire ant field reaction and immunotherapy safety characteristics: The IFACS study

Mark S. La Shell, MD, Christopher W. Calabria, MD, and James M. Quinn, MD
Travis Air Force Base, Calif, and Lackland Air Force Base, San Antonio, Tex

<table>
<thead>
<tr>
<th>TABLE III. Risk factors for SRs to IFA SCIT per injection</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SR to IFA SCIT</strong></td>
</tr>
<tr>
<td>---------------------</td>
</tr>
<tr>
<td>LLR</td>
</tr>
<tr>
<td>Asthma</td>
</tr>
<tr>
<td>Sex (female)</td>
</tr>
<tr>
<td>Age (&gt;50 y)</td>
</tr>
<tr>
<td>ACE inhibitor†</td>
</tr>
<tr>
<td>Field reaction‡</td>
</tr>
<tr>
<td>Maintenance‡</td>
</tr>
<tr>
<td>Build-up and BAM‡</td>
</tr>
<tr>
<td>Build-up§</td>
</tr>
<tr>
<td>BAM§</td>
</tr>
<tr>
<td>SR to ST</td>
</tr>
<tr>
<td>Concentration of ST§</td>
</tr>
</tbody>
</table>

SCIT with RFA WHBE is safe, but increased risk in patients with LLR with SR to Skin tests

La Shell M et al J Allergy Clin Immunol 2010;125:1294-9
Conclusions
Imported fire ant whole body extract combined with timothy grass resulted in significant and rapid timothy protein degradation. Imported fire ant whole body extract mixed with cat, ragweed, or *D pteronyssinus* revealed aeroallergen stability, yielding the possibility of combining these extracts in a single immunotherapy injection.

Compatibilities of IFA WBE with other common aeroallergens remain undetermined and thus are **not recommended for single-injection immunotherapy formulations**.

Red **imported** fire ant
Solenopsis invicta

CASE REPORT

**Anaphylaxis Caused by Imported Red Fire Ant Stings in Málaga, Spain**

S Fernandez-Melendez,¹ A Miranda,¹ JJ Garcia-Gonzalez,¹ D Barber,²
M Lombardero²

**Due to work with tropical wood imported from Brazil to Spain**
- Hymenoptera (ants, bees, etc.)
- Coleoptera (beetles)
- Strepsiptera (twisted-winged parasites)

Simplified cladogram of insect groups and very simplified. Note that Aptygotes, Paleoptera and Exopterygotes are possibly paraphyletic groups.
not

- *Hymenoptera* (ants, bees, etc.)
- *Coleoptera* (beetles)
- *Strepsiptera* (twisted-winged parasites)
- Hymenoptera (ants, bees, etc.)
- Coleoptera (beetles)
- Strepsiptera (twisted-winged parasites)
Beetle-Dermatitis

*Paederus-Species*

Cantharidin, Paederin
Ladybug

Harmonia axyridis
Larvae of Harmonia axyridis
Asian ladybugs (*Harmonia axyridis*): A new seasonal indoor allergen

Takuya Nakazawa, MD, PhD, a Shama M. Satinover, MS, a Lisa Naccara, BA, a Lucy Goddard, RN, a Bojan P. Dragulev, PhD, b Edward Peters, MD, c and Thomas A. E. Platts-Mills, MD, PhD a Charlottesville, Va, and Austin, Tex

**TABLE 1.** Twenty patients reporting symptoms to ALE: environmental exposure and serum IgE antibody levels

<table>
<thead>
<tr>
<th>Age (yr/sex)</th>
<th>Symptoms</th>
<th>Season</th>
<th>Skin test</th>
<th>Household infestation</th>
<th>ALB</th>
<th>IgE antibody (IU/mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>46/FM</td>
<td>Rhinitis, cough</td>
<td>Winter</td>
<td>ND</td>
<td>++ +</td>
<td>59</td>
</tr>
<tr>
<td>2</td>
<td>68/WM</td>
<td>Cough, asthma</td>
<td>Year round</td>
<td>++ ++</td>
<td>30</td>
<td>5 10.6 10.6 Grass, moth, Berlin beetle</td>
</tr>
<tr>
<td>3</td>
<td>54/WM</td>
<td>Rhinitis</td>
<td>Winter</td>
<td>++ ++ ++</td>
<td>41</td>
<td>Neg Neg Grass</td>
</tr>
<tr>
<td>4</td>
<td>56/WF</td>
<td>Rhinitis, cough</td>
<td>Winter</td>
<td>ND ++</td>
<td>14</td>
<td>2.1 Neg Neg Grass, Berlin beetle</td>
</tr>
<tr>
<td>5</td>
<td>57/WF</td>
<td>Asthma, rhinitis</td>
<td>Winter</td>
<td>++ ++</td>
<td>10</td>
<td>0.4 0.4 Neg Neg</td>
</tr>
<tr>
<td>6</td>
<td>72/WF</td>
<td>Asthma, rhinitis</td>
<td>Winter</td>
<td>++ ++ ++</td>
<td>1.6</td>
<td>0.6 0.6 Neg Neg, Mît</td>
</tr>
<tr>
<td>7</td>
<td>58/WF</td>
<td>Cough, conjunctivitis</td>
<td>Winter</td>
<td>++ ++</td>
<td>4.1</td>
<td>Neg Neg Neg</td>
</tr>
<tr>
<td>8</td>
<td>19/WM</td>
<td>Rhinitis</td>
<td>Spring</td>
<td>ND ++</td>
<td>26</td>
<td>1.5 Neg Neg Neg, Mît</td>
</tr>
<tr>
<td>9</td>
<td>43/WF</td>
<td>Asthma</td>
<td>Fall</td>
<td>++ ++ ++</td>
<td>1.6</td>
<td>2.3 1.8 3.1 Dog, moth, grass, Berlin beetle</td>
</tr>
<tr>
<td>10</td>
<td>58/FW</td>
<td>Asthma</td>
<td>Year round</td>
<td>++ ++</td>
<td>0.6</td>
<td>Neg Neg Neg</td>
</tr>
<tr>
<td>11</td>
<td>76/WF</td>
<td>Asthma</td>
<td>Winters</td>
<td>++ ++</td>
<td>0.6</td>
<td>Neg Neg Neg, Berlin beetle</td>
</tr>
<tr>
<td>12</td>
<td>42/WF</td>
<td>Rhinitis</td>
<td>Spring/flu</td>
<td>ND ++</td>
<td>1.2</td>
<td>Neg Neg Neg</td>
</tr>
<tr>
<td>13</td>
<td>51/WF</td>
<td>Rhinitis, conjunctivitis</td>
<td>Fall</td>
<td>ND ++</td>
<td>54.5</td>
<td>Neg Neg Neg, Berlin beetle</td>
</tr>
<tr>
<td>14</td>
<td>59/WF</td>
<td>Chronic cough, rhinitis</td>
<td>Year round</td>
<td>ND ++</td>
<td>0.38</td>
<td>Neg Neg Neg</td>
</tr>
<tr>
<td>15</td>
<td>45/WF</td>
<td>Asthma, rhinitis</td>
<td>Year round</td>
<td>ND ++</td>
<td>0.4</td>
<td>Neg Neg Neg, Grass</td>
</tr>
<tr>
<td>16</td>
<td>49/WF</td>
<td>Asthma, hives</td>
<td>Fall</td>
<td>ND ++</td>
<td>Neg</td>
<td>Neg Neg</td>
</tr>
<tr>
<td>17</td>
<td>63/WF</td>
<td>Asthma, rhinitis</td>
<td>Winter</td>
<td>++ ++ ++</td>
<td>3.6</td>
<td>Neg Neg Neg, Berlin beetle</td>
</tr>
<tr>
<td>18</td>
<td>40/WF</td>
<td>Asthma</td>
<td>Winter</td>
<td>++ ++</td>
<td>Neg</td>
<td>Neg Neg</td>
</tr>
<tr>
<td>19</td>
<td>39/WF</td>
<td>Asthma</td>
<td>Year round</td>
<td>ND ++</td>
<td>Neg</td>
<td>Neg Neg, Mît</td>
</tr>
<tr>
<td>20</td>
<td>34/WF</td>
<td>Asthma</td>
<td>Year round</td>
<td>++ ++ ++</td>
<td>0.68</td>
<td>0.67 19.6 0.7 Grass, moth</td>
</tr>
</tbody>
</table>

Cr. Cockroaches: F. female, M. male; W. white.

*Other allergens tested included rye grass, moth, Berlin beetle, and dog.
#Patient #13 reported a large local swelling of the neck after being bitten by a ladybug.
The IgE antibody responses to moth included 2 sera with high titre.
Ladybug - Allergy

History
Work with wheat, Seasonal RCA (winter)

Skin test
Extracts (Not comm avail)

IgE
ImmunoCAP

Therapy
Symptomatically Eradication (SIT)
Crossreactivity
Ladybugs and Cockroaches

A. Emergency Room Group (Asthmatic)

B. Asian Ladybug Group

C. Inhibition Assays

Nakazewa J Allergy Clin Immunol 2007
Cockroaches

- German cockroach
- Brown-banded cockroach
- American cockroach
- Australian cockroach
- Smoky-brown cockroach
- Brown cockroach
- Florida woods cockroach
- Surinam cockroach
- Oriental cockroach
- Cuban cockroach
Cockroaches

Current reviews of allergy and clinical immunology
(Supported by a grant from Astra Pharmaceuticals, Westborough, Mass)

Series editor: Harold S. Nelson, MD

Cockroach allergens and asthma

L. Karla Arruda, MD, PhD, a,b Lisa D. Vailes, MS, c Virginia P. L. Feriani, MD, PhD, a
Ana Beatriz R. Santos, BSc, b Anna Pomés, PhD, c and Martin D. Chapman, PhD c
Ribeirão Preto, Brazil, and Charlottesville, Va

Although cockroach allergens are found throughout the house, including beds, furniture, and carpets, the highest levels are typically found in the kitchen, and these levels are perhaps the best indicator of cockroach infestation in a house. 8,14,19 However, exposure in the bedroom and family room may be more relevant in causing sensitization.

J Allergy Clin Immunol 2005
Tropomyosin

Seafood

Pen a T u.a.

Housedust-Mite

Cockroaches

Helbling A. Schw Med Wschr 1997
Santos AB, J Allergy Clin Immunol 1997
Kutting B, Brehler R. Hautarzt 2001
Mite-Crustaceae-Syndrome

What's on an allergologist's mind....

Housedust-Mite
Cockroach

Tropomyosin
Pen a 1

Seafood
Red Mosquito - Mite-Crustaceae-Syndrome

What's on an allergologist's mind....

Housedust-Mite, Seafood, Tropomyosin Pen a 1
Local reaction
f (Host)
f (Mosquito)

You don’t feel the sting
Only the reaction
Advances in mosquito allergy.

Peng, Zhikang; Simons, F
Current Opinion in Allergy & Clinical Immunology. 7(4):350-354, August 2007.
Mosquito allergy:

Allergens are in the saliva

<table>
<thead>
<tr>
<th>Protein name</th>
<th>Allergen name</th>
<th>Molecular weight (kDa)</th>
<th>cDNA sequenced</th>
<th>Biological functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>α-Amylase 1</td>
<td>Aed a 1</td>
<td>81.5</td>
<td>Yes</td>
<td>Anticoagulant factor Xa</td>
</tr>
<tr>
<td>Esterase</td>
<td>Aed a 4</td>
<td>67</td>
<td>Yes</td>
<td>Anticoagulant factor Xa</td>
</tr>
<tr>
<td>Anticoagulant-factor Xa</td>
<td>Aed a Xa</td>
<td>54</td>
<td>Yes</td>
<td>Anticoagulant factor Xa</td>
</tr>
<tr>
<td>Aed a Xa</td>
<td>Aed a Xa ?</td>
<td>44</td>
<td>Yes</td>
<td>Anticoagulant factor Xa</td>
</tr>
<tr>
<td>Female-specific protein, D7</td>
<td>Aed a 2</td>
<td>37</td>
<td>Yes</td>
<td>Unknown</td>
</tr>
<tr>
<td>Sialokinins</td>
<td>Aed a 3</td>
<td>30</td>
<td>Yes</td>
<td>Unknown</td>
</tr>
<tr>
<td>Lysozyme</td>
<td></td>
<td>1.4</td>
<td>Yes</td>
<td>Unknown</td>
</tr>
</tbody>
</table>

Reproduced from Peng and Simons [1].

Peng, Zhikang; Simons, F
Current Opinion in Allergy & Clinical Immunology. 7(4):350-354, August 2007.
# Mosquito Allergy

**History**
- Mostly large local reactions
- Systemic allergic symptoms < 3%

**Skin test**
- Extracts (Com. Available, Sens +/-)
- Recombinant allergens

**IgE**
- ELISA > ImmunoCAP

**Therapy**
- Symptomatically
- Prevention (Repellents, Long sleeves)
- SIT with WBA

---

Feng Curr Opin Allergy Clin Immunol 2007
McCormack Ann Allergy 1995
Mosquitoes as sources of inhalant allergens: Clinicoinmunologic and biochemical studies

236 patients in North-India with Asthma

FIG 1. Inhibition of mosquito (C quinquefasciatus) RAST results with homologous (C quinquefasciatus) and the 2 heterologous mosquito WBEs (A aegypti and A stephensi) and 8 unrelated allergen extracts.

Kausuar J J Allergy Clin Immunol 2009
Red mosquito larvae
Allergy against Red mosquito larvae

**History**  Feeding fishes, Preparing fish food

**Skin test**  Extracts (Not com avail)

**IgE**  ImmunoCAP

**Therapy**  Symptomatically
Change of fish food

Crossreactivity

Red Mosquito larvae

Chironomids

Cockroaches

Housedust-Mite

Pen a 1 u.a.

Johansson E Allergy 2001
Insect bites and stings

Most common allergens

iRFA
Danke schön

Merci

Gracias

Grazie

Thank you

peter.schmid@usz.ch