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 polytopi, H. feroniarum) and several Acaroidea (Acarus farris, Rhizoglyphus echinopus, Caloglyphus berlesei). Some other unidentified mites, mainly belonging to the astigmatid, 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 Pulawy 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. Histioomatidae), e.g. Histiostroma polyposi (Oudemans), ca. 80% of earwigs were infested with hypopodes of this species; ca. 20% of examined earwigs were settled with H. feroniarum (Dufour), Histiostroma 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
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
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 parts, especially mobile segments of legs (tarsi) and head (mouth parts, antennae), were usually free of mites.
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


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. Spotykana 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
rozprzestrzanianiu się roztoczy.


Rozmieszczenie roztoczy przyczepionych na ciele owada było dosyć charakterystyczne. Najliczniejsze skupienia hypopusów obserwowano na tułowiu; najczęściej zasiedlały one przednią, tylną i boczną jego powierzchnię. Odwólk 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 nieosłoniête powierzchnie ciała, dystalne segmenty 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 pasieках, 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, pszczola miodna, roztocze, skorek pospolity, ule pszczele.