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Neonicotinoid Insecticides and Bees

An Annotated Bibliography

Complied by Olivia Sproviero, Julia Masterman, and Samantha Morton

Table of Contents

Rank By 2016 Journal Impact Factor

I. Nature

Impact Factor: 2016: 40.137 || 5 year: 43.769

Journal Rank: 1 out of 64 in "Multidisciplinary Sciences" Category (Journal Citation Reports)

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On The Use of Neonicotinoid in Agricultural Products:

XXXI. Environmental Science and Technology

Impact Factor: 2016: 6.198 || 5 year: 6.96

Journal Rank: 7 of 93 in the "Entomology" category (Journal Citation Reports)

A. 2015 Douglas

1. Large-Scale Deployment of Seed Treatments Has Driven Rapid Increase in Use of Neonicotinoid Insecticides and Preemptive Pest Management in US Field Crops
   a) This study synthesized publicly available data to estimate and interpret trends in neonicotinoid use since their introduction in 1994, with a special focus on seed treatments. Findings revealed that neonicotinoid use increased rapidly between 2003 and 2011, as seed-applied products. 34-44% of soybeans and 79-100% of maize hectares were treated in 2011. This finding contradicts recent analyses, which concluded that insecticides are used today on fewer maize hectares than a decade or two ago. Suggests that carefully targeted efforts could considerably reduce neonicotinoid use in field crops without yield declines or economic harm to farmers.
      - 49 Times Cited (Web of Science)

XXXII. Nature

Impact Factor: 2016: 40.137 || 5 year: 43.769

Journal Rank: 1 out of 64 in "Multidisciplinary Sciences" Category (Journal Citation Reports)

https://jcr-incites-thomsonreuters-com.ezproxy.bu.edu/JCRJournalHomeAction.action

A. 2015 Kessler

1. Bees prefer foods containing neonicotinoid pesticides

a) A study challenging the argument that reported negative effects of neonicotinoids on bees can choose to forage on other available flowers and hence avoid or dilute exposure. The study found that the honeybee, *Apis mellifera*, and the buff-tailed bumblebee, *Bombus terrestris*, do not avoid concentrations of three of the most commonly used neonicotinoids, imidacloprid (IMD), thiamethoxam (TMX), and clothianidin (CLO), in food. Furthermore, bees of both species prefer to eat more of sucrose solutions laced with IMD or TMX than sucrose alone.
    - Cited 69 Times (Web of Science)

On Neonicotinoids Effects on Overall Ecosystem Functioning:

XXXIII. Environmental Science and Pollution Research
Impact Factor: 2016: 2.741 || 5 year: 3.023
Journal Rank: 79 of 229 in the "Environmental Sciences" category (Journal Citation Reports)

A. 2015 Simon-Delso (Meta-analysis)
    1. Systemic insecticides (neonicotinoids and fipronil): trends, uses, mode of action and metabolites
        a) A review of the global literature exploring the risks and growing body of evidence that persistent, low concentrations of phenyl-pyrazole fipronil and neonicotinoids pose serious risks of undesirable environmental impacts.
            - Cited 117 Times (Web of Science)

XXXIV. Environmental Science and Pollution Research
Impact Factor: 2016: 2.741 || 5 year: 3.023
Journal Rank: 79 of 229 in the "Environmental Sciences" category (Journal Citation Reports)

A. 2015 Pisa (Meta-analysis)
    1. Effects of neonicotinoids and fipronil on non-target invertebrates
        a) Assesses the state of knowledge regarding the effects of large-scale pollution with neonicotinoid insecticides and fipronil on non-target invertebrate species of terrestrial, freshwater and marine environments. A large section of the assessment is dedicated to the state of knowledge on sublethal effects on honeybees (Apis mellifera).
            - Cited 114 Times (Web of Science)

B. 2015 Gibbons (Meta-analysis)
    1. A review of the direct and indirect effects of neonicotinoids and fipronil on vertebrate wildlife
        a) A review of 150 studies of neonicotinoids direct (toxic) and indirect (e.g. food chain) effects on vertebrate wildlife—mammals, birds, fish, amphibians and reptiles. We focus on two neonicotinoids, imidacloprid and clothianidin, and a third insecticide, fipronil, which also acts in the same systemic manner. All three insecticides exert sub-lethal effects,

ranging from genotoxic and cytotoxic effects, and impaired immune function, to reduced growth and reproductive success, often at concentrations well below those associated with mortality.
    - Cited 65 Times (Web of Science)

2. 2015 Chagnon (Meta-analysis)
    a) Risks of large-scale use of systemic insecticides to ecosystem functioning and services
        - A review of the state of knowledge regarding the potential impacts of neonicotinoid and fipronil on ecosystem functioning and services provided by terrestrial and aquatic ecosystems including soil and freshwater functions, fisheries, biological pest control, and pollination services. Highlights the economic and cultural concerns around agriculture and aquaculture production and the role these insecticides may have in threatening food security.
            (a) Cited 55 Times

XXXV. Nature

Impact Factor: 2016: 40.137 || 5 year: 43.769

Journal Rank: 1 out of 64 in "Multidisciplinary Sciences" Category (Journal Citation Reports)

A. 2014 Hallmann

1. Declines in insectivorous birds are associated with high neonicotinoid concentrations
    a) Investigates the hypothesis that the most widely used neonicotinoid insecticide, imidacloprid, has a negative impact on insectivorous bird populations. In the Netherlands, local population trends were significantly more negative in areas with higher surface-water concentrations of imidacloprid.
        - Cited 127 Times (Web of Science)

On Neonicotinoid Effects on Impaired Disease Resistance:

XXXVI. Journal of Insect Physiology

Impact Factor: 2016: 2.227 || 5 year: 2.556

Journal Rank: 12 of 93 in the "Entomology" category (Journal Citation Reports)

A. 2016 Brandt

1. The neonicotinoids thiacloprid, imidacloprid, and clothianidin affect the immunocompetence of honey bees (Apis mellifera L.)
    a) This laboratory experiment investigates the sublethal effects of the neonicotinoids thiacloprid, imidacloprid, and clothianidin on individual immunity, by studying three major aspects of immunocompetence in worker bees: total hemocyte number, encapsulation response, and antimicrobial activity of the hemolymph. It was found that Thiacloprid

and imidacloprid reduced all three aspects at field realistic concentrations. Results suggest that neonicotinoids affect the individual immunocompetence of honey bees, possibly leading to impaired disease resistance.

- 35 Times Cited (Web of Science)

XXXVII. PNAS

Impact Factor: 2016: 9.661 || 5 year: 10.414

Journal Rank: 4 of 64 in the "Multidisciplinary Sciences" category (Journal Citation Reports)

A. 2013 Prisco

1. Neonicotinoid clothianidin adversely affects insect immunity and promotes replication of a viral pathogen in honey bees

a) Demonstrates that the neonicotinoid insecticide clothianidin negatively modulates NF-kappa B immune signaling in insects and adversely affects honey bee antiviral defenses controlled by this transcription factor. Gives evidence that exposure to clothianidin, by enhancing the transcription of the gene encoding this inhibitor, reduces immune defenses and promotes the replication of the deformed wing virus in honey bees bearing covert infections.

- Cited 148 Times (Web of Science)

On Neonicotinoid Effects on Bee Cognitive Functioning and Colony Collapse:

XXXVIII. Nature Communications

Impact Factor: 2016: 12.124 || 5 year: 13.092

Journal Rank: 3 of 64 in "Multidisciplinary Sciences" Category (Journal Citation Reports)

A. 2013 Palmer

1. Cholinergic pesticides cause mushroom body neuronal inactivation in honeybees

a) Studies the effects of pesticides that target cholinergic neurotransmission and their effects on insect pollinator population decline. Uses recordings from mushroom body Kenyon cells within the honeybee brain, to show that the neonicotinoids imidacloprid and clothianidin, and the organophosphate miticide coumaphos oxon, cause a depolarization-block of neuronal firing and inhibit nicotinic responses. The study's neuronal mechanism may account for the cognitive impairments caused by neonicotinoids. It predicts that exposure to multiple pesticides that target cholinergic signalling will cause enhanced toxicity to pollinators.

- Cited 66 Times (Web of Science)

XXXIX. Science

Impact Factor: 2016: 37.205 || 5 year: 38.062

Journal Rank: 2 of 64 in "Multidisciplinary Sciences" Category (Journal Citation Reports)

A. 2012 Henry

1. A Common Pesticide Decreases Foraging Success and Survival in Honey Bees

a) This study simulated exposure events on free-ranging foragers labeled with radio-frequency identification tags. Findings support the theory that nonlethal exposure of honey bees to thiamethoxam (neonicotinoid systemic pesticide) causes high mortality due to homing failure at levels that puts bee colonies at risk of collapse.
    - Cited 401 Times (Web of Science)

B. 2012 Whitehorn
1. Neonicotinoid Pesticide Reduces Bumble Bee Colony Growth and Queen Production
    a) This laboratory experiment exposed colonies of the bumblebee *Bombus terrestris* under field-realistic levels of the neonicotinoid imidacloprid, then allowed the bees to develop naturally under field conditions. Treated colonies had a significantly reduced growth rate and suffered an 85% reduction in production of new queens compared with control colonies.
        - Cited 358 Times (web of science)

XL. Nature

Impact Factor: 2016: 40.137 || 5 year: 43.769

Journal Rank: 1 out of 64 in "Multidisciplinary Sciences" Category (Journal Citation Reports)

A. 2012 Gill
1. Combined pesticide exposure severely affects individual- and colony-level traits in bees
    a) Studies the combinatorial effects of agricultural intensification, in which bees are exposed to numerous pesticides when foraging. The study found that (1) chronic exposure of bumblebees to two pesticides (neonicotinoid and pyrethroid) at concentrations that could approximate field-level exposure impairs natural foraging behaviour and increases worker mortality (2) worker foraging performance was significantly reduced (3) combinatorial exposure to pesticides increases the propensity of colonies to fail.
        - Cited 255 TImes (Web of Science)

B. 2015 Rundolf (Letters)
1. Seed coating with a neonicotinoid insecticide negatively affects wild bees
    a) Studied how neonicotinoids influence bees, and wild bees in particular, in real-world agricultural landscapes in Sweden. It was found, under field conditions, that seed coating with Elado, an insecticide containing neonicotinoid clothianidin and the non-systemic pyrethroid beta-cyfluthrin, applied to oilseed rape seeds, reduced wild bee density, solitary bee nesting, and bumblebee colony growth and reproduction.
        - Cited 150 Times (Web of Science)

C. 2015 Stanley (Letters)
1. Neonicotinoid pesticide exposure impairs crop pollination services provided by bumblebees

a) Evidence supporting the theory that pesticide exposure can reduce the pollination services bumblebees deliver to apples, a crop of global economic importance. Bumblebee colonies exposed to a neonicotinoid pesticide provided lower visitation rates to apple trees and collected pollen less often. These findings show that pesticide exposure can impair the ability of bees to provide pollination services, with implications for the sustained delivery of stable crop yields.
    - Cited 32 Times (Web of Science)

D. 2013 Cressey (News in Focus)
1. Bee studies stir up pesticide debate
    a) A review of the study "Seed coating with a neonicotinoid insecticide negatively affects wild bees" (2015 Rundolf) in Sweden which monitored how bees respond to neonicotinoids in the wild.
        - Cited 6 Times (Web of Science)

XLI. Nature Communications
Impact Factor: 2016: 12.124 || 5 year: 13.092
Journal Rank: 3 of 64 in "Multidisciplinary Sciences" Category (Journal Citation Reports)

A. 2016 Woodcock
1. Impacts of neonicotinoid use on long-term population changes in wild bees in England
    a) Used a multi-species dynamic Bayesian occupancy analysis, to find evidence of increased population extinction rates in response to neonicotinoid treatment use on oilseed rape. It was found that species foraging on oilseed rape were on average three times more negatively affected by exposure to neonicotinoids than non-crop foragers. Results suggest that sub-lethal effects of neonicotinoids could scale up to cause losses of bee biodiversity.
        - Cited 25 Times (Web of Science)

XLII. Proceedings of the Royal Society B
Impact Factor: 2016: 4.8 || 5 year: 5.417
Journal Rank: 9th of 85 in the "Biology" category (Journal Citation Reports)

A. 2015 Godfray (Meta-analysis)
1. A restatement of the natural science evidence base concerning neonicotinoid insecticides and insect pollinators
    a) This project summarizes the natural science evidence base relevant to neonicotinoid insecticides and insect pollinators in policy-neutral terms. A series of evidence statements are listed and categorized according to the nature of the underlying information. The evidence summary forms the appendix to the paper and an annotated bibliography is provided.
        - Cited 98 Times (Web of Science)