ACARO-ENTOMOLOGICAL CONTAMINATIONS OF PROPOLIS

(INTRODUCTORY OBSERVATIONS)

Wit Chmielewski

Department of Bee Products, Apiculture Division, Research Institute of Pomology and Floriculture, Kazimierska 2, 24-100 Pulawy, Poland; e-mail: wit.chmielewski@man.pulawy.pl

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Summary

Propolis was scraped from various parts of beehives (bars, frames, walls, floorboards) and collected from special propolis traps installed inside hives (double queen excluders); some material was picked up also from beehive debris. Macro- and microscopical analyses of samples show that majority of them were contaminated and infested with various arthropods, mainly with mite and insect species commonly known as stored product pests and invaders of bee hives. The most numerous of mites were *Glycyphagus domesticus* (De Geer), *Carpoglyphus lactis* (L.), *Tyrophagus longior* (Gerv.), *Acarus* spp. and some other acaroid species belonging to families *Acaridae* and *Glycyphagidae*. Among insects very frequent were *Achroia grisella* (Fabr.), *Galleria mellonella* (L.), *Tribolium madens* Charp., *Dermestes lardarius* L., psocids (*Psocoptera*) and other inhabitants of bee hives. Almost all of the propolis samples were also contaminated with dead bees and their body fragments.

Keywords: arthropods, contaminations, insects, mites, pests, propolis.

INTRODUCTION

Results of biochemical investigations on propolis show that composition of this product is varied and its biological activity expressed among others by antibacterial characteristics is usually very high (Meresta, Meresta 1980, 1982, 1985; Muszyńska et al. 1992; Rybak-Chmielewska et al. 1991, 1992; Scheller et al. 1968, 1977). Flavonoids, organic acids, terpenes and some other substances belong to very active constituents of propolis. In this connexion it is a valuable natural product very useful for improvement of human health and beauty. Like other attractive hive products (honey, pollen, bee-bread, royal jelly, venom) it is used as an essential ingredient for preparation of various kinds of medicines (ointments, tinctures) for healing of body injuries. Cosmetics with addition of propolis or its extracts, such as body creams and face masks, are also prepared and recommended for application in cosmetology. As such, this product should be of the highest quality and most of all free of various contaminations and pests, which commonly occur in bee-hives and mostly multiply in large numbers (Banaszak 1980; Chmielewski 1971, 1992; Haragsim et al. 1987). Raw propolis usually contains some additions of other bee products such as bee-bread, honey, pollen, wax and dead bees. These contaminations work as lures and decoys for various mites and insects, associates of bees, which often colonize and infest contaminated propolis. Results of biological studies conducted earlier on attractiveness of pollen loads and bee-bread for acaroid mites show that development of these pests and their population increase on these kinds of food are very intensive (Chmielewski 1978, 1995). That is why they spread and multiply inside bee-hives, infesting and contaminating other hive

products including propolis (Chmielewski 1991, 1996).

The aim of this study was the assessment of the hygienic condition of propolis harvested from beehives with special regard to the species composition of acaro-entomofauna infesting and contaminating this product.

MATERIAL AND METHODS

The project was carried out in the Department of Bee Products, Apiculture Division, Research Institute of Pomology and Floriculture (Pulawy, Poland). Observations were conducted and propolis was collected irregularly for some years (1995-1999). Some of experiments were made in resident experimental apiary of the Institute; some material was received from four private apiaries localized in Pulawy and neighbourhood. Propolis was gathered and stored mainly on the occasion of the survey of bee colonies e.g. during their spring inspections. Samples of propolis scrapings were collected from various propolized hive elements (bars, frames, walls, floors) of over 50 beehives (mainly in private apiaries), plus about 20 samples of this product collected by means of propolis traps (mainly in resident experimental apiary), i.e. double perforated zinc or plastic queen excluders installed inside of hives, between brood and super honey chambers. Some additional samples (small pieces of propolis) found in bee-hive debris of wintering bee colonies were also examined. A total of over 70 samples (5-50 g weight) were collected and analysed. All live and dead arthropods (these last ones were usually pressed into propolis clods or sticked on their gluey surface) or other acaro-entomological contaminations (cocoons, exuvia, excrements, various body fragments) were picked up and determined macro- (bigger arthropods) or microscopically (mites, tiny insects). Mites and insects were prepared if necessary (microscopic slides) and identified by means of suitable guides and descriptions (e.g. Chmielewski 1998, Hughes 1976, Zachvatkin 1941, and others).

Intensity of contamination of propolis was expressed by numbers of collected objects calculated per 100 g of propolis, after a three degree scale as follows: I - 1-2 objects, II - 3-5 objects, III - > 5 objects per 100 g of the product.

RESULTS AND DISCUSSION

Over 500 entomological objects, i.e. 280 live and dead insects (imagines, pupae + other development instars) plus some of their body fragments, were isolated from gathered propolis samples. As a result of microscopic analyses of collected material (stereoscopic microscope) about a thousand (960) mites (larvae, nymphs and adults; exact number of eggs was difficult to establish) were found.

The majority of analysed samples (94.3%) were infested and contaminated with various arthropods. Usually they were contaminated with dead bees (workers, brood, pieces of their bodies). 71.4% of examined samples were contaminated with other insects belonging to over 20 species (over 12 families). Among other arthropods found in propolis the most frequent (64.3% of samples) and numerous (from single to a few dozens or even over a hundred specimens per 100 g of the product) were mites (over 11 species from 7 families); some acarological material was undetermined because of juvenile development stages of those pests or heavy body injuries of some specimens. A total of 30 (42.9%) examined samples showed the 3rd degree contamination (from 6 to160 /average - 23.3/ pests per 100 g propolis sample); 28.6% - 2nd degree contamination (3-5 pests/100 g); 22.9% - 1st degree contamination and only 4 samples (5.7%) were free of arthropods.

Detailed results of screening collected propolis samples for contamination with the following mites, insects and other arthropods are given below:

Acarina - mites

Acaridae:

Acarus siro L. - flour mite

Acarus immobilis Griffiths

Tyrophagus longior (Gerv.)

Tyrophagus putrescentiae (Schr.) - mold mite

Acaridae - undetermined specimens

Carpoglyphidae:

Carpoglyphus lactis (L.) - driedfruit mite

Glycyphagidae:

Glycyphagus domesticus (De Geer) - house mite

Lepidoglyphus destructor (Schr.) - long hair mite

Glycyphagidae - undetermined specimens

Aceosejidae:

Melichares tarsalis (Berl.)

Cheyletidae:

Cheyletus eruditus (Schr.)

Cheyletidae - undetermined specimens

Tarsonemidae:

Tarsonemus fusarii Cooreman

Tarsonemidae - undetermined specimens

Varroidae:

Varroa jacobsoni Oud.

Gamasidae, Parasitidae, Phytoseiidae, Oribatida, Tydeidae - undetermined specimens

Insecta - insects

Coleoptera

Anobiidae:

Stegobium paniceum (L.) - drugstore beetle

Dermestidae:

Anthrenus museorum (L.)

Anthrenus verbasci L. - varied carpet beetle

Dermestes lardarius L. - larder beetle

Dermestes maculatus De Geer - hide beetle

Trogoderma granaria Everts - khapra beetle

Dermestidae - undetermined specimens

Ptinidae:

Ptinus fur L. - whitemarked spider beetle

Tenebrionidae:

Tenebrio molitor L. - yellow mealworm

Tribolium madens (Charpentier) - black flour beetle

Tenebrionidae - undetermined specimens

Cryptofagidae, Lathrididae, Mycetophagidae - undetermined specimens

Hymenoptera

Apidae:

Apis mellifera L. - honey bee

Vespidae:

Paravespula germanica F. - German yellowjacket

Formicidae, Myrmicidae - undetermined specimens

Diptera

Muscidae - undetermined specimens

Lepidoptera

Pyralidae:

Achroia grisella (F.) - lesser wax moth

Cadra cautella (Walker) - almond moth

Ephestia elutella Hubner - tobacco moth

Galleria mellonella (L.) - greater wax moth

Plodia interpunctella (Hubner) - Indianmeal moth

Tineola biselliella (Hummel) - webbing clothes moth

Pyralidae, Tineidae - undetermined specimens

Psocoptera

Athropidae:

Lepinotus inquilinus Heyden

Liposcelidae:

Liposcelis divinatorius Muller - booklouse

Pterolichidae:

Lachesilla pedicularia L. - cosmopolitan grain psocid

Dermaptera

Forficulidae:

Forficula auricularia L. - European earwig

Thysanura

Lepismatidae:

Lepisma saccharina L. - common silverfish

Arthropoda (other groups)

Cheliferidae:

Chelifer canroides (L.) - house (book) pseudoscorpion

Collembola, Crustacea, Isopoda - undetermined specimens.

The majority (over 50%) of the propolis samples was contaminated also with bee provisions (honey, pollen, bee bread), wax, dead bees (body fragments, brood) and various plant material. These „additions" are attractive food for various invaders, mainly arthropods associated with bees, and pests usually infesting and contaminating hive products. Almost all of such samples were usually strongly infested (III-rd degree of contamination), mainly with acaroid mites, some groups of insects - darkling beetles, dermestid beetles, wax moths, psocids, as some of these pests are also necro- and polyphagous fed dead bees and their provisions. In this connexion they also play an important part in the spreading of bee diseases and in fungal infestation of hive products. Some mites (*Acaridae*, *Glycyphagidae*, *C. lactis*) and insects (*Dermestidae, Tenebrionidae, Pyralidae, Corrodentia*) are inhabitants of storage rooms, farm buildings and houses. They are commonly known as pests of food and other stored products, including hive products (honey, pollen, bee-bread, wax). These species are not only economic but also of great hygienic and sanitary importance as the causes of heavy diseases of humans, especially sensitive persons, and animals, such as bronchial asthma (bronchitis), conjunctivitis, dermatitis and rhinitis. There are known various dermathological complaints such as „grocer's itch", caused by house mites, *G. domesticus* and by other acarid species - mold mite or copra mites, *T. putrescentiae*, which caused allergic skin inflammation, the so called „copra itch". Besides of this, almost all of these inhabitants, seasonal invaders, accidental intruders and visitors of beehives, permanent associates of bees and pests of their provisions, are effective vectors of pathogenic and saprophytic microorganisms (bacteria, fungi, viruses) causing bee diseases, infestations and damage of hive products (including propolis) and worsening their quality.

Intensity of infestation (degrees of contamination) of propolis depends, among others, on methods of its harvesting and storage. Samples collected from propolis traps (double perforated queen excluders) were usually cleaner (I-st and II-nd contamination degrees or sometimes even free of pests) in comparison with propolis scraped occasionally from various parts of bee-hives and collected from hive debris, which was usually strongly contaminated (III-rd degree, over 5 pest individuals per 100g of sample). State of hygiene of propolis regarding its contamination with pests seems to be also dependent on its storage conditions (temperature, relative humidity, package).

Results of observations presented herein show that samples of propolis collected from our resident experimental apiary, stored and protected against pest infestation by means of used refrigetor (hermetic containers, low temperature - near 0°C and RH - below 50%), were significantly cleaner (I-st or sometime II-nd contamination degrees) than material samples received from private apiaries, where they were usually stored under primitive conditions, in unsuitable rooms, leaky or open containers, without proper protection against mites and insects.

CONCLUSIONS

— The majority of arthropods found in propolis belong to stored products mites (*Acaridae, Carpopglyphidae, Glycyphagidae*) and insects (*Dermestidae, Pyralidae, Tenebrionidae*), commonly known as synantropic pests of economic and sanitary importance (e.g. causing human allergy, spreading pathogens and saprophytic microorganisms).

— Intensity of propolis infestation and contamination with arthropods depend on methods of production and storage of propolis and ranged from single (1-2) specimens (I-st degree) in samples collected systematically by means of special traps, to some (3-5 objects - II-nd degree) or even over 5 objects (III-rd degree) per 100g of the product collected occasionally with use of traditional method (scraping various parts of hives).

— Primitive methods of propolis production (cleaning ceilings, scraping frames and beehive walls, collecting from hive debris etc.) and its storage under wrong conditions (high humidity and temperature, leaky or open containers) are favourable for spreading and development of pests.

— Special traps (double perforated queen excluders) for harvesting and use of refrigetors for storage and protection of propolis seem to be worthy of recommendation for use by beekeepers interested in such production.

— Production of propolis with use of special equipment (propolis traps) and storage in hygienic conditions (low temperature and RH, clean and hermetic containers) ensure product of the high purity (almost free of mites and insects) and of the best quality (high biological activity).

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AKARO-ENTOMOLOGICZNE ZANIECZYSZCZENIA PROPOLISU

(OBSERWACJE WSTĘPNE)

Chmielewski W.

Streszczenie

Propolis zbierano nieregularnie przy okazji przeglądu rodzin pszczelich w kilku pasiekach krajowych na terenie Puław i w okolicy. Materiał zeskrobywano z ramek, beleczek powałkowych, ścian uli, dennic i krat odgrodowych. Pewną liczbę próbek (niewielkie kawałki) wybrano z osypu zimowego, ale większość stanowiły próby zebrane z poławiaczy propolisu (tzw. „kitołapek“) zrobionych z kawałków krat odgrodowych zainstalowanych wewnątrz uli. Próby badano makro- i mikroskopowo.

Propolis z ramek i innych elementów uli był zanieczyszczony zwykle zapasami pokarmu pszczół (miód, pyłek, pierzga), woskiem, martwymi pszczołami (fragmenty ciał, czerw) i różnymi materiałami pochodzenia roślinnego, które stanowią zazwyczaj atrakcyjny pokarm dla różnych stawonogów towarzyszących pszczołom w ich gniazdach i działają jak przynęta na szkodniki pasieczne.

Spośród roztoczy spotykanych w kicie pszczelim najczęściej występowały rozkruszki (*Acaroidea*): *Glycyphagus domesticus* (De Geer), *Carpoglyphus lactis* (L.), *Tyrophagus* spp., *Acarus* spp. (różne stadia rozwojowe, hypopusy, martwe roztocze, produkty przemiany materii). Owady reprezentowane były głównie przez barciaki (motylice woskowe) - *Achroia grisella* (Fabr.) i *Galleria mellonella* (L.), *Tineidae, Phycitidae* (poczwarki, egzuwia, wylinki larwalne, kokony, ekskrementy) i in. Bardzo częstymi szkodnikami były także psotniki (*Psocoptera*) i chrząszcze (*Coleoptera*). Najpospolitszymi z nich były trojszyki, *Tribolium madens* Charp., mącznik młynarek - *Tenebrio molitor* L., skórniki - *Dermestes lardarius* L. i kilka innych (*Dermestes, Stegobium, Trogoderma*).

Wnioski wynikające z tych badań można sformułować następująco:

Większość stawonogów znalezionych w propolisie należy do roztoczy magazynowych i owadów znanych powszechnie jako szkodniki synantropijne o dużym gospodarczym i

sanitarnym znaczeniu (np. wywołujące uczulenia u ludzi i zwierząt).

Stopień porażenia i zanieczyszczenia stawonogami zależy od metod pozyskiwania i składowania propolisu.

Prymitywne metody produkcji propolisu (zeskrobywanie z ramek i z innych części uli, wybieranie z osypu itp.) i przechowywanie surowca w nieodpowiednich warunkach (wysoka wilgotność i temperatura, nieszczelność opakowań) sprzyjają rozprzestrzenianiu się i rozwojowi szkodników.

Zbieranie propolisu przy użyciu specjalnego sprzętu (poławiacze propolisu zmontowane w formie powałek z krat odgrodowych), magazynowanie go w higienicznych warunkach, konfekcjonowanie i przechowywanie w czystych i hermetycznych pojemnikach, gwarantuje wysoką czystość i jakość towaru, który jest wtedy prawie wolny od owadów i roztoczy.

Słowa kluczowe: stawonogi, zanieczyszczenia, owady, roztocze, szkodniki, propolis.