Come together against pests

Packaging that Saves Food

Country Czech Republic

Düsseldorf 2017

Jan Hubert, Vlado Volek

Program Epsilon

SYBA

ÚNMZ
Úřad pro technickou normalizaci, měření a zkušebnictví
www.unmz.cz

CEN
Comité Européen de Normalisation

IPPO
International Press Packaging Organisation
www.ippopress.org

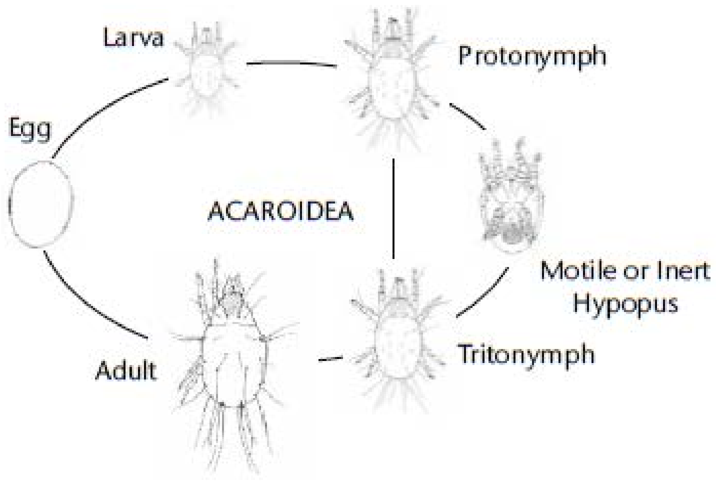
EPIC
European Packaging Institutes Consortium
www.epic-packaging.org

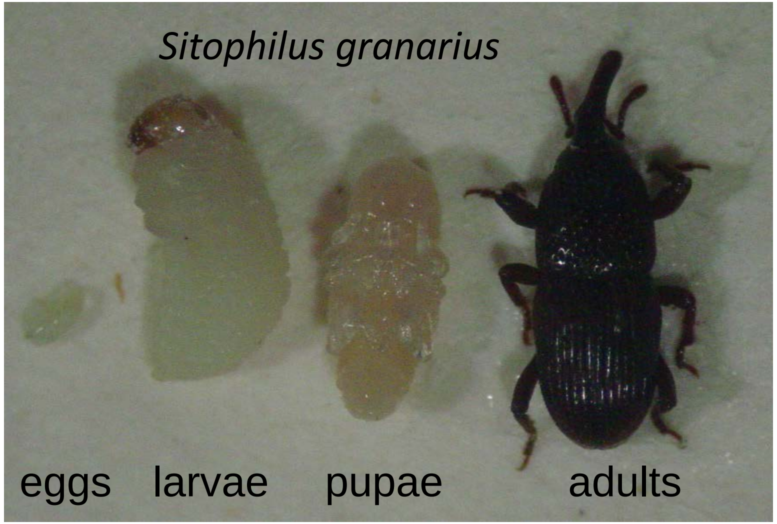
WPO
World Packaging Organisation
www.worldpackaging.org

FEFPEB
Fédération Européenne des Fabricants de Palettes et Emballages en Bois
www.fefpeb.org

Stored Product Pests

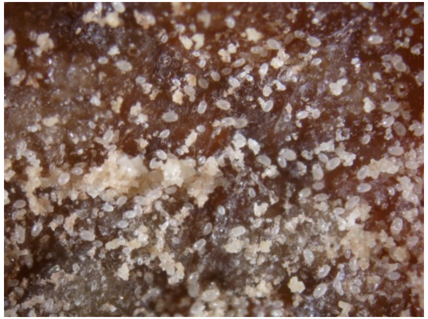
- Insects and mites living in stored product commodities
- The life cycle incorporated to the commodity - all development from eggs to adults, except dispersion
- Nutrients, habitat (moisture and temperature) and shelters;



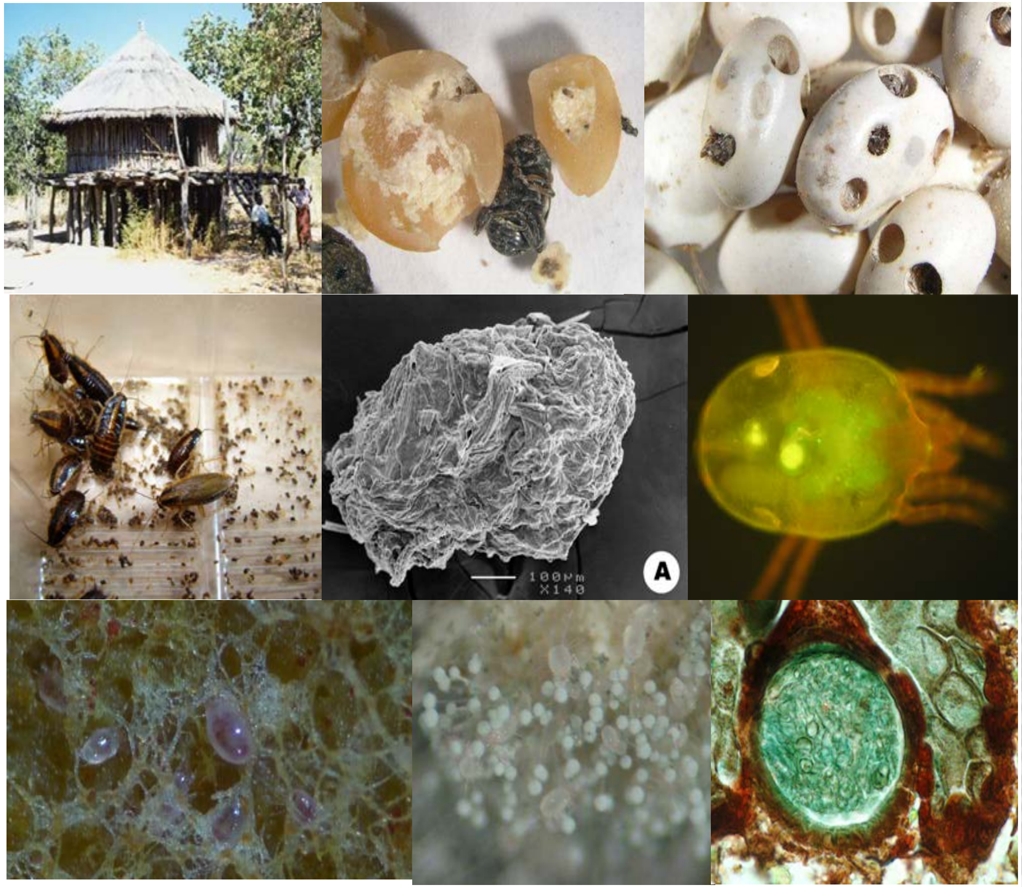


Infestation

- Nutrients, habitat (moisture and temperature) and shelters;
- Stored product pest – short development cycle 3 weeks, high reproduction capability;
- Association to microorganisms (fungi and bacteria);
- The food is exposed to the stored product pest after post harvest, during storage and transport to the consumer kitchen;
- Although the food processor may take all possible precautions to produce insect-free commodity, they often have no control over the product during shipping and storage.



Why the beetles and mites are pests?



- Competition with humans - decreasing nutrient contents in the stored food;
- Contamination of stored food by compounds which they produced carcinogens and allergens;
- Transmission and interaction to bacteria and fungi, i.e. indirect influence on mycotoxin production.

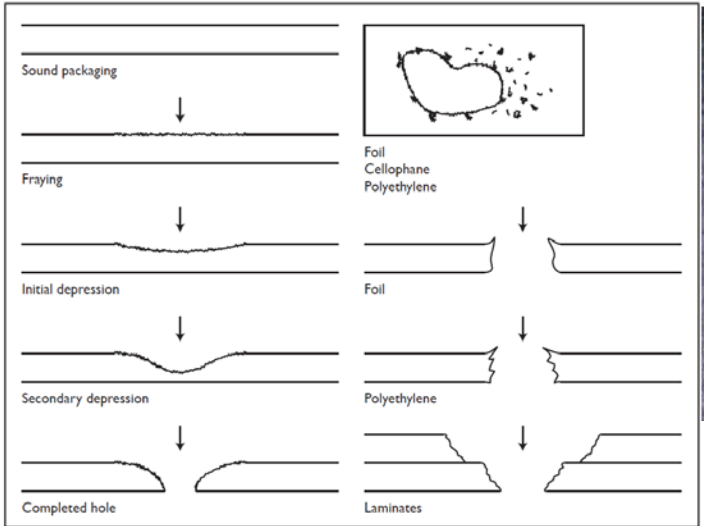
Food Packaging

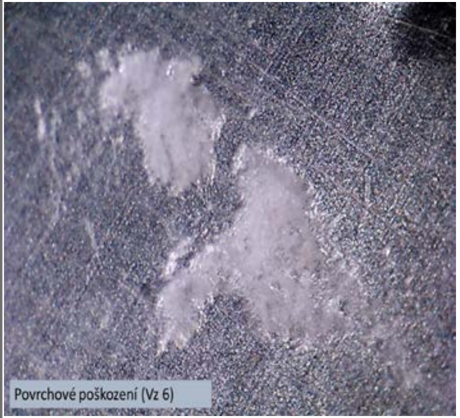
- Stored-product insects can cause serious postharvest losses, estimated from up to 9% in developed countries to 30% or more in developing countries (Phillips and Thorne 2009)
- A pet manufacturer recently reported $1 million in one year in one product line because of arthropod infestation (Mullen et al. 2012)
- The protective packaging of the finished products is considered by food producers to be: (a) key component of any IPM and Hazard analysis and critical control points (HACCP) program in production facilities; (b) the last line of defense against pest infestation when their finished products reach supermarkets and households
- Widespread use of susceptible food-packaging materials is important because losses from arthropod infestation are the sum cost of growing, harvesting, transportation processing and packaging.
- Food and beverage packaging make up more than $70 billion of the U.S. packaging market and more than $200 billion worldwide (Mullen et al. 2012).

http://www.beunpackaged.com/

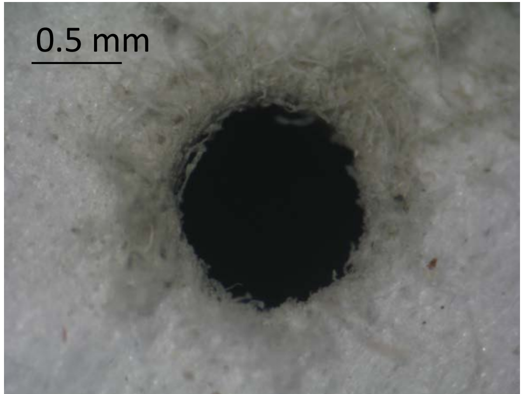
UNPACKAGED

Arthropods and packaged food





Film (mono) PE white, unprinted



Infestation routes to the food packages

- Penetrators – can chew holes directly into packaging material.

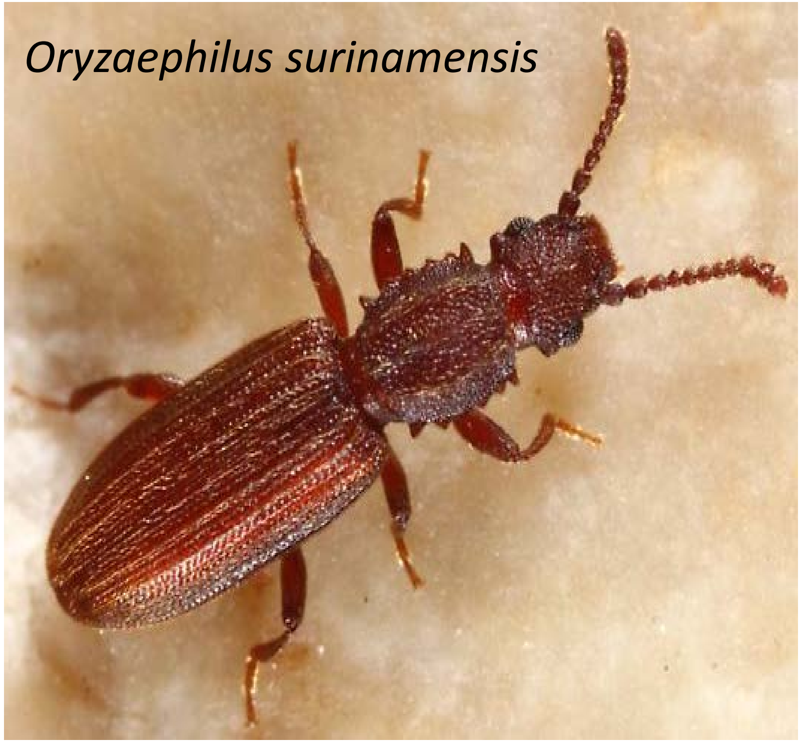
Sitophilus granarius

Rhizoperta dominica

Lasioderma serricorne

Infestation routes to the food packages

- Invaders – enter package through existing openings.



Stored product mites as invaders

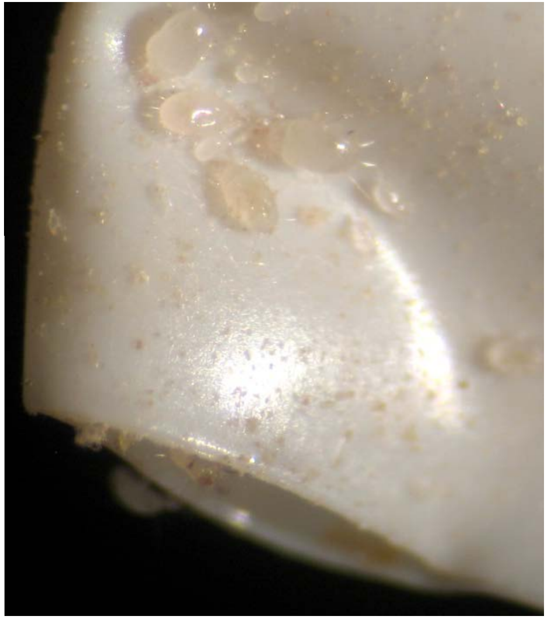
- Invaders – enter package through existing openings.

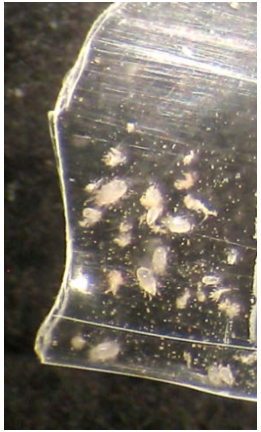
No.	Description-composition	Thickness	Carpoglyphus lactis		Tyrophagus putrescentiae	
		(μm)	Inf.	N	Inf.	N
1	Film (mono) PP transparent, printed	40	1	9,000	2	2,840; 5,170
2	Film (mono) PE white, unprinted	40	0		5	18; 256; 675; 1,480; (1)
3	Film (duplex) PP/PP, unprinted	20/30	1	30(312)	2	27; (1)
4	Film (duplex) PP/PP cast, unprinted	25/25	0		0	
5	Film (duplex) PET/PE white, unprinted	12/70	0		0	
6	Film (triplex) petmet/AL/PE, unprinted	12/9/60	0		1	(1)
7	Film (triplex) PET/petmet/PE, unprinted	12/12/40	0		1	2
8	Film (duplex) PP/PP, printed	30/20	0		0	
9	Film (duplex) PP/ppmet, printed	30/20	2	1; (2)	0	
10	Plastic PP + IML cup, snap-on plastic PP lid	500*/450**	0		0	

* wall thickness, ** lid thickness; AL, aluminum foil; PP, polypropylene; PE, polyethylene; PET, Polyethylene terephthalate; met, metalized; IML, in-mould-label

Stored product mites (Acari: Astigmata) infesting food in various types of packaging

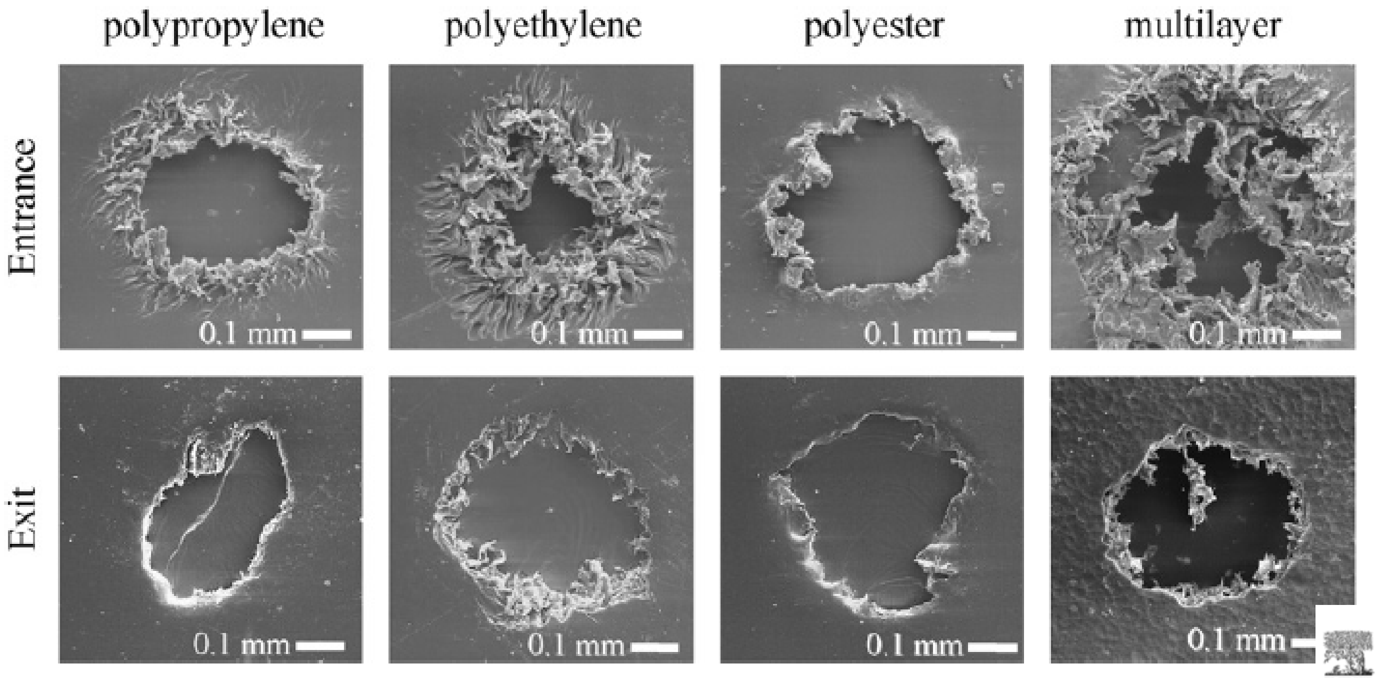
Jan Hubert · Marta Nesvorna · Vlado Volek





Trapping of the route of entry

- Based on differences in the appearance of damage on both sides of the holes, it should be possible to determine the side from which an insect penetrated a plastic film.



Rhizoperta dominica penetration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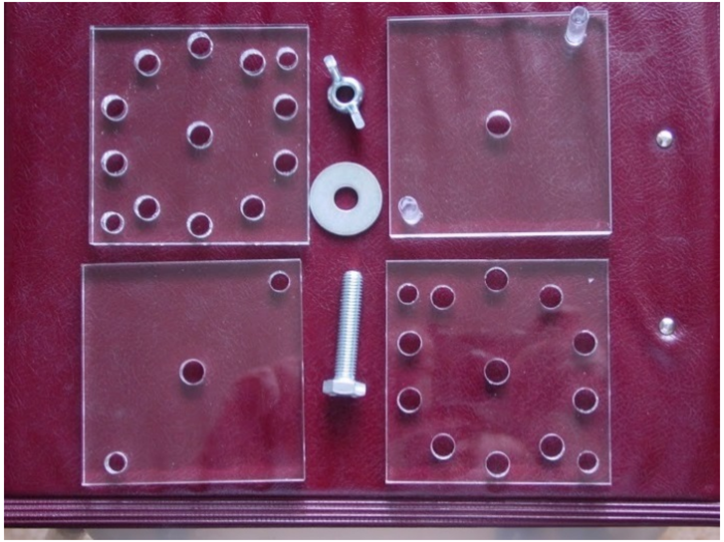
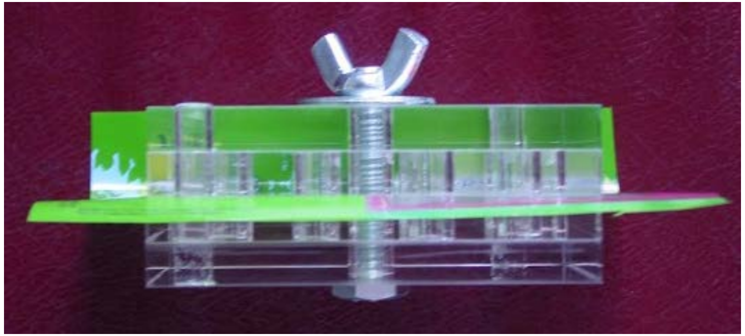
Damage characteristics produced by insect pests in packaging film

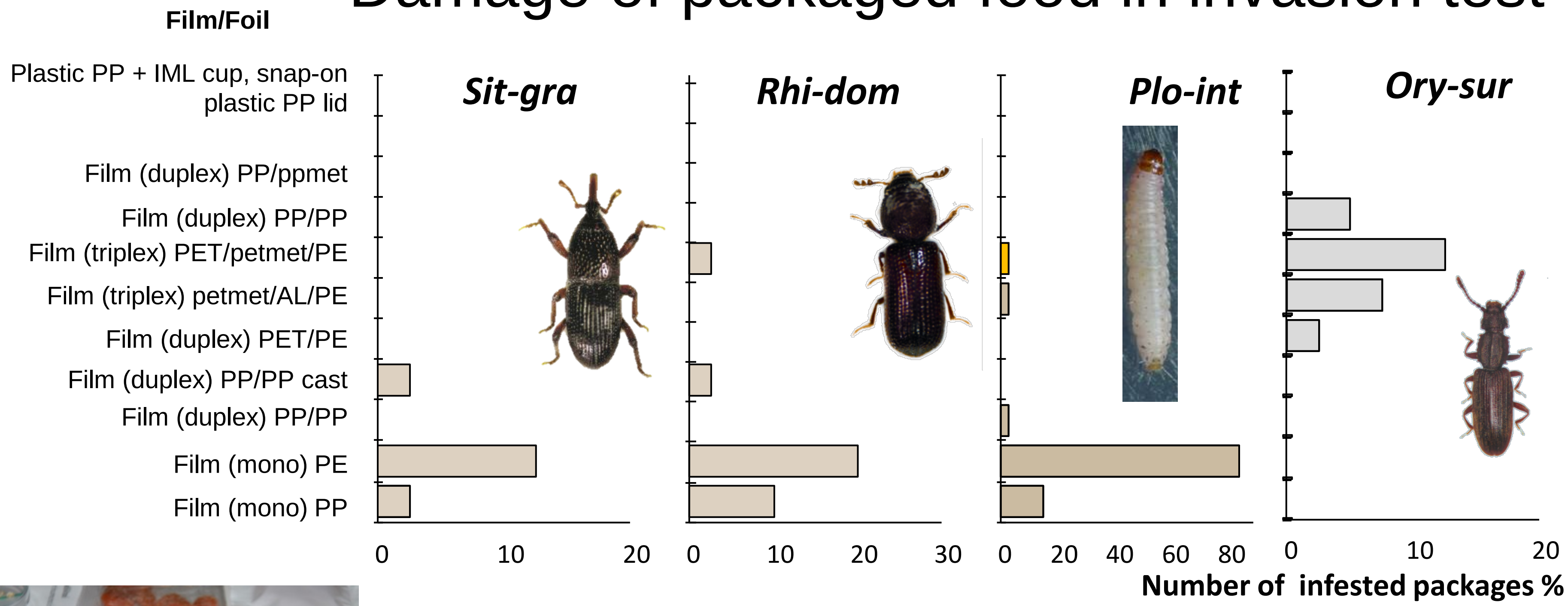
J. Riudavets*, I. Salas, M.J. Pons

How to test – penetration?





Damage of packaged food in invasion test



Legend:

AL, aluminum film; PP, polypropylene; PE, polyethylene; PET, Polyethylene terephthalate; met, metalized; IML, in-mold-label

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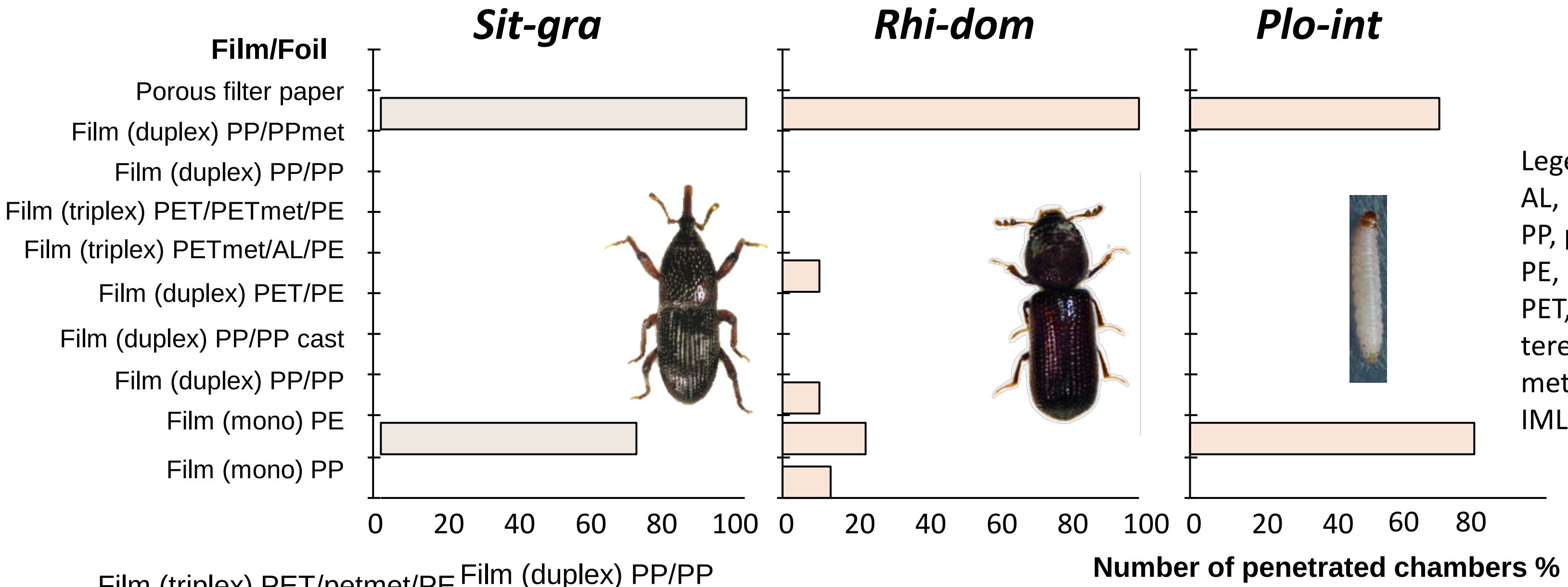
journal homepage: www.elsevier.com/locate/foodcont

Comparison of the resistance of mono- and multilayer packaging films to stored-product insects in a laboratory test

Vaclav Stejskal [a], Marie Bostlova [a], Marta Nesvorna [a], Vlado Volek [b], Vaclav Dolezal [b], Jan Hubert [a,*]

Various damage of the foils by penetrators



Legend:
AL, aluminum film;
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PE, polyethylene;
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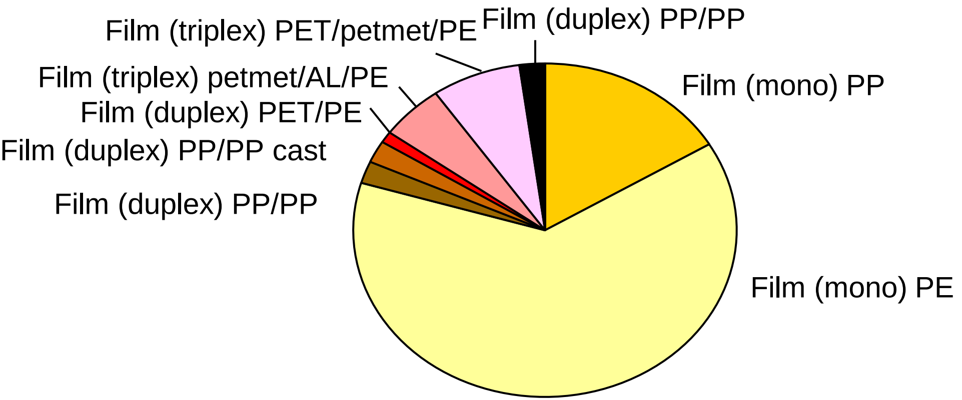
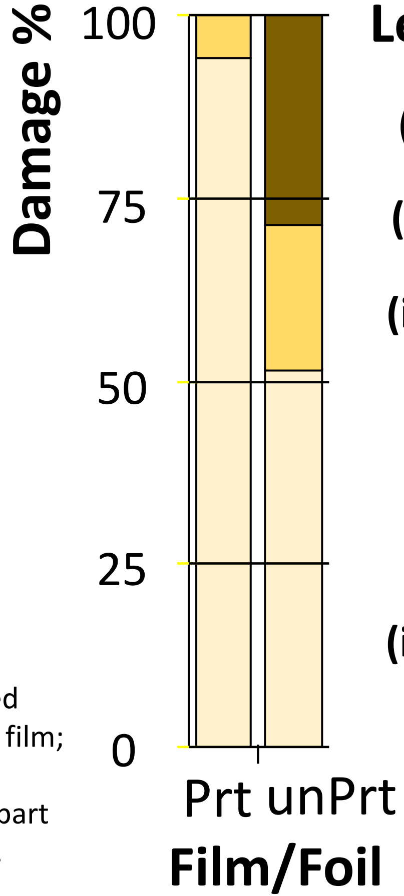
met, metalized;
IML, in-mold-label



The comparison of the proportion of penetrated films from both previous tests; film Nos. 9 - 11 were not included, film 9 was not penetrated and films 10 and 11 were not included due to the control function.

Damage of the printed and unprinted foil by *Rhyzoperta dominica*



Legend:

(i) without any injury

(ii) surface injury without any holes

(iii) small hole without full penetration of an insect through the film

(iv) fully penetrated film, when insects moved through the film and infested food on the opposite side of the chamber.

Legend:
Prt - printed part of the film; **unPrt** - unprinted part of the film.

Conclusion

(1.) We found that the tested species differ in their ability to penetrate or invade protective food-packaging films.
(2.) We confirmed that the chemical composition of the film affects the level of film resistance against pest penetration.
(3.) We did not fully confirm the generally accepted belief that film thickness is a key protective feature against insect penetration/invasion.
(4.) We report the first observation that the printed parts of films are more mechanically resistant to pest penetration than the unprinted parts.
(5.) We observed that multilayer films are more mechanically resistant than monolayers are to penetrators.
(6.) We report the first observation that sealing imperfections in multilayer films provide potential access for invader (*O. surinamensis*) infestations.

Thank you for your attention…

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