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MEDIA BRIEFING NOTES

WORLDWIDE INTEGRATED ASSESSMENT ON SYSTEMIC PESTICIDES

Concern about the impact of systemic pesticides on a variety of beneficial species has been growing over the last 20 years. While attention has mainly focused on the economically important honey bee, scientists and others have also registered growing alarm about the decline in many other insect species.

The main focus of this concern has been the group of chemicals called neonicotinoids (neonics), which were introduced as pesticides to agriculture in the 1990s and have now become widespread. Although a few restrictions have been put in place, for example, by the European Commission on behalf of EU member states,, governments have wavered over whether the science is conclusive enough to indicate action.

The *Worldwide Integrated Assessment* (WIA) undertaken by the *Task Force on Systemic Pesticides* set out to provide a comprehensive, independent analysis of these chemicals and their impact on ecosystems and biodiversity, in order to inform appropriate action in the future.

The findings will be published in the peer-reviewed Journal *Environmental Science and Pollution Research* in Summer 2014.

WIA

This is the first meta-analysis to be undertaken on two groups of systemic insecticides, neonics and fipronil, and the first time that all the relevant information from studies all over the world has been pulled together in one place.

Some aspects of this analysis have been broadly acknowledged before (e.g. risks to honeybees), but some have not (e.g. risks to birds, earthworms, other pollinators and aquatic invertebrates).

Individual studies have focussed on impacts on particular organisms, habitats or locations (e.g. bees in France, waterways in the Netherlands, birds in the US) and relatively few have specifically focused on biodiversity and ecosystem impacts, so this analysis moves our understanding forward in a much more holistic and extensive way.

Where the available data enable this, the analysis extends consideration of the risks beyond individual species and groups, to whole communities and ecosystem processes.

Undertaken by 29 independent scientists from numerous disciplines, the WIA considered over 800 peer-reviewed publications.

KEY FINDINGS

Harm

- Neonics persist – particularly in soil – for months and in some cases years and accumulate. This effectively increases their toxicity by increasing the duration of exposure of non-target species.

- The metabolities of neonics (the compounds which they break down into) are often as or more toxic that the active ingredients.

- The classic measurements used to assess the toxicity of a pesticide (short-term lab toxicity results) are not effective for systemic pesticides and conceal their true impact. They typically only measure direct acute effects rather than chronic effects via multiple routes of exposure. In the case of acute effects alone, some neonics are at least 5,000 to 10,000 times more toxic to bees than DDT.

- The effects of exposure to neonics range from instant and lethal to chronic. Even long term exposure at low (non-lethal) levels can be harmful. They are nerve poisons and the chronic damage caused can include: impaired sense of smell or memory; reduced fecundity; altered feeding behaviour and reduced food intake including reduced foraging in bees; altered tunneling behaviour in earthworms; difficulty in flight and increased susceptibility to disease.

Ecosystems

- Neonics 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.

- 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.

Species

- Neonics and fipronil have impacts that extend far beyond the intended crop, plant and pest species.

- They are causing significant damage and pose a series risk of harm to a wide range of beneficial invertebrate species in soil, vegetation, aquatic and marine habitats and are affecting ecosystem services as a result.

- There is a lack of research into the impact on vertebrate species though the assessment revealed sub-lethal impacts of concern across a range of species including birds.

- The risk of harm occurs at field exposure levels (i.e. the amounts used in agriculture) and lower.

- It is clear that present day levels of pollution with neonics resulting from authorized uses, frequently exceed 'lowest observed adverse effect concentrations' for a wide range of non-target species and are thus likely to have large scale and wide ranging negative biological and ecological impacts.

- The evidence is also clear that neonics pose a serious risk of harm to honey bees and other pollinators.

- In bees, field-realistic concentrations adversely affect individual navigation, learning, food collection, longevity, resistance to disease and fecundity. For bumblebees, irrefutable colony-level effects have been found, with exposed colonies growing more slowly and producing significantly fewer queens. 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.

The most affected groups of species are:

Terrestrial invertebrates

Terrestrial invertebrates such as earthworms are exposed to potential contamination via all four routes (air, water, soil, plants) with:

- high exposure through soil and plants
- medium exposure through surface water and leaching
- low exposure via air (dusts)

The assessment found that both individuals and populations can be adversely affected by low or acute (i.e. ongoing) exposure making them highly vulnerable at field realistic

concentrations – i.e., the concentrations which can be found in agriculture. These effects range from behaviour modification such as feeding inhibitions to mortality.

These species provide a myriad of ecosystem services, including the regulation and cycling of nutrients, carbon storage, and support for plant growth and are dependent on the diverse and complex biological communities that are present in soils.

Insect pollinators

Insect pollinators such as bees and butterflies are exposed to contamination through all four routes with:

- high exposure through air and plants
- medium exposure through water.

The assessment found that both individuals and populations can be adversely affected by low or acute exposure making them highly vulnerable.

Pollinators exposed to contaminated pollen, nectar and water are harmed at field realistic concentrations.

Aquatic Invertebrates

The next most affected group are aquatic invertebrates such as freshwater snails and water fleas which are exposed via water and potentially plants, are vulnerable to low and acute exposure and which can be affected at the individual, population and community levels.

The moderate to high water solubility of neonicotinoids enables them to contaminate both surface and groundwater and hence leach into waterways, where high concentrations have depleted aquatic insect abundance and diversity.

The impacts identified on this group are reduced feeding behaviour, impaired growth and mobility.

Birds

Birds are the next most vulnerable with low and medium exposure via all four routes and affected at medium levels of exposure for both individuals and populations.

Others

Fish, amphibians and microbes were all found to be affected after high levels or prolonged exposure. Samples taken in water from around the world, have been found to exceed ecotoxicological limits on a regular basis.

There are insufficient data to assess whether or not there is an impact on mammals or reptiles but in the case of the latter, the researchers concluded that it was probable.

Gaps

- Almost as concerning as what is known about neonics, is what is not. There is little information about the quantities of systemic pesticides being applied, nor is there much screening of concentrations of neonics in the environment. Where screening has been carried out neonics and fipronil are often detected.

- Toxicity to most organisms has not been investigated. E.g. toxicity tests have only been carried out on four of the approximately 25,000 known species of bee, and there have been hardly any studies of toxicity to other pollinator groups such as hoverflies or butterflies.

- Toxicity to vertebrates (such as granivorous mammals and birds which are likely to consume dressed seeds) has only been examined in a handful of species.

- Sub-lethal effects have not been studied in most organisms, yet they are known to be profound in bees, and for those few other species where studies have been done, sub-lethal doses of these neurotoxic chemicals have been reported to have (mostly) adverse impacts on behaviour at doses well below those that cause death.

Conclusions

- The present scale of use of neonics is not sustainable.

- Their continued use can only accelerate the global decline of important invertebrates and, as a result, risk reductions in the level, diversity, security and stability of ecosystem services.

- The findings of the WIA demonstrate that the current extensive use of this group of persistent highly toxic chemicals is affecting global biodiversity:

  By exerting widespread and chronic exposure to non-target organisms at individual as well as population level;

  Through the impacts of this exposure, affecting the essential ecosystem services and functions these organisms provide.

- The large scale, prophylactic use of broad-spectrum systemic insecticides must be reconsidered.

- The authors strongly suggest that regulatory agencies apply more precautionary principles and further tighten regulations on neonicotinoids and fipronil and start planning for a global phase-out or at least start formulating plans for a strong reduction of the global scale of use.

BACKGROUND

Neonicotinoid/fipronil Pesticides

Neonicotinoids are a class of neuro-active, nicotine-based insecticides which were developed in 1991 and brought into commercial use in the mid-1990s. Fipronil is also neuro-active and was developed at the same time.

Unlike other pesticides, which remain on the surface of the treated foliage, systemic pesticides, including neonicotinoids and fipronil, are taken up by the plant and transported to all the tissues (leaves, flowers, roots and stems, as well as pollen and nectar). Products containing neonicotinoids/fipronil can be applied at the root (as seed coating or soil drench) or sprayed onto crop foliage. The insecticide toxin remains

active in the soil or plant for many months (or years), protecting the crop season-long.

Neonicotinoids/fipronil act on the information processing abilities of invertebrates, affecting specific neural pathways. They are popular as broad-spectrum insecticides, as they are considered less directly toxic to vertebrate species including humans.

These systemic insecticides have become the most widely used group of insecticides globally, with a market share now estimated at around 40% of the world market. Common compounds include acetamiprid, clothianidin, dinotefuran imidacloprid, nitenpyram, nithiazine, thiacloprid, thiamethoxam and fipronil, with global sales of over US $2.63 billion in 2011.

The global market for seed treatments is expanding even more rapidly, growing from US $210 million in the 1990s to US $1295 million in 2008, at which point neonicotinoids made up 80% of all seed treatment sales worldwide.

Neonicotinoids are still toxic even at very low doses. They have a higher persistence in soil and water than conventional pesticides remaining in situ for months on average, and this results in sustained and chronic exposure of non-target organisms, such as invertebrates. Because they are relatively water-soluble, they run off into aquatic habitats easily. Growing concern about their connection to bee colony collapse disorder has led to restrictions on their use in EU Countries. Concern about their impact on other non-target species including birds, has been growing for the last five years.

Task Force On Systemic Pesticides

The Task Force on Systemic Pesticides is the response of the scientific community to concern around the impact of systemic pesticides on biodiversity and ecosystems. Its intention is to provide the definitive view of science to inform more rapid and improved decision-making.

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NOTES

Press Conferences releasing the findings will be held in Manila and Brussels on the 24th June, Ottawa on the 25th and Tokyo on the 26th.

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