PHORETIC MITES (*Acarina*) ON EARWIGS, *Forficula auricularia* L. (*Insecta*, *Dermaptera*), FOUND IN APIARIES

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Summary

Adult specimens of European earwig, *Forficula auricularia* collected from honeybee, *Apis mellifera* colonies with external mites were examined. Microscopic analyses of 211 earwigs showed that 81.5% of them were infested with mites. The following mites were recorded - phoretic hypopi of *Anoetoidea* (*Histiostoma polypori, H. feroniarum*) and several *Acaroidea* (*Acarus farris*, *Rhizoglyphus echinopus*, *Caloglyphus berlesei*). Some other unidentified mites, mainly belonging to the astigmadid, mesostigmatid and the trombiculid groups, were also recorded. The numbers of mites varied enormously and ranged from 1 to over 100 individuals per one earwig specimen. Mites were attached to particular surface regions of an insect's body. The most numerous hypopi colonies were observed on the front, end and lateral surfaces of the thorax. The abdomen of the earwig was settled mainly in the neighbourhood of the earwig thorax and near distal end of its abdomen (cerci). Hypopodes attached to earwig legs were sometimes observed. Hypopodes were also found attached to its head but this was rare. Smooth and unprotected body surfaces, distal body parts, especially mobile segments of legs (tarsi) and head (mouth parts, antennae), were usually without mites. The results of this study show a significant portion of earwigs transporting and spreading mites in the apiary environment, in which earwigs had penetrated.

Keywords: *Acarina, Acaridae*, apiary, *Apis mellifera*, beehives, European earwig, *Forficula auricularia*, *Histiostomatidae*, honeybee, hypopus, mites, phoresy.

INTRODUCTION

The European earwig, *Forficula auricularia* L. belongs to the group commonly known insects often occurring in an apiary environment. Earwigs as polyphagous animals feed on plant and animal food. In beehives and their surroundings they prey on various small arthropods living in this environment. They also feed on dead bees, food scraps, provisions of hosts and hive products (bee-bread, honey, pollen). They are active, and usually nocturnal. They penetrate beehives, pollen traps and their surroundings looking for food. During the day they hide in crevices, especially under flight boards, pollen traps, roofs of hives and quilts on the ceiling boards. They often occur inside honeycomb cells, which have been left free of bees.

Investigations conducted on entomofauna of beehives and hive products show that earwigs are almost constant invaders of these habitats (Chmielewski 1992, 1996, 2001-2005).

There are also some data on phoretic associations of mites cohabiting together with these earwigs (Behura 1950, Chmielewski 1977a, b, 1984, 2009).

During examinations of hives and their

surroundings it was found that a lot earwigs were infested with mites. The mites were attached to the earwigs body. The results of these observations provided the motivation to study the phoretic relationships of these two groups of arthropods (mites – earwigs) and the significant role of the insects, which they play in spreading mites.

MATERIAL AND METHODS

15 samples of adult earwigs were collected from 12 beehives (*Apis mellifera* L.) and their surroundings. The beehives were on a private, stationary apiary in the Puławy region (south-east Poland). The samples were collected during the summer and autumn months (June – November, 2004-2006). The collection area included orchards, forest, meadow and agricultural fields. The collected earwigs were examined for external mites using a stereoscopic microscope. If necessary, both insects and mites were kept in a refrigerator (temperature at below 0ºC) prior to examination. They were counted after removal. Lactic acid (50%) was used to fix large numbers for routine examination and sorting. Both, air dried and 75% alcohol fixed material, were used for Scanning Electron Microscopy. For the purposes of identification, mites were mounted in Oudeman's fluid (as recommended by Hughes 1976) on microscope slides. They were used for the recording of mite prevalence and intensity on earwigs.

RESULTS

A total number of 211 imagines of European earwig, *F. auricularia* were collected from beehives of *A. mellifera*. Those included all specimens separated from 15 samples (an average of 14 (1-28) earwigs per sample) of material. Acarological analyses showed that all collected samples contained earwig specimens were settled with mites. The percentage of insects infested with mites in particular samples, ranged from 37.5 to 100%. Total infestation of this material was 81.5% of earwigs infested mainly with phoretic forms (hypopodes) of mites, but 18.5% were found to be free of them. A total number of 1440 mite specimens were isolated from the body surface of insects. The average number of mites was 8.4 per one earwig specimen. This number varied enormously and ranged from a single mite to 85 hypopi, or even over 100 individuals.

The following external mites as phoretants were found on the body surface of earwigs: *Anoetoidea* (mainly hypopi of fam. *Histiostomatidae*), e.g. *Histiostoma polypori* (Oudemans), ca. 80% of earwigs were infested with hypopodes of this species; ca. 20% of examined earwigs were settled with *H. feroniarum* (Dufour), *Histiostoma* sp., *Myianoetus* sp. and several *Acaroidea* (fam. *Acaridae*) - *Acarus farris* Oudemans, *Rhizoglyphus echinopus* Fumouse et Robin, *Caloglyphus berlesei* (Michael), *Calvolia* sp. Some other unidentified mites, belonging mainly to trombiculid (parasitic larvae) and mesostigmatid groups (*Trombidiformes*, *Mesostigmata*), were rare or sporadically recorded, and usually in small numbers only.

The adaptations of hypopodes for life on the surface of an insect's body includes reduced mouth parts (gnathosoma), strong suckers localized on sucker plates and tarsi, tactile tarsal setae and sensilla, strong sclerotized body cuticle, small size and dorsal-ventrally flattened body shape (Fig. 1-3).

Attachment of mites on particular regions of the body surfaces of insects was very characteristic. The most numerous hypopi colonies were observed on the front, end and lateral surfaces of the thorax. The abdomen was settled mainly in the neighbourhood of the earwigs' thorax, and also in its distal part, near the abdominal

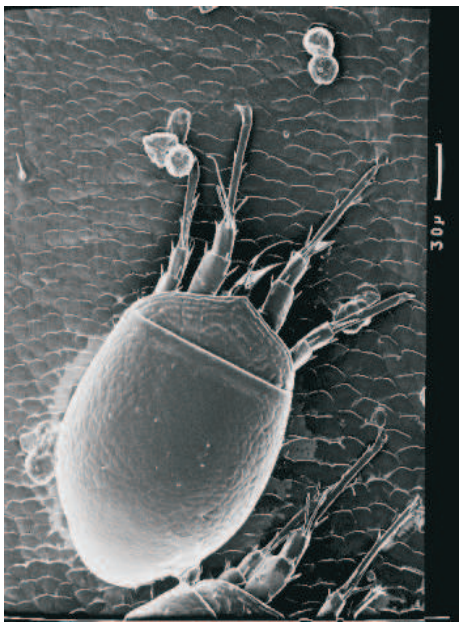

Fig. 1 - *Histiostoma* sp., hypopus - dorsal view.

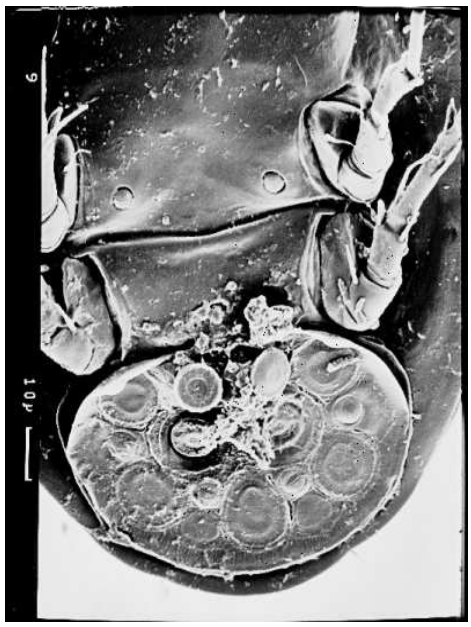

Fig. 3 - *Histiostoma* sp., hypopus - hypopal sucker plate.

Fig. 2 - *Histiostoma* sp., hypopus - ventral view.

Fig. 4 - European earwig, *Forficula auricularia* L. and mites attached to front of its thorax.

end (cerci) (Fig. 4-7). Sometimes hypopodes were found as attached to earwig legs (coxa, femur). They were also sometimes observed and rather rare on its head (eyes), but this was rare. Smooth and unprotected body surfaces, distal body

Fig. 5 - *Forficula auricularia* L. - the front of thorax with attached Histiostoma hypopi.

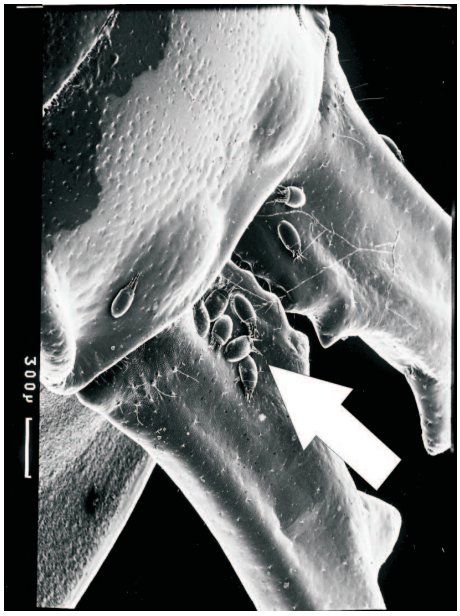

Fig. 7 - Anoetoid hypopodes on the surface at the very back of earwig abdomen.

Fig. 6 - Concentration of mites attached to lateral side of earwig thorax.

parts, especially mobile segments of legs (tarsi) and head (mouth parts, antennae), were usually free of mites.

DISCUSSION AND CONCLUSIONS

Results obtained during the present investigations of species composition, abundance and prevalence of mites associated with earwigs show, that the majority of them are phoretic on their hosts. Microscopic analyses of acarological material collected from insects give evidence that they are representatives of the *Anoetoidea* and *Acaroidea* superfamilies (hypopodes forms), mainly belonging to the *Histiostomatidae* and *Acaridae* families. Of them *H. polypori* (hypopi) seems to be the dominating species, phoretic on the insects. Other anoetoids and acaroids were not so numerous and rarely observed. Also trombiculids (parasitic

larvae) and mesostigmatids occurred usually as single specimens. Sporadic occurrence of representatives of this last group seems to be accidental phenomenon.

The presented results show that earwigs play a significant role in mite – insect relations. Earwigs play a very important role in the transportation and spreading of mites in an apiary environment penetrated with these insects.

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REFERENCES

Behura B. K. (1950) – A Little-known Tyroglyphoid Mite, *Histiostoma polypori* (Oud.), and its Association with the Earwig, *Forficula auricularia* Linn. *Nature*, 165: 1025-1026.

Chmielewski W. (1977a) – Powstawanie i znaczenie stadium hypopus w życiu roztoczy z nadrodziny *Acaroidea. Prace Nauk. Inst. Ochr. Roślin*, 19(1):5-94.

Chmielewski W. (1977b) – Wyniki obserwacji powiązań roztoczy z owadami (Acari-Insecta). *Pol. Pismo entomol*., 47:59-78.

Chmielewski W. (1984) – Histiostoma *polypori* (Oud., 1914) (*Acarina, Anoetinae*) - gatunek nowo stwierdzony na terenie Polski. *Prace Nauk. Inst. Ochr. Roślin*, 26(1):87-91.

Chmielewski W. (1992) – Skład gatunkowy i liczebność akarofauny w osypie naturalnym zimujących rodzin pszczelich. *Pszczeln. Zesz. Nauk*., 36:74-90

Chmielewski W. (1996) – Species composition of acaro-entomofauna of honey. *Pszczeln. Zesz. Nauk*., 40(2):205-212.

Chmielewski W. (2001) – Skład gatunkowy szkodliwej akaro-entomofauny świeżych obnóży pyłkowych. Mat. XXXVIII Nauk. Konf. Pszczel., Puławy 2001:13-14.

Chmielewski W. (2002) – Acaro-entomological contaminations of propolis. *J. apic. Sci.*, 46(1):17-23.

Chmielewski W. (2003) – Insects and mites - pests of bee-bread stored in honeycombs. *J. apic. Sci*., 47(2):87-92

Chmielewski W. (2005) – Results of investigations on infestation and contamination of propolis with arthropods. *J. apic. Sci*., 49(2):59-67.

Chmielewski W. (2009) – Przenoszenie roztoczy (Acarina) przez skorki spotykane w ulach pszczelich. *Przegląd Pszczelarski* (in press).

FORETYCZNE ROZTOCZE (*Acarina*) NA SKORKACH, *Forficula auricularia* L. (*Insecta, Dermaptera*), WYSTĘPUJĄCYCH W PASIEKACH

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Streszczenie

Skorki, *Forficula auricularia*, należą do owadów często występujących w środowisku pasiecznym, w magazynach i pracowniach pszczelarskich. Spotyka się je w ulach, gdzie żerują na odpadkach pokarmu pszczół i martwym czerwiu, a także są drapieżcami i wrogami naturalnymi drobnych stawonogów, szkodników pszczół i produktów pszczelich. W czasie przeglądów rodzin pszczelich, spotykano często skorki z przyczepionymi do ich ciała roztoczami, głównie w stadium hypopus. Obserwacje te skłoniły do podjęcia badań nad foretycznymi powiązaniami między tymi grupami stawonogów i ich znaczeniem w

rozprzestrzenianiu się roztoczy.

Badania przeprowadzono w miesiącach lipiec – październik, w latach 2004-2006, w liczącej 12 rodzin pszczelich prywatnej pasiece stacjonarnej, zlokalizowanej w Puławach. Zebrano 15 prób liczących średnio po ok. 14 (1-28) owadów w próbie. W każdej z prób stwierdzono obecność skorków opanowanych przez roztocze (34,5-100% owadów z roztoczami). Zebrany materiał przechowywano w niskiej temperaturze (zamrażarka), a następnie owady przeglądano sukcesywnie pod mikroskopem stereoskopowym. Z wyizolowanego materiału wykonano preparaty mikroskopowe, które posłużyły następnie do identyfikacji gatunków roztoczy. Z części zabezpieczonego materiału wykonano zdjęcia pod mikroskopem skaningowym. Z łącznej liczby 211 odłowionych imagines *F. auricularia,* 172 (81,5%) było opanowanych przez roztocze. W wyniku analizy mikroskopowej wyizolowano 1440 osobników roztoczy w stadium hypopus, należących głównie do rodzin *Histiostomatidae* (*Histiostoma poplypori*, *H. feroniarum*) i *Acaridae* (*Acarus farris*, *Rhizoglyphus echinopus*, *Caloglyphus berlesei*).

Rozmieszczenie roztoczy przyczepionych na ciele owada było dosyć charakterystyczne. Najliczniejsze skupienia hypopusów obserwowano na tułowiu; najczęściej zasiedlały one przednią, tylną i boczne jego powierzchnie. Odwłok zasiedlany był głównie na granicy z tułowiem, a także w końcowej jego części, w okolicy przysadek odwłokowych (cerci). Stosunkowo nielicznie spotykano je na odnóżach (coxa, femur) i rzadko na głowie (oczy). Gładkie i nieosłonięte powierzchnie ciała, dystalne segmenty kończyn, a zwłaszcza końcowe, ruchliwe człony nóg (stopy) i głowy (aparat gębowy, czułki), były zwykle wolne od roztoczy.

Prezentowane tu wyniki badań rzucają nowe światło na znaczenie skorków w pasiekach, nie tylko jako szkodników zapasów pokarmu pszczół i drapieżców - wrogów naturalnych innych stawonogów towarzyszących pszczołom w ich gniazdach, lecz także zwracają uwagę na ich istotną rolę jako przenosicieli roztoczy w ich rozprzestrzenianiu w środowisku pasiecznym penetrowanym przez te owady.

Słowa kluczowe: *Acarina*, *Acaridae*, *Apis mellifera*, forezja, *Forficula auricularia*, *Histiostomatidae*, hypopus, pasieka, pszczoła miodna, roztocze, skorek pospolity, ule pszczele.