Veterinary Sciences • *Open Access* • Volume 9, Issue 5 • May 2022 • Article number 199

Document type
Review • *Gold Open Access* • *Green Open Access*

Source type
Journal

ISSN
23067381

DOI
10.3390/vetsci9050199

Publisher
MDPI

Original language
English

View less

Bee Stressors from an Immunological Perspective and Strategies to Improve Bee Health

El-Seedi, Hesham R.[a, b, c, d] ; Ahmed, Hanan R.[d] ; Abd El-Wahed, Aida A.[e] ; Saeed, Aamer[f] ; Algethami, Ahmed F.[g] ; Attia, Nour F.[h] ; Guo, Zhiming[i] ; Musharraf, Syed G.[j] ; Khatib, Alfi[k, l] ; Alsharif, Sultan M.[m] ; Al Naggar, Yahya[n, o] ; Khalifa, Shaden A. M.[p] ; Wang, Kai[q]

Hide additional authors Save all to author list

[a] Pharmacognosy Group, Department of Pharmaceutical Biosciences, Uppsala University, Biomedical Centre, P.O. Box 591, Uppsala, SE 751 24, Sweden

[b] International Research Center for Food Nutrition and Safety, Jiangsu University, Zhenjiang, 212013, China

[c] International Joint Research Laboratory of Intelligent Agriculture and Agri-Products Processing (Jiangsu University), Jiangsu Education Department, Nanjing, 210024, China

[d] Department of Chemistry, Faculty of Science, Menoufia University, Shebin El-Kom, 32512, Egypt

[e] Department of Bee Research, Plant Protection Research Institute, Agricultural Research Centre, Giza, 12627, Egypt

[f] Department of Chemistry, Quaid-I-Azam University, Islamabad, 45320, Pakistan

[g] Al nahal al jwal Foundation Saudi Arabia, P.O. Box 617, Al Jumum, Makkah, 21926, Saudi Arabia

[h] Chemistry Division, National Institute of Standards, 136, Giza, 12211, Egypt

[i] School of Food and Biological Engineering, Jiangsu University, Zhenjiang, 212013, China

[j] H.E.J. Research Institute of Chemistry, International Center for Chemical and Biological Sciences, University of Karachi, Karachi, 75270, Pakistan

[k] Department of Pharmaceutical Chemistry, Kulliyyah of Pharmacy, International Islamic Univetsity Malaysia, Kuantan, 25200, Malaysia

[l] Faculty of Pharmacy, Universitas Airlangga, Surabaya, 60155, Indonesia

[m] Biology Department, Faculty of Science, Taibah University, Al Madinah, 887, Saudi Arabia

[n] Zoology Department, Faculty of Science, Tanta University, Tanta, 31527, Egypt

[o] General Zoology, Institute for Biology, Martin Luther University Halle-Wittenberg, Hoher Weg 8, Halle, 06120, Germany

[p] Department of Molecular Biosciences, The Wenner-Gren Institute, Stockholm University, Stockholm, SE 106 91, Sweden

[q] Institute of Apicultural Research, Chinese Academy of Agricultural Sciences, Beijing, 100093, China

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Abstract

Honeybees are the most prevalent insect pollinator species; they pollinate a wide range of crops. Colony collapse disorder (CCD), which is caused by a variety of biotic and abiotic factors, incurs high economic/ecological loss. Despite extensive research to identify and study the various ecological stressors such as microbial infections, exposure to pesticides, loss of habitat, and improper beekeeping practices that are claimed to cause these declines, the deep understanding of the observed losses of these important insects is still missing. Honeybees have an innate immune system, which includes physical barriers and cellular and humeral responses to defend against pathogens and parasites. Exposure to various stressors may affect this system and the health of individual bees and colonies. This review summarizes and discusses the composition of the honeybee immune system and the consequences of exposure to stressors, individually or in combinations, on honeybee immune competence. In addition, we discuss the relationship between bee nutrition and immunity. Nutrition and phytochemicals were highlighted as the factors with a high impact on honeybee immunity. © 2022 by the authors. Licensee MDPI, Basel, Switzerland.

Author keywords

agrochemicals; ecological stressors; honeybees; immunity; nutrition; sustainable beekeeping

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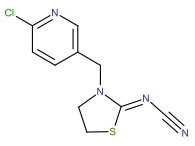
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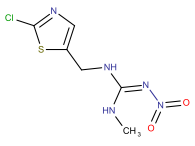
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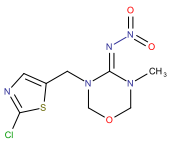
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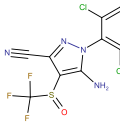
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Indexed keywords

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Funding details

Funding sponsor	Funding number	Acronym
National Natural Science Foundation of China	32172791	NSFC

See opportunities by NSFC

Funding text 1
This work was supported by National Natural Science Foundation of China (32172791).

Funding text 2
Acknowledgments: Kai Wang also gratefully acknowledged the financial support from the National Natural Science Foundation of China. #Dedicated with great pleasure and honor to Rob Verpoorte, Leiden University, Netherland on the occasion of his 75th birthday.

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El-Seedi, H.R.; Pharmacognosy Group, Department of Pharmaceutical Biosciences, Uppsala University, Biomedical Centre, P.O. Box 591, Uppsala, Sweden; email:hesham.el-seedi@farmbio.uu.se

Wang, K.; Institute of Apicultural Research, Chinese Academy of Agricultural Sciences, Beijing, China; email:kaiwang628@gmail.com

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