A REVIEW OF THE BIOLOGY OF BRAULA FLY (*BRAULA COECA* NITZSCH 1818) (DIPTERA: BRAULIDAE) AND ITS SIGNIFICANCE FOR EUROPEAN HONEYBEES IN AUSTRALIA.

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Summary

Braula fly (*Braula coeca*) has worldwide distribution but is usually considered a minor pest of honey bees (*Apis mellifera*) in most countries. In Australia, it has been present in Tasmania for at least 90 years but was found only recently on the mainland. The wingless fly has strong capabilities to grasp the hairs on honey bees and can move quickly on the host. Braula fly is a honey bee inquiline, inhabiting the honey bee colony within which it undertakes all stages of its life cycle. They use chemical camouflage to avoid detection by the colony. The honey bee queen is the preferred host and the fly steals food from the bees as they are fed. Heavily infested queens may have decreased egg laying, and braula fly larvae damage the caps of honeycomb. Usually, braula fly populations are controlled by treatments for the ectoparasitic mite *Varroa destructor*.

Key words; ectoparasite, attachment, bee, pheromone, *Apis mellifera*

INTRODUCTION

The European honey bee (*Apis mellifera* L.) (EHB) were first imported into Australia in 1822 (Schlipalius 2023) and the industry continues to grow. Australian exports of agricultural commodities in 2019/2020 were valued at more than A$25 billion with many industries relying on pollination by EHB (Plant Health Australia 2021). In 2021, the Australian beekeeping industry including approximately 25,000 registered beekeepers managing about 672,200 colonies (Plant Health Australia 2021). The Australian beekeeping industry faces many endemic pests, diseases, and extremes of climate (Roberts *et al.* 2015; Bourke 2020a,b; Frost 2020; Bernasconi and Honan 2022; Schlipalius 2023).

Several exotic insect pests have established in Australia and adversely impact honey bee activities including European wasp (*Vespula germanica* F.), small hive beetle *Aethina tumida* (Murray), braula fly (*Braula coeca* Nitzsch 1818), wax moths, (*Galleria mellonella* (Linnaeus 1758) and *Achroia grisella* (Fabricius, 1794)), and giant willow aphid *Tuberolachnus salignus* (Gmelin) (Brown 1979; Gillespie *et al.* 2003; Dominiak and Worsley 2018). The ectoparasitic mite, *Varroa destructor*, has recently established on the east coast (Bourke *et al.* 2024). Many of these insect pests rapidly became widely distributed in Australia (Horwood *et al.* 1993; Neumann *et al.* 2010; Kwadha *et al.* 2017). Conversely, braula fly has been slow to expand its range beyond Tasmania.

BRAULA FLY BIOLOGY

Braula fly (sometimes called *bee lice* or *bee louse*) is a small red-brown, flattened, wingless parasite that lives on the bodies of bees. Much of the life history and knowledge of braula fly was summarised by Knutson (1978) and Morse (1987) and will not be covered in detail here. In brief, braula fly eggs are 0.84 mm by 0.42 mm. Eggs may be deposited in many locations however only eggs deposited in capped honeycomb will hatch (Frost 2024). Larvae hatch and tunnel under the beeswax cappings, leaving 1 mm tracks across the surface of the honeycomb. The larval tunnelling results in a fractured appearance and this is a key indicator for the presence of braula fly (Frost 2024). Larvae progress through three instars (7 – 11 days) and subsequently pupate. The pupae are 1.4 – 1.7 mm long and 0.5 – 0.75 mm wide, and the pupal period lasts about three days. The development from egg to adult takes 10 – 23 days, depending primarily on temperature. Adult braula fly survive on adult bees and are not known to survive in their absence (Frost 2024).

Braula fly moves close to the mouth parts of bees and steals small amounts of the food fed to it by other bees (Frost 2024). Braula fly feed on honey and pollen directly from the mouth of its host during trophallaxis where food is shared between bees (Martin and Bayfield 2014). Queen honey bees receive a much higher frequency of feeding compared to workers and drones (Barton-Smith and Caron 1984; Martin and Bayfield 2014). In *Braula pretoriensis,* which also infests *Apis mellifera*, Esnault *et al.* (2019) reported that flies could induce regurgitation by striking the upper end of the bee's labium until the bee extended its tongue.

ATTACHMENT TO BEES

Braula fly has six legs with feet that have several comb-like teeth or claws which enable braula fly to grip to the hairs of the bee's body (Buscher *et al.* 2021). Despite this, adults can move freely, quickly and efficiently in any direction on the host (Buscher *et al.* 2021). Adults stay resting on the host thorax for most of the time (Buscher *et al.* 2021). However, braula fly often move their legs back and forth to capture hairs in close proximity and may collect bunches of hairs to secure attachment (Buscher *et al.* 2021). This grip allows the braula fly to avoid detachment during bee grooming (Buscher *et al.* 2021). These attachment forces have a safety factor of >1000 (Buscher *et al.* 2021). Parasitised bees, particularly queens, are restless, nervous, weakened, and occasionally shake their legs or rub their bodies with their wings to remove the parasites, usually without success (Marchiori 2023).

DAMAGE AND IMPORTANCE

Some authors consider that braula fly is not a serious threat to commercial beekeeping, as it does not damage or parasitize any stage of the honey bee life cycle (Honan 2022; Biosecurity New Zealand 2022; Marchiori 2023). Braula fly is of very little economic importance and there are no international trade implications (Anonymous 2022). The main economic effect of braula fly is that the larval stage burrows under the cappings of the honeycomb and the damage can detract from the appearance of honeycomb for sale making it unsaleable or of reduced value (Frost 2024).

However, dense braula fly populations in hives can be significant. For instance, Benton (1896) found 75 braula fly on one queen although numbers of less than a dozen were more common. Bailey (1963) suggested that high levels of braula fly on a single queen could decrease her egg-laying capacity. In severe cases, an infested queen can carry up to 100 adult braula fly which caused reduced egg laying (Bailey and Ball 1991). Heavily infested queens may be seen as inferior or old and replaced by a younger queen (supersedure) (Tarpy 2024). Heavy larval infestations especially in weak colonies causes paralysis of larvae and decreases the queens egg laying efficiency (Marcangeli *et al.* 1993; Yusuf *et al.* 2024). Also, death of developing bees could occur (Yusuf *et al.* 2024). Its potential as a pathogen vector has not been fully explored (Marchiori 2023). Colwell *et al.* (2023) were the first to establish the presence of black queen cell virus (BQCV) and two strains of deformed wing virus (DWV-A and DWV-B) in braula fly in Canada, but they did not establish if braula fly could serve as a viral vector.

BRAULA PREFERENCE FOR DRONES, WORKERS OR QUEENS

The fact that queen bees are fed more intensively than other EHB castes is likely the reason that queens may be preferred over workers and drones as braula fly hosts. However, the published data on host preference within EHB hives is quite equivocal.

Worker bees

In America, braula fly was found usually on worker bees (Phillips 1925). Barton Smith and Caron (1984) found that 98.6% of workers had a single braula fly.

Drones

Yusuf *et al.* (2024) found that braula fly rarely attaches to drones (males). Young drones were more likely to be infested versus old drones (Barton Smith and Caron 1984).

Queens and nurse bees

Braula fly preferred to attach to the queen, rather than the drone or worker bees (Phillips 1925; Honan 2022). Often, braula fly were found on the queen and drones (Biosecurity New Zealand 2022). Virgin and mated queens were more likely to be infested than young drones (Barton Smith and Caron 1984). Mated queens were more likely to be infested than virgin queens (Barton Smith and Caron 1984; Buscher *et al*. 2021). Braula fly has a preference to infest the queen (Martin and Bayfield 2014) or the queen and nurse bees (Yusuf *et al.* 2024) with 62% of examined queens harboured lice (Barton Smith and Caron (1984). Queens and nurse bees are preferred hosts because they smell like a queen, and queens receive more food than workers (Korst and Velthius 1982; Martin and Bayfield 2014; Yusuf *et al.* 2024).

Normally, alien species in an EHB colony are attacked but braula fly have evolved a survival mechanism. The queen is the most attended and longest living individual in the colony, but braula fly remains undetected on queens by the worker bees. Braula fly possesses a cuticular hydrocarbon profile that mirrors that of their host honey bee colony (Martin and Bayfield 2014). This chemical camouflage is most likely due to odour acquisition from the honey bee host: even small colony-specific differences in the alkene isomer patterns of the honey bees also were detected in the associated braula fly profiles (Martin and Bayfield 2014).

For braula fly, this odour acquisition may have other advantages. Braula fly successfully re-mounted worker

bees that previously carried them but not worker bees that had not carried them, with those carrying them having more 9-oxo-2(E)-decenoic acid (9-ODA; queen pheromone) and 10-hydroyx-2(E)-decenoic acid (10-HDA; worker pheromone) (Yusuf *et al.* 2024). By eavesdropping on their host's pheromones, braula fly makes choices regarding which bee to use as a host, and this technique should result in their higher prevalence and survival (Yusuf *et al.* 2024).

DETECTION AND TREATMENT

Braula fly is not considered a significant pest (Honan 2022; Marchiori 2023) however apiarists should check the health of colonies. Examination of adult worker and queen bees may reveal the presence of braula fly. When viewed with the naked eye, braula fly can be confused with *Varroa* spp., *Tropilaelaps* spp. (ectoparasitic mite), and *Mellitiphis alvearios* (pollen mite) that are found sometimes in colonies (Buscher *et al*. 2021; Biosecurity New Zealand 2022). Additionally, detection methods used for *Varroa* spp. are likely to be suitable for braula fly (Frost 2024). The methods include alcohol wash, soapy water wash, or sugar shake of 300 bees (Frost 2024; Taylor *et al.* 2025).

Usually, treatment is minimal (Frost 2024). The standard practise of uncapping honeycomb during extraction is an effective means of larval control (Frost 2024). Freezing for at least 24 hours will kill all stages of braula fly (Biosecurity New Zealand 2022; Frost 2024; Honan and Webster 2024).

For adult braula fly, early remedies included a bag of naphthalene on the bottom of the hive which caused the fly to drop from the bees to the bottom of the hive, where they could be captured (Phillips 1925, Marchiori 2023). However, naphthalene can drive the bees from the hive, perhaps depending on the dosage (Phillips 1925). Nicotine smoke numbed braula fly and they fell from their host to the floor of the hive (Marchiori 2023).

Fumigation with 0.02 g of amitraz or aerosol treatment with 0.006 g of amitraz killed very few braula fly (Kulincevic *et al.* 1991). Fumigation with 0.0025 g of fluvalinate killed many braula fly but the aerosol application using 0.0012 g of fluvalinate killed significantly more braula fly (Kulincevic *et al.* 1991). Treatment timing may be important; for *Braula orientalis* Orosi, treatment in early summer was likely to keep pest populations low for the remaining seasons (Ghzawi *et al.* 2009). This timing was based on the hypothesis that braula fly has one generation per year (Marchiori 2023).

Following the recent establishment of *V. destructor* on June 2022 in New South Wales (NSW), Australia (Bourke *et al*. 2024), the use of miticides for *Varroa* management also should provide control of braula fly populations (Frost 2024) in areas where both pests are present. This is because amitraz and fluvalinate, used to control *V. destructor,* are effective also on braula fly. In August 2024 and March 2025, *V. destructor* was detected in Victoria and Queensland respectively (Agriculture Victoria 2024; Queensland Government 2025).

Braula fly prefers clean and pristine conditions and dies in response to exposure to many chemicals, even nicotine smoke (Honan and Webster 2024). There are no specific pesticide treatments registered in Australia for braula fly (J. Kidston (NSW DPI) 2024, pers. comm.). A new fungal species, *Dimeromyces braulae* (Ascomycota, Laboulbeniales) was described on braula fly in the Czech Republic with an infection rate of 12.6% (Rossi *et al.* 2016) and may be a biological control in the future.

DISPERSAL AND DISTRIBUTION

Dispersal happens because braula fly attaches itself to adult honey bees. Therefore, braula fly is spread by swarms, drifting bees (bees returning accidentally to the wrong hive), packaged bees (a package of many workers and a single queen used to initiate new colonies) and queen bees (Buscher *et al.* 2021; Frost 2024). Drifting drones, infested with braula fly, are accepted readily in other colonies within an apiary (Buscher *et al.* 2021). Additionally, robbing behaviours (removal of resources from weak hives by strong hives) and absconding bees can spread braula fly (Biosecurity New Zealand 2022). Internationally, braula fly adults can be introduced on imported infested queens (Phillips 1925). Additionally, braula fly larvae are spread by the removal and transport of infested honeycomb (Frost 2024).

Braula fly was first reported from Europe, Russia, and South Africa in the early 1900's, and there were frequent introductions in the USA (Phillips 1925). Apart from Antarctia, braula fly is currently widespread overseas and was reported from all other continents except mainland Australia until recently (Honan 2022; Marchiori 2023).

In Australia, braula fly was not present in the early 1900's (Gale 1905). By 1932, braula fly was found at

many areas in Tasmania (Anonymous 2024) and now is considered endemic in Tasmania (Honan 2022; Frost 2024).

Nearly a century later, braula fly was detected in multiple apiaries in Victoria in August 2022 (Anonymous 2022). The Consultative Committee on Emergency Plant Pests (CCEPP – see Anderson *et al*. 2017 for details) advised all other states of the extension of range (Anonymous 2022). Braula fly remains a notifiable pest in Victoria under the Livestock Disease Control Act 1994, and beekeepers must report the suspected presence of braula fly. The pest had been eradicated several times at different locations in Victoria (Honan 2022).

In September 2022, braula fly was detected in NSW for the first time in colonies originating from Victoria, following an illegal movement of colonies from the Sunraysia region to NSW (Honan 2022). The infested colonies were returned to Victoria to help keep NSW free from braula fly (Honan 2022). Movement restrictions were implemented to control the movement of potentially infested colonies to delay or prevent establishment in NSW. In January 2024, braula fly was detected in colonies near Tamworth NSW (Honan and Webster 2024). There were no interstate links with the Tamworth detection (Honan and Webster 2024). No attempt was made to eradicate the infestation as there was no economic or scientific justification (Honan and Webster 2024). Braula fly remains a notifiable pest in NSW (Honan 2022; Frost 2024). NSW was mindful that the cost of regulations should not exceed the economic importance (Anonymous 2022). Currently, braula fly is considered established in Tasmania, Victoria and New South Wales (Frost 2024). However, any suspect detections should be reported to the free call Emergency Plant Pest Hotline on 1800 084 881 (Frost 2024).

Braula fly has not been detected in Queensland (Schlipalius 2023) despite Tamworth being relatively close to the Queensland boarder. Braula fly was not found in a survey of Norfolk Island (Malfroy *et al.* 2016). Given that honey bee imports into Norfolk Island ceased in 1992, it is hoped that Norfolk Island will remain free from braula fly.

CLOSING COMMENTS

Braula fly is likely to remain part of beekeeping in south eastern Australia as it is well established. Braula fly remains exotic to New Zealand and is a notifiable organism there (Biosecurity New Zealand 2022), and has not been reported in other Pacific nations. Pacific nations may restrict or regulate imports from Australia so that they can remain free from braula fly. The need to actively manage braula fly is likely to be supplanted by management procedures required to control populations of *V. destructor* as it likely spreads throughout south eastern Australia. Other Australian states without *V. destructor* will need to check colonies for braula fly and may need to introduce treatments if pest populations increase. Early summer may be the best time for treatments.

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REFERENCES

Agriculture Victoria (2024). Varroa detected in Victoria. https://agriculture.vic.gov.au/about/media-centre/media-releases/2024-releases/varroa-mite-detected-in-victoria. Accessed 22 July 2025.

Anderson, C., Low-Choy, S., Whittle, P., Taylor, S., Gambley, C., Smith, L., Gillespie, P., Locker, H., Davis, R. and Dominiak, B. (2017). Australian plant biosecurity surveillance systems. *Crop Protection* **100**: 8-20.

Anonymous. (2022). Detections of braula fly in bee hives. ABC Rural. web address https://www.treecrop.com.au/news/detection-braula-fly-bee-hives/. Accessed 21 November 2024.

Anonymous. (2024). The history of beekeeping in Tasmania. https://www.tasmaniabeekeepers.org.au. Accessed 26 November 2024.

Bailey, L. (1963) *Infectious diseases of the honey bee.* Land Books London Ltd, 176 pp.

Bailey, L. and Ball, B.V. (1991). Honey bee pathology, 2nd edition. Academic Press, London.

Barton-Smith, I. and Caron, D.M. (1984). Distribution of the bee louse *Braula coeca* Nitzsch in honeybee colonies and its preferences among workers, queens and drones. *Journal of Apicultural Research* **23**: 171-176.

Benton, F. (1896). *The Honey Bee. A journal of instruction in apiculture.* USDA Technical Bulletin, Washington, 18 pp.

Bernasconi, A. and Honan, K. (2022). NSW floods kill millions of bees, apiarists warn of flow-on effects to horticulture. https://www.abc.net.au/news/2022-03-16/floods-destroy-nsw-beehives-devastating-industry/100910904. Accessed 22 November 2024.

Biosecurity New Zealand (2022). Braula fly (*Braula coeca*). https://www.mpi.govt.nz/dmsdocument/50074-Braula-Braula-coeca-Fact-sheet#. Accessed 22 November 2024.

Bourke, R. (2020a). National Bee Biosecurity Program. *Australian Honeybee News* **13**: 42-45.

Bourke, R. (2020b). Barrier systems: the key to containing AFB. *Amateur Beekeeper* **6**: 14.

Bourke, R., Page, M., Frost, E.A., Millyn B., Anderson, C. and Dominiak, B.C. (2024). First detection and initial distribution of *Varroa destructor* in New South Wales, Australia – the first 100 days towards eradication. *General and Applied Entomology* **52**: 31-36.

Brown, G.R. (1979). The European wasp is a potentially dangerous import. *Agricultural Gazette* **90**: 38-39.

Buscher, T.H., Petersen, D.S., Bijma, N.N., Baumler, F., Pirk, C.W.W., Busse, S., Heepe, L. and Gorb, S.N. (2021). The exceptional attachment ability of the ectoparasite bee louse *Braula coeca* (Diptera, Braulidae) on the honey bee. *Physiological Entomology* **47**: 83-95.

Colwell, M. J., Pernal, S. F. and Currie, R. W. (2023). Detection of honey bee (*Apis mellifera* L.) viruses in the inquiline *Braula coeca* and comparison with viruses in the ectoparasite *Varroa destructor*. SSRN Electronic Journal. doi:10.2139/ssrn.4314517.

Dominiak, B.C. and Worsley, P. (2018). First detection of giant willow aphid *Tuberolachnus salignus* (Gmelin, 1790) (Hemiptera: Aphididae: Lachninae) in New South Wales, Australia. *General and Applied Entomology* **46**: 25-30.

Esnault, O., Meenowa, D. Snookar, P., Chauzat, M-P. and Dellatte, H. (2019). Spread and strain determination of *Varroa destructor* following its introduction to Mauritius and interactions with the bee louse *Braula pretoriensis* in honey bee colonies. *Journal of Apicultural Research* **58**: 75-83.

Frost, E.A. (2020). 24 million acres: Reports from Australia's massive fire scar. *Million Blossoms* **2**:18-22.

Frost, E. (2024). Braula fly. DPI Prime fact 31566. 2nd edition. https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0011/1538039/Primefact_Braula-fly_Mar_2024.pdf

Gale, A. (1905). Enemies of bees. *Agricultural Gazette of New South Wales* **16**: 489-492.

Ghzawi, A.A-M, A, Zaitoun, S. and Shannag, H. (2009). Management of *Braula orientalis* Orosi (Diptera: Braulidae) in honeybee colonies with tobacco smoke under semiarid conditions. *Entomological Research* **39**: 168-174.

Gillespie, P., Staples, J., King, C., Fletcher, M.J. and Dominiak, B.C. (2003). Small hive beetle, *Aethina tumida* (Murray) (Coleoptera: Nitidulidae) in New South Wales. *General and Applied Entomology* **32**: 5-7.

Honan, K. (2022). Exotic bee parasite braula fly detected in NSW as fight against varroa mite continues. ABC Rural. https://www.abc.net.au/news/2022-09-05/exotic-bee-parasite-braula-fly-in-nsw-illegal-hive-movement/101404814. Accessed 22 November 2024.

Honan, K. and Webster, L. (2024). Detection of braula fly in NSW poses issues for beekeeping industry. ABC Rural. https://www.abc.net.au/news/rural/2024-03-02/braula-fly-threat-for-nsw-beekeeping-industry/103525712. Accessed 22 November 2024.

Horwood, M.A., Toffolon, R.B. and Brown, G.R. (1993). Establishment and spread of *Vespula germanica* (F.) (Hymenoptera: Vespidae) in New South Wales and the influence of rainfall on its abundance. *Journal of the Australian Entomological Society* **32**: 241-248.

Knutson, L. (1978). Insect: Diptera (flies) bee lice. In *Honey bee pests: predators and diseases* (Morse RA Ed.) Cornell University Press, NY, 129-137.

Korst, P.J.A.M. and Velthius, H.H.W. (1982). The nature of trophallaxis in honeybees. *Insectes Sociaux* **29**: 209-221.

Kulincevic, J.M., Rinderer, T.E. and Miadjan, V.J. (1991). Effects of fluvalinate and amitraz on bee lice (*Braula coeca* Nitzsch) in honey bee (*Apis mellifera* L.) colonies in Yugoslavia. *Apidologie* **22**: 43-47.

Kwadha, C.A., Ong'amo, G.O., Ndegwa, P.N., Raina, S.K. and Fombong, A.T. (2017). The biology and control of the greater wax moth, *Galleria mellonella*. *Insects* **8**: 61.

Malfroy, S.F., Roberts, J.M.K., Perronbe, S., Maynard, G. and Chapman, N. (2016). A pest and disease survey of the isolated Norfolk Island honey bee (*Apis mellifera*) population. *Journal of Apicultural Research* **55**: 202-211.

Marcangeli, J., Eguaras, M., Oppedisano, M. and Fernandez, N. (1993). The Association between *Varroa jacobsoni* (Acari: Varroidae) and *Braula schmitzi* (Diptera: Braulidae) in the *Apis mellifera* (Hymenoptera: Apidae) colonies. *Apiacta* **28**: 65–68.

Marchiori, C.H. (2023). Families Braulidae and Streblidae (Insecta: Diptera) as ecoparasites of mammals. *International Journal of Frontiers in Science and Technology Research* **5**: 1-13.

Martin. S.J. and Bayfield, J. (2014). Is the bee louse *Braula coeca* (Diptera) using chemical camouflage to survive within honeybee colonies? *Chemoecology* **24**: 165-169.

Morse, R.A. (1987). The braulids. *American Bee Journal.* **127**: 429-431.

Neuman, P., Hoffman, D., Duncan, M. and Spooner-Hart, R. (2010). High and rapid infestation of isolated commercial honey bee colonies with small hive beetles in Australia. *Journal of Apicultural Research* **49**: 343-344.

Phillips, E.F. (1925). The bee-louse, *Braula coeca*, in the United States. United States Department of Agriculture, Department Circular 334. 11 pp.

Plant Health Australia. (2021). The National Plant Biosecurity Status Report 2020. Pp 277.

Queensland Government. (2025). First detection of *Varroa destructor* in Queensland. https://www.dpi.qld.gov.au/news-media/news/first-varroa-destructor-qld. Accessed 22 July 2025.

Roberts, J., Anderson, D. and Durr, P. (2015). Upgrading knowledge on pathogens (particularly viruses) of Australian honeybees. Rural Industries Research and Development Corporation. Publication No15/095. 23 pp.

Rossi, W., Maca, J. and Preisler, J. (2016). A new parasitic fungus on the cleptoparasite of bees *Braula coeca* (Insects, Diptera): *Dimeromyces braulae* (Ascomycota, Laboulbeniales). *Nova Hedwigia* **102**: 271-274.

Schlipalius, D. (2023). Beekeeping in Queensland: biosecurity threats and challenges. *The Australian Entomologist* **50**: 343-350.

Tarpy, D.R. (2024). Collective decision-making during reproduction in social insects: a conceptual model for queen supersedure in honey bees (*Apis mellifera*). *Current Opinion in Insect Science* **66**: 101260.

Taylor, M.A., Goodwin, M.R., McBrydie, H. M., Cox, H.M. and Dominiak, B.C. (2025). Relative effectiveness of methods that sample worker honey bees to estimate Varroa destructor populations in Aphis mellifera colonies.*Apidologie* **56**: 14.

Yusuf, A., Pirk, C. and Crewe, R. (2024). A hitchhikers's ride: the honey bee louse *Braula coeca* (Insects, Diptera) selects its host by eavesdropping. *Journal of Chemical Ecology* **50**: 214-221.