The Wildlife Trusts Position Statement
Neonicotinoid insecticides

TWT position

The Wildlife Trusts are calling for an outright ban on the use of all neonicotinoid insecticides. There is a growing body of evidence to show that neonicotinoids have a detrimental effect at sub-lethal doses on insect pollinators; pose a serious risk of harm to a wide range of beneficial invertebrate species in soil, vegetation, aquatic and marine habitats; and pose a severe risk to the wider environment and delivery of essential ecosystem services.

For these reasons, The Wildlife Trusts believe that the continued use of neonicotinoids in the UK represents an unacceptable risk to insect pollinator populations and ecosystem health. We urge the Government to retract its opposition to the EU ban, recognise the scale of the risks posed by the continued use of neonicotinoids and place a permanent moratorium on the use of all neonicotinoid insecticides.

Key points

- Neonicotinoids, which are used as an insecticide on crops such as oil-seed rape, are harmful to a wide range of invertebrates, including pollinators such as honey bees and bumblebees;

- Pollination is a vital ecosystem service that maintains biodiversity and sustains agricultural crop yields. It is estimated that a collapse in pollinators would cost the UK economy *c*. £1.8 billion per year[1].

- We could see a collapse in ecosystems across the agricultural landscape and beyond if pollinators become scarce;

- The risk of environmental contamination is high and the impacts of neonicotinoid pollution have already been documented in the Netherlands, where high levels of imidacloprid pollution have been linked to declines in insectivorous farmland birds[2].

[1] UK National Ecosystem Assessment (2011) UNEP-WCMC, Cambridge.

[2] Caspar *et al.* (2014) Declines in insectivorous birds are associated with high neonicotinoid concentrations. Nature 511:341-343

Background information

1. Since the introduction of neonicotinoids in 1991, there has been growing concern that they could be harmful to insect pollinators (and other invertebrates) at sub-lethal doses. Neonicotinoids have been cited as a contributory factor in Colony Collapse Disorder and have been shown to chronically impair bee foraging behaviour[3].

2. Most plant communities in the UK rely on pollinating insects to reproduce and therefore spread (apart from wind-pollinated species, such as grasses). Insect pollinators also form a vital part of the food chain for other species, including birds, reptiles and amphibians. It follows that any insecticide that drastically reduces pollinator numbers will have effects beyond the agricultural sector and will ultimately affect the health and function of entire ecosystems.

3. The registration documents/fact sheets for the individual neonicotinoids state that they are toxic or highly toxic to bees, either acutely or chronically via pollen and nectar[4]. However, the manufacturers of the insecticides claim that neonicotinoids do not cause direct bee mortality at small doses.

4. The European Food Safety Authority's risk assessment of three neonicotinoids (clothianidin, imidacloprid and thiametoxam) resulted in the European Commission introducing a two-year ban of their use on crops attractive to bees in December 2013, despite opposition from the UK Government. Defra is of the view that the body of evidence assessed so far supports the conclusion that neonicotinoids do not threaten honey bee populations if properly used.

5. Neonicotinoids are still widely used in the UK, since the EU moratorium only covers the use of three neonicotinoids on certain crops, and the UK does not currently monitor neonicotinoid pollution.

What are neonicotinoids?

6. Neonicotinoids are a relatively new group of systemic insecticides routinely used in modern farming systems to help protect crops such as oilseed rape, maize, sugarbeet, sunflowers and potatoes from sap sucking insects such as aphids and other insect herbivores.

7. There are a variety of neonicotinoid compounds, all nicotine-based , which include imidacloprid, clothianidin, acetamiprid, thiacloprid, thiamethoxam, dinotefuran and nitenpyram.

8. Neonicotinoids are usually applied as a seed dressing or soil treatment. They are taken up in the sap as the plant grows and transported to roots, stems, leaves and flowers, so that insect herbivores such as aphids will die after consuming treated crops.

9. In the UK, five neonicotinoids are registered for use: imidacloprid, clothianidin, acetamiprid, thiacloprid and thiamethoxam. They are used mainly for treatment of oilseed rape, cereals and potatoes.

[3] Gill & Raine (2014) Chronic impairment of bumblebee natural foraging behaviour induced by sublethal pesticide exposure. Functional Ecology doi: 10.1111/1365-2435.12292

[4] See www.npic.orst.edu/factsheets/imidacloprid.pdf; www.epa.gov/opp00001/about/intheworks/clothianidin-registration-status.html

How do they work?

10. Neonicotinoids are neurotoxic and act on the insect's nervous system, binding with nerve receptors and resulting in paralysis and death.

11. More specifically, the active chemical has an affinity for nicotinic acetylcholine receptors which are important neurotransmitter[5] receptors. This particular neural pathway is more abundant in insects than in mammals and birds, making the chemical particularly toxic to insects.

12. However, research has shown that neonicotinoids *do* act on mammalian pathways[6,7] and could damage human health[8]. Sub-lethal impacts of concern have been noted across a range of vertebrate species, including birds, and the risk of harm occurs at field exposure levels (ie. the amounts used in agriculture) and lower.[9]

Impacts on pollinating insects

13. The effects of exposure to neonicotinoids range from instant and lethal to chronic; even long term exposure at low (non-lethal) levels can be harmful.[9]

14. In the case of acute effects alone, some neonicotinoids are at least 5,000 to 10,000 times more toxic to bees than DDT.[9]

15. In bees, field-realistic concentrations adversely affect individual navigation, learning, food collection, longevity, resistance to disease and fecundity.[9]

16. For bumblebees, irrefutable colony-level effects have been found, with exposed colonies growing more slowly and producing significantly fewer queens.[9]

17. Field studies with free-flying bee colonies have proved difficult to perform, because control colonies invariably become contaminated with neonicotinoids, a clear demonstration of their pervasive presence in the environment.[9]

18. Neonicotinoids contaminate the crop's pollen and nectar sources, so all insects feeding on nectar, including pollinators such as honey bees, bumble bees, hoverflies and butterflies, are exposed to a small dose of the toxin when the crop is in flower.

19. Neonicotinoids bind irreversibly and cause permanent, cumulative damage. This means that prolonged exposure to low (non-lethal) doses will produce toxic effects over time[10,11] and there is a growing body of evidence, using field-realistic dosages of the insecticide [12,13,14] to show

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[5] Neurotransmitters are endogenous chemicals that transmit signals from a neuron to a target cell across a synapse
[6] Duzguner V, Edogaan S (2010) Acute oxidant and inflammatory effects of *imidacloprid* on the mammalian central nervous system and liver in rats. Pest. Biochem. Physiol 97, 13-18
[7] Kimura-Kuroda J *et al.* (2011) Nicotine-like effects of neonicotinoids on rat cerebellar neurons. Neuroscience Research 71, suppl.
[8] Calderon-Segura ME *et al.* (2012) Evaluation of genotoxic and cytotoxic effects in human peripheral blood lymphocytes exposed *in vitro* to neonicotinoid insecticides. Journal of Toxicology Volume 2012, Article ID 612647
[9] Task Force for Systemic Pesticides http://www.tfsp.info/
[10] Tennekes HA, Sanchez-Bayo F(2011) Time-Dependent Toxicity of Neonicotinoids and Other Toxicants: Implications for a New Approach to Risk Assessment. J Environment Analytic Toxicol S4:001
[11] Tennekes HA (2010) The significance of the Druckrey-Kupfmuller equation for risk assessment – the toxicity of neonicotinoid insecticides to arthropods is reinforced by exposure time. Toxicology 276, 1-4
[12] Henry et al (2012) *A Common Pesticide Decreases Foraging Success and Survival in Honey Bees.* Science Vol 336 :348-350
[13] Penelope R. Whitehorn et al.(2012) *Neonicotinoid Pesticide Reduces Bumble Bee Colony Growth and Queen Production.* , Science Vol 336: 351 - 352
[14] Gill & Raine (2014) Chronic impairment of bumblebee natural foraging behaviour induced by sublethal pesticide exposure. Functional Ecology doi: 10.1111/1365-2435.12292

that 'sub-lethal' doses affect the survival of honey bees and bumble bees by interfering with foraging behaviour and foraging efficiency.

20. Researchers at Stirling University exposed colonies of bumble bees to miniscule doses of imidacloprid. They found that treated colonies had a significantly reduced growth rate and suffered an 85% reduction in production of new queens compared with control colonies. They conclude that '*there is an urgent need to develop alternatives to the widespread use of neonicotinoid pesticides on flowering crops wherever possible*.'[15]

21. In February 2015 a study by independent scientists at the University of Dundee found evidence that neonicotinoids at levels normally used in farming affected bumblebees' ability to forage, concluding that '*our research demonstrates beyond doubt that the level of neonicotinoids generally accepted as the average level present in the wild causes brain dysfunction and colonies to perform poorly when consumed by bumblebees.'*

Colony Collapse Disorder (CCD)

22. CCD is a recent, widespread phenomenon affecting honey bee colonies in the Northern hemisphere. It is characterized by a sudden disappearance of honey bees from the hive. The syndrome is mysterious in that there are often no corpses found, and although there are often many disease organisms present, no outward signs of disease, pests, or parasites exist.[16] Multiple causes of CCD have been proposed, such as combinations of pesticides, pathogens, parasites and natural habitat degradation.

23. In some European countries, increasing concern about the connection between CCD and neonicotinoids has led to a partial or full ban of some neonicotinoids. As early as 1994, French beekeepers noticed that over the course of a few days, after sunflowers had bloomed, a substantial number of their hives would collapse because the worker bees flew off and never returned, leaving the queen and immature workers to starve. French beekeepers believed the root cause was the new insecticide Gaucho®, an imidacloprid-based neonicotinoid which was being applied to sunflowers for the first time. It took French beekeepers nearly 10 years to secure a ban of imidacloprid in France for use on sunflowers and maize. Other European countries that have a partial or full ban of some of neonicotinoid products include Germany, Italy and Slovenia.

Wider environmental impacts

24. In June 2014, the Task Force on Systemic Pesticides published the largest global study into the effects and risks of systemic pesticides, including neonicotinoids. Having studied over 1,000 peer reviewed papers, the Task Force concluded that:

- Neonicotinoids impact all species that chew a plant, sip its sap, drink its nectar, eat its pollen or fruit and these impacts cascade through an ecosystem, weakening its stability.
- The combination of persistence (over months or years) and solubility in water has led to large scale contamination of, and the potential for accumulation in, soils and sediments, ground and surface water and treated and non-treated vegetation.

[15] Whitehorn *et al*.(2012) Neonicotinoid Pesticide Reduces Bumble Bee Colony Growth and Queen Production. , Science Vol 336: 351 - 352

[16] Oldroyd BP (2007) What's Killing American Honey Bees? PLoS Biol 5(6): e168. doi:10.1371/journal.pbio.0050168

- In addition to contaminating non-target species through direct exposure (e.g. insects consuming nectar from treated plants), the chemicals are also found in varying concentrations outside treated areas. They run off into surrounding soil and aquatic habitats easily. This polluted water, along with the dust created during the drilling of treated seeds, can contaminate wild plants growing in agricultural field margins and hedgerows providing the potential for major impacts on a broad range of non-target herbivorous invertebrates living in or near farmland.
- This provides multiple routes for chronic and acute exposure of non-target species. Organisms inhabiting farmland are being chronically exposed and so are aquatic organisms living downstream of farmland, including inhabitants of riparian zones, estuarine and coastal marine systems.
- The large scale bioavailability of these insecticides in the global environment at levels that are known to cause lethal and sub-lethal effects on a wide range of terrestrial, aquatic and soil beneficial microorganisms, invertebrates and vertebrates, poses risks to ecosystem functioning and services provided by terrestrial and aquatic ecosystems including soil and freshwater functions such as litter break down and nutrient cycling, food production, biological pest control, and pollination services.

25. Neonicotinoids have been detected in soil sampled from unplanted fields and in dandelions (another favourite pollen source) growing near treated fields. Contamination routes could include air-borne deposition or movement of insecticide through the soil (neonicotinoids are highly soluble and take a long time to break down, so are termed 'persistent'.)[17]

26. Major contamination of Dutch surface water with imidacloprid has been linked to declines in invertebrate-dependent bird species[18].

27. Data from the Netherlands has linked neonicotinoid pollution to the decline of farmland birds[19]. The species most affected were starlings, tree sparrows and swallows, which all feed on insects. Water pollution levels of just 20 nanograms of imidacloprid per litre led to a 30% fall in bird numbers over ten years – and some water had contamination levels 50 times higher than this.

Defra's National Pollinator Strategy (NPS)

28. Defra published the NPS[20] in November 2014, alongside a set of five simple actions that people can take to help meet "Bees' Needs," which are hosted on The Wildlife Trusts' website.[21]

29. The Wildlife Trusts welcomed the Strategy as a positive first step but were concerned that its recommendations would need to be strengthened significantly in order to deliver real gains for wild pollinators.

30. Regarding neonicotinoids, the NPS recommends further research in order to:
    - determine the effects of neonicotinoids on populations of wild and managed pollinators in field conditions;

[17] Krupke CH, Hunt GJ, Eitzer BD, Andino G, Given K (2012) Multiple Routes of Pesticide Exposure for Honey Bees Living Near Agricultural Fields. PLoS ONE 7(1): e29268. doi:10.1371/journal.pone.0029268
[18] Tennekes HA (2010) The systemic insecticides: a disaster in the making
[19] Caspar *et al.* (2014) Declines in insectivorous birds are associated with high neonicotinoid concentrations. Nature 511:341-343
[20] Defra https://www.gov.uk/government/publications/national-pollinator-strategy-for-bees-and-other-pollinators-in-england
[21] wildlifetrusts.org/Bees-needs

- assess the impact of the restrictions on neonicotinoids on farmers' decisions on cropping, pesticide use and other management changes.

31. Joan Walley MP, Chair of the Environmental Audit Committee, expressed disappointment that '*the Government seems stubbornly determined to keep open the possibility of challenging the EU ban on the neonicotinoid pesticides that have been linked to pollinator declines. They are right to propose more research aimed at developing further field-trial data, but I believe Defra should acknowledge that the balance of evidence available from lab tests and other field-trials already clearly demonstrates the need for the ban [based] on the precautionary principle.'*

The Wildlife Trusts
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