

# The Threat of Neonicotinoid Pesticides

on Honeybees, Ecosystems, and Humans

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**JEPA**

Japan Endocrine-disruptor Preventive Action

# Neonicotinoid pesticides and Honeybee Losses

## *Japan's current situation and the government's response*

### **Urgent need for government actions**

- 1.The Japanese government should put an immediate halt to all unnecessary use of pesticides.
- 2.The use of neonicotinoid should be temporally stopped and a government initiated action should be started before severe damage is caused to the plentiful ecosystems in Japan.
- 3.The Japanese government should consider the negative impact throughout the ecosystems and carry out emergency fact finding survey's immediately.

### **Japan is the world's largest user of agricultural pesticides**

According to the OECD Pesticide Reviews 2002, Japan is the world's largest user of pesticides (per unit area). At 7 times that of the U.S. and 2.5 times that of France, the small nation of Japan is literally covered in pesticide. The nations of the EU in 2007 started regulating the use of organicphosphorous pesticides, however, Japan continues to use large amounts of such pesticides. The use of neonicotinoid pesticides, which is suspected around the world as one of the direct causes of the honeybee losses on a mass scale, has increased its usage with the volume nearly tripling over the last 10 years.

### **Facts about the honeybee losses**

In 2005, there were sporadic reports of large numbers of dead honeybees across different regions in Japan. Harm has been sustained in Iwate prefecture, Hokkaido, and the Kyushu areas where neonicotinoid pesticides (name of active ingredients: clothianidin, dinotefuran) were used for controlling shield bugs eradication from rice paddies, and when it has been sprayed on crops. In Hokkaido, not only manual spraying, but also unmanned helicopters have sprayed this pesticide at around an 8:1 dilution, which is not far from the undiluted product, to which has caused large scale damage to the local honey bee population. It is also known that even at a 2000:1 dilution, this pesticide can cause harm to honeybee populations. And yet still the pesticide has started to be used widely on a daily basis, but the Japanese government turns a blind eye and continues to show no interest in this pesticide problem.

### **Japan's undertaking towards this issue**

On the cause of the large number honeybee losses: The Ministry of Agriculture, Forestry and Fisheries is not concerned with pesticides and is blaming the honeybee losses on mites and viruses and a variety of other causes.

The response from the Ministry of Agriculture, Forestry and Fisheries; For the insufficient number of honeybees to pollinate the agricultural crops, we have constructed a stable supply/demand system, and have already started a supply system for affected areas where levels are low. Also, we ensure that the beekeepers and the farmhouses are in close contact so that the honeybees will avoid areas and times of the day when pesticides are used.

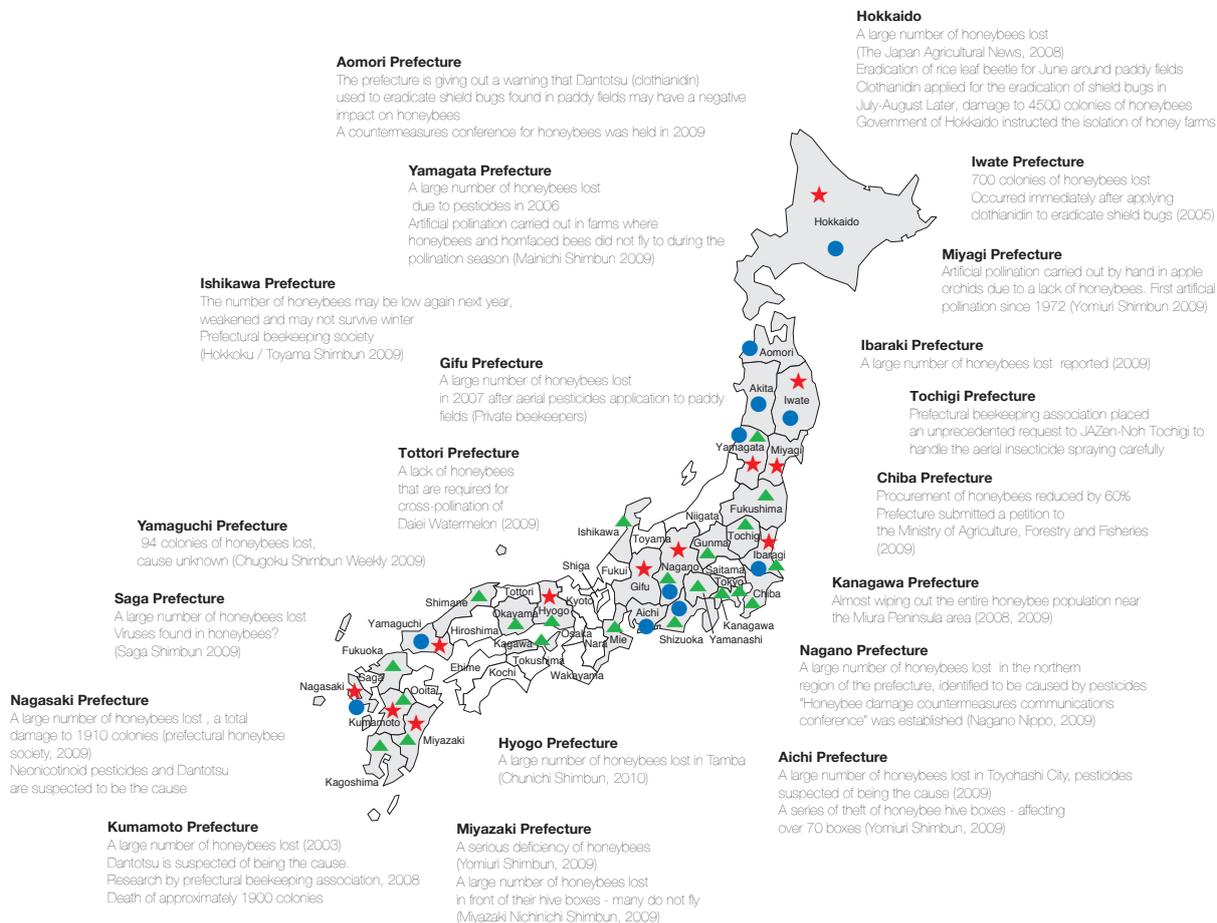
From the honeybee study report by the Ministry of Agriculture, Forestry and Fisheries (April, 2010), it found that clothianidin and dinotefuran (neonicotinoid pesticides) are detected in 92.3% of the dead honeybees sent to it from beekeepers. Regardless of all this, the report concludes that it could not identify the main reason for causing the honeybee losses.

### **Damage to ecosystems other than honeybees**

There is wide concern across Japan that neonicotinoid might be the cause of the decline in the number of insects and birds on farmlands through its heavy use. However, there have been no field surveys to date carried out in order to prove this.

# Honeybee losses are spreading across Japan

- ★ Prefectures where honeybee losses that may be caused by neonicotinoid pesticides
- ▲ Prefectures where honeybees for cross-pollination are lacking (21 prefectures, according to the Ministry of Agriculture, Forestry and Fisheries survey in 2009)
- Honeybee losses that are related to pesticides, according to the Ministry of Agriculture, Forestry, and Fisheries research report (April, 2010)



There have been reports of 700 swarms of honeybee losses due to the use of neonicotinoid pesticide (Product name: Dantotsu, name of ingredient: clothianidin) for the purpose of controlling shield bugs, and there have also been similar reports of losses occurring in Hokkaido and in Nagasaki prefecture. However at present, the Ministry of Agriculture, Forestry and Fisheries is not looking at the dangers of pesticides, instead is blaming the cause of honeybee losses on mites, stress, and a temporary ban on the importation of queen bees.

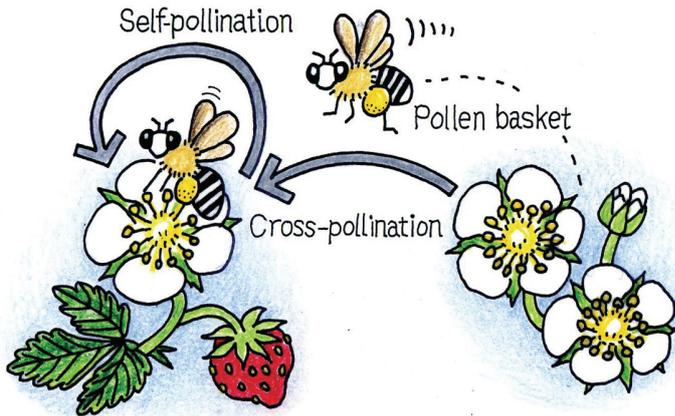
And in 2009, as a measure against the problem of insufficient honeybee numbers for cross-fertilization of pollens throughout the country, a demand/supply adjustment policy was made to secure the honeybee stability. A system will be made that will supply honeybees sufficiently to regions where there is a need for honeybees for the pollination of agricultural crops.

Under the lack of countermeasures for these types of new pesticides in Japan, apart from the harm on honeybees, we are also seeing significant numbers

of sparrows and other wild birdlife, along with other insects disappearing. It is thought that this pesticide has the possibility of causing further loss of a multiple range of bird and insect life. And the most concerning thing above all is that the farmers who do not know this pesticide very well are mixing the neonicotinoid pesticides with the organicphosphorous pesticides for use on their farms. Where this combined pesticide is being used, there have been reports from prefectures such as Nagasaki of not only harm to honeybees, but also in chickens and humans. In order to prevent similar harm from occurring again, there is urgent need for information calling attention to the problem from the government.

# Honeybees are pollinators

Honeybees are pollinators \* who help carry the pollen from the stamen to the pistil pollination, while the bees pick up honey and pollens to feed their larvae. Honeybees have two important roles in farming and in nature.



Honeybees pollinate the pollens of a flower they are currently on (self-pollination) or the pollens of a flower they have previously been on, to the pistil of other flowers (cross-pollination).

Illustration: Saori Yasutomi

## The role of the honeybees

### 1. Pollination (mating) of crops

Farms rely mainly on honeybees for pollination for fruits such as strawberries and grapes, vegetables such as tomatoes and eggplants, as well as for obtaining seeds for the following year. The productivity of farming relies on honeybee. The unforeseen disappearance of honeybees will cause a devastating impact on farming. Honey and propolis could also disappear from our kitchen.

### 2. The pollination of trees and field flowers

Majority of angiosperm (plants with flowers) require wild honeybees and bumblebees for pollination in order to make seeds and bear next generation. The diversity of plants is maintained through the pollination carried out by honeybees. As a result, the biodiversity of ecosystems in forest and rural area are rich and stable.

## Major crops that honeybees pollinate

Fruits	Vegetables
 Strawberry	 Tomato
 Melon	 Eggplant
 Watermelon	 Cucumber
 Peach	 Pumpkin
 Pear	 Winter melon
 Apple	 Lettuce
 Japanese apricot	 Broccoli
 Loquat	 Rape
 Japanese plum	 Buckwheat
 Persimmon	 Onion

## Honeybees are index species – tells us about changes in the environment

Index species refer to species that can indicate if their environment worsens. Honeybees are one of such index species. Furthermore, honeybees always return to their hives and one can see the rise or decline in the number of bees. This is especially true for bred honeybees, where breeders can easily tell whether their environment is good or bad. Losses of honeybees that are occurring today are a warning about unusual changes in the ecosystem in which these honeybees live.

The use of the controversial neonicotinoid is thought to be reducing not only pollinators such as honeybees, but also many other species within the environment, especially many other types of insects as well as many organisms, and to be collapsing the ecosystem.

\* Pollinators include not only honeybees, but also other bees including bumblebees as well as insects such as flower chafers, longhorn beetles, butterflies, moths, and flies.

# Possible causes of honeybee losses

## Colony Collapse Disorder (CCD) ?

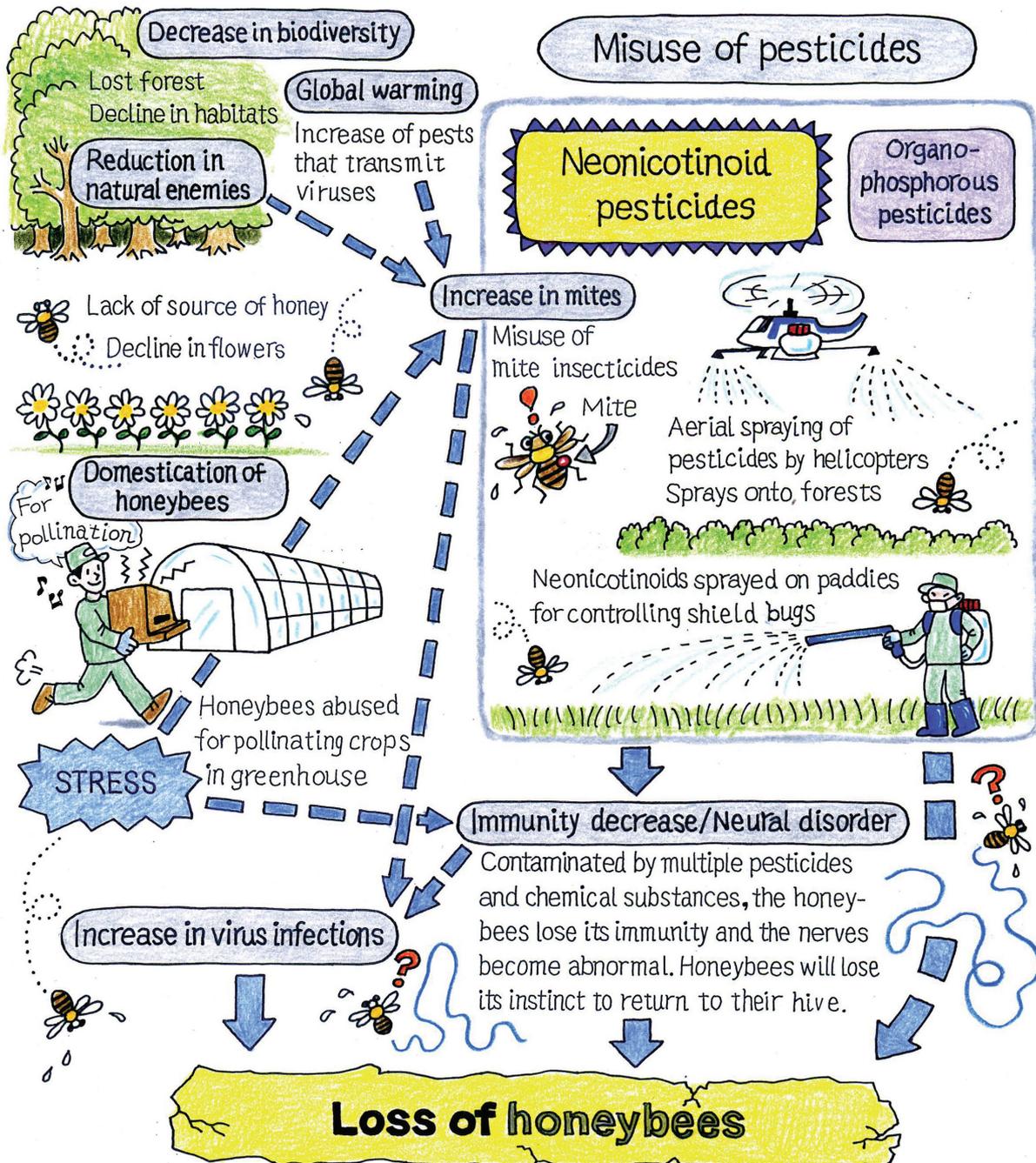
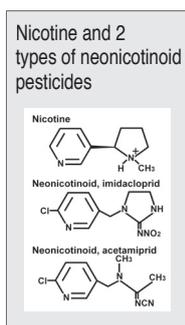


Illustration: Saori Yasutomi

# What are neonicotinoid pesticides?

Neonicotinoid (new nicotine-like substance) is a type of pesticide that is often used recently. It is named after a similar poisonous substance called nicotine, which is found in cigarettes. Neonicotinoid was developed around 1900 after the organophosphorous pesticide. Seven types of neonicotinoid pesticides are shown in the table below.

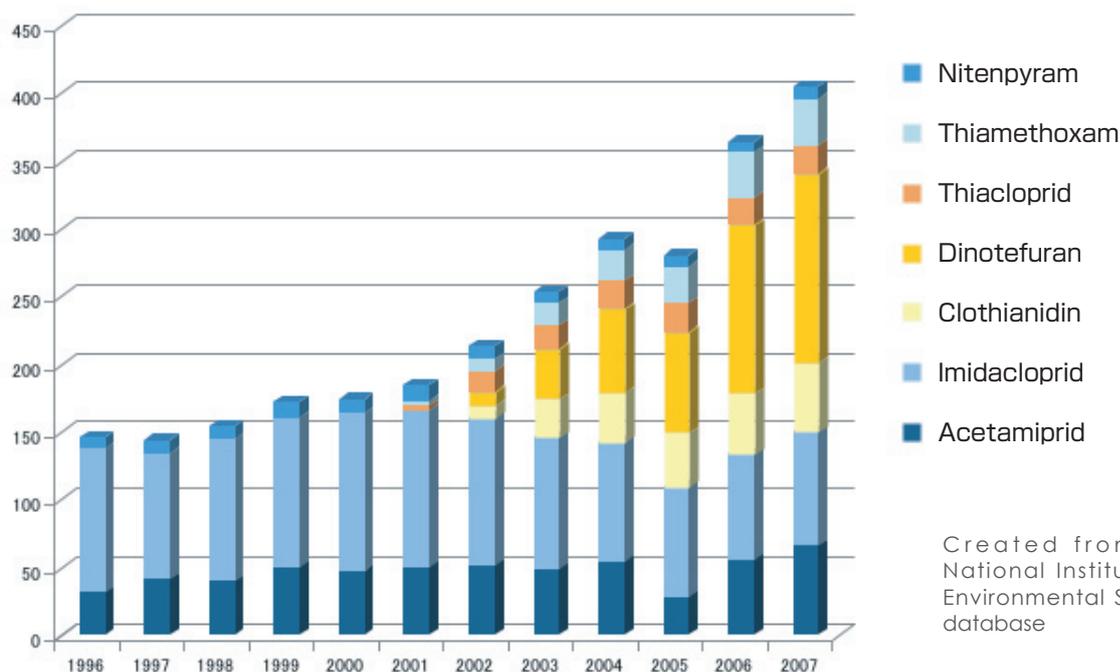


water. A new type (phenylpyrazole) of systemic pesticide called fipronil is also being used frequently. It is used for eradicating fleas in pets, household insecticides, and pesticides. This also has neurotoxicity, and is gathering attention as one of the causes for honeybee losses. Furthermore, it is reported that neonicotinoid can be more persistent in the environment depending on the conditions, and it can stay in the soil for extended periods (over 1 year).

## The usage of neonicotinoid continues to increase

The domestic shipment of neonicotinoid products is increasing annually and it has grown by 3 times in the past 10 years. It is used throughout our lives from farming, forestry, and in homes (building materials, and termite eradication. Refer to the following page for other examples), and is taking over organophosphorous pesticide which were /is used widely.

**Domestic shipment of neonicotinoid pesticides in Japan** (Active ingredient, t)



## Seven types of neonicotinoid pesticides

IngredientProduct	Name	Developed by
Acetamiprid	Mospilan, Matsu green, Kadan, Yielder SG	Nippon Soda
Imidacloprid	Admire, Hachikusan, Earth garden, Merit	Bayer
Nitenpyram	Bestguard, Pedan best	Sumitomo Chemical Co., Ltd.
Clothianidin	Dantotsu, Full swing, Moriate, Hustler, Takelock	Sumitomo Chemical Co., Ltd.
Dinotefuran	Starkle, Albarin, Bonfran	Mitsui Chemicals Agro
Thiamethoxam	Actara, Cruiser FS30	Syngenta
Thiacloprid	Winbaird, Eco-one Froable	Bayer

# Usage and product names of Neonicotinoids

## Product name (name of active ingredients)

<b>Forestry</b> Prevention of pine wilt disease	<b>Gardening</b> Flowers / lawn	<b>Farming</b> Rice / Fruits / Vegetables
Matsu Green solution (acetamiprid) Starkle (dinotefuran) Moriarte SC (clothianidin)	Bestguard (nitenpyram) Earth garden (imidacloprid) Yielder SG (acetamiprid) Kadan fertilizer with insecticides (acetamiprid) Mospilan(acetamiprid)	Dantotsu (clothianidin) Bestguard (nitenpyram) Admire (imidacloprid) Mospilan (acetamiprid) Albarin (dinotefuran) Prince froable (fipronil) Cruiser FS30 (thiamethoxam) Starkle (dinotefuran) Hustler powder (clothianidin)



<b>Homes</b> Termite eradication / Building materials	<b>Pets</b> flea control	<b>Residential</b> insecticides
Hachikusan (imidacloprid) Agenda SC (fipronil) Takelock (clothianidin)	Frontline (fipronil) Advantage Plus (imidacloprid)	Kobaega Hoihoi (dinotefuran) Ari no su tettei shometsu chu (dinotefuran) Bonfran (dinotefuran) Black cap (fipronil) Wiper one G (fipronil)

\*Product name (name of active ingredients)

\*Fipronil:A new type of insecticide (not a neonicotinoid type, but a phenylpyrazole type)  
 It is attracting attention in countries like France as a cause of honeybees losses

# Accelerating the collapse of the ecosystem

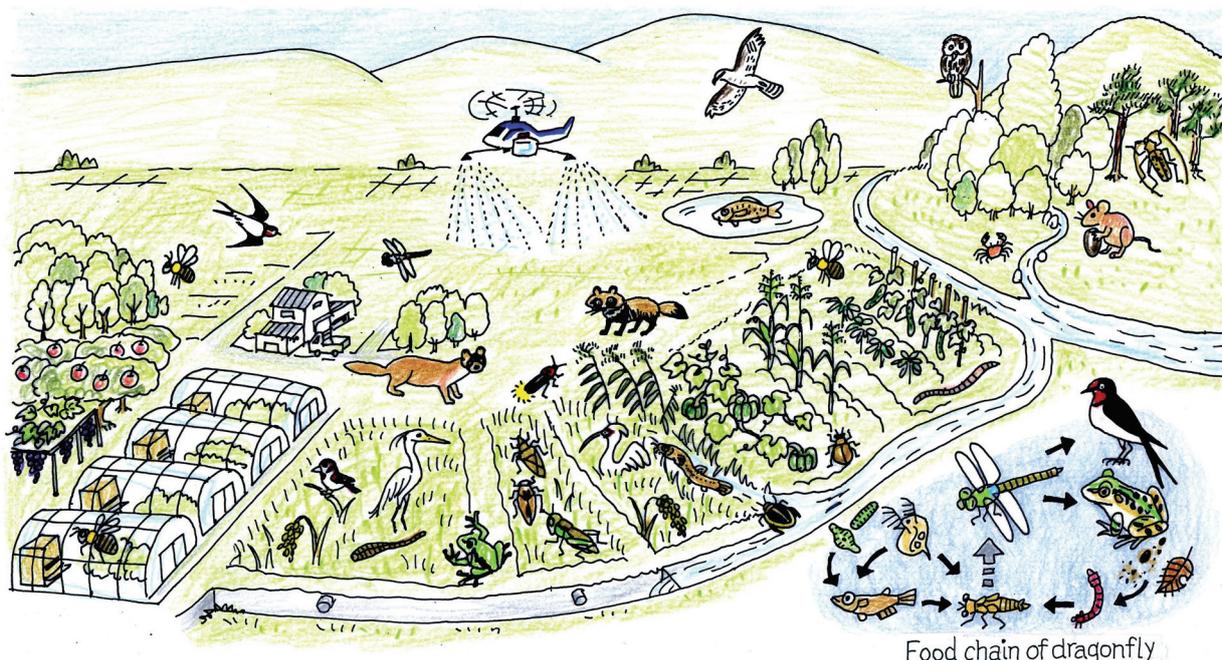


Illustration: Saori Yasutomi

Ecosystems maintain the biodiversity by means of close relationships between organisms such as plants and animals, and soil, air, and water that surround organisms while using the energy from the sunlight. Let us now examine the ecosystem of a model of farm village in Japan, where neonicotinoid has begun affecting the environment.

## A farm village ecosystem – the loss of the biodiversity

A farm village has many different ecosystems such as paddies, fields, brushes, grass fields, reservoirs, irrigation canals and so on. In its entirety forms a farm village ecosystem. In insects alone, there are over 1000 types of species within a paddy field. A farm village ecosystem therefore has a complex links between a vast number of different species through food chains.

Pesticides can affect not only pests, but also pollinators such as honeybees, as well as many insects such as dragonflies, and birds. For example, it is known that fipronil affects dragonflies, and neonicotinoid causes severe damages to insects. This substances are also persistent in the environment and contaminate rivers and soils, which in turn affect many kinds of organisms which live in such environments. Many pesticides have been used in farming areas to date, therefore it is thought that neonicotinoid will further accelerate the damage to these environments. If individuals of a species are reduced or the species becomes extinct due to pesticides, other species may be reduced or become extinct through the food chain. This will cause the ecosystem to become increasingly poor in terms of its diversity.

## Biodiversity in a farm village ecosystem

\*Endangered species

Plants	diatom and microorganisms, rice, vegetables, other grass, various trees, etc.
Insects	butterflies, moths, beetles (chafers, longhorn beetles, etc.), cicadas, bees, locusts, shield bugs, etc.
Aquatic insects	non-biting midges, dragonflies, predaceous diving beetle*, fireflies, mosquitoes, etc.
Aquatic species	pond snails*, radix*, freshwater crabs, Loach, Japanese killifish*, honmoroko and crucian carp (fresh water fish from the carp family), etc.
Reptiles / amphibians	frogs (tadpoles), lizards, snakes, etc.
Birds	snipes, plovers, herons, northern goshawk*, owls, sparrows, swallows, etc.
Mammals	mice, raccoon dog, Japanese mink, Japanese marten, etc.
Soil organisms	earthworms, mites, bacteria, fungi, larvae of beetles (such as chafers) and of cicadas, etc.

# Neonicotinoid does not wash off

**Maximum residue level for acetamiprid (ppm)**

Food	Japan		U S	E U	Food	Japan		U S	E U
	Current	Revised ***				Current	Revised ***		
Strawberries 	5	3	0.6	0.01*	Tea leaves 	50	30	50**	0.1*
Apples 	5	2	1.0	0.1	Tomatoes 	5	2	0.2	0.1
Pears 	5	2	1.0	0.1	Cucumbers 	5	2	0.5	0.3
Grapes 	5	5	0.35	0.01*	Cabbages 	5	3	1.2	0.01*
Watermelons 	0.5	0.3	0.5	0.01*	Broccolis 	5	2	1.2	0.01*
Melons 	1	0.5	0.5	0.01*	Bell pepper 	5	1	0.2	0.3

\*Detection limit is set as the maximum residue level  
 \*\*\*Submitted on March 2010

\*\*In the US, the 50ppm is set only for imported teas

## Systemic pesticides contaminate entire plant

Neonicotinoid is widely used for growing rice, vegetables, fruits, chrysanthemum, and roses, as well as for prevention against termites and pine wilt disease. Sprayed neonicotinoid is absorbed directly by the plant through leaves and stalks as it is permeable. Neonicotinoid distributed on the soil will be absorbed from the root. As this substance is systemic pesticide, it is distributed to roots, stalks, leaves, flowers, pollens, honey, and fruits to retain its effects of pesticide. Neonicotinoid therefore cannot be washed off as it permeates inside the plant. It is known that it is 10 times more poisonous for honeybees to take neonicotinoid which is contained in honey, pollen, or water, than when they are directly exposed to neonicotinoid (for example, clothianidin).

## Residues much higher than in Europe and in the US

Ministry of Health, Labor, and Welfare sets residues of neonicotinoid pesticide in food, in order for us to be safe from foods such as fruits, vegetables, and teas. The current maximum residue levels of acetamiprid are so

high that a proposal of revising current maximum levels were submitted by citizen's group in March this year. The levels are nevertheless 1.7-25 times that of the levels in the US, and 3-500 times that of the levels in EU. In other words, the proposal levels were not proper (see table above). One reason behind this is that it is difficult to reduce the maximum residue levels to the level of Europe and of the US as Japan uses more pesticides.

## Harmful to humans, too

Under the current situation where the maximum residue levels for fruits and vegetables in Japan are high, there are reports by doctors which suggest that neonicotinoid is affecting the health of people. There are people who complain of food poisoning, with symptoms including trembling of hands and fingers, irregular pulse, defect of short-term memory, headaches, vomiting, and insomnia. (Source: "AERA" magazine, September 22nd 2008 edition and December 1st 2008 edition)

# Neonicotinoids disrupt the nerve functions

## Neonicotinoid / Organophosphorous pesticides disrupt the neural transmission

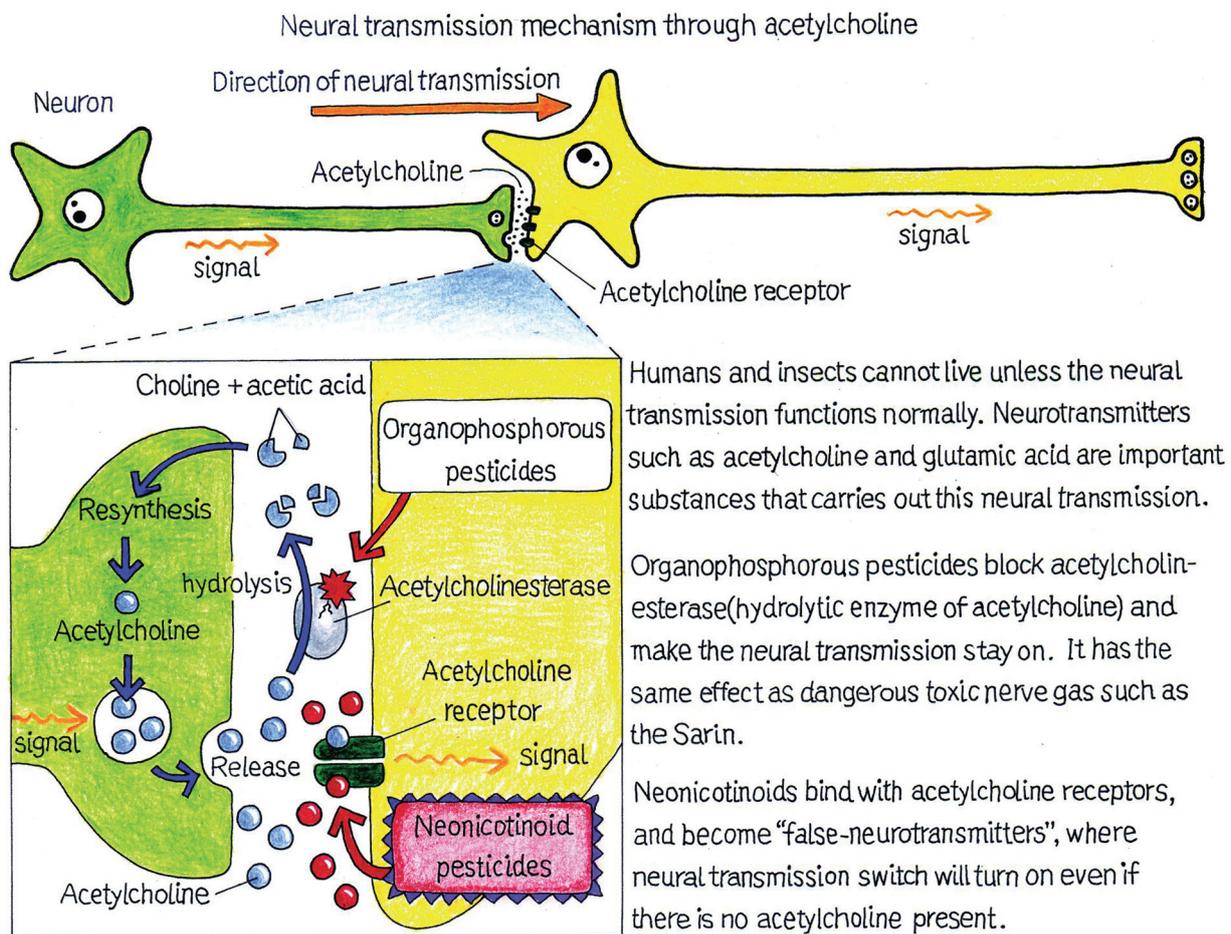


Illustration: Saori Yasutomi

### What are the effects of neonicotinoids?

Neonicotinoids disturb the normal function of acetylcholine which plays an important role in the nervous system. Acetylcholine is one of the neurotransmitters which binding to the receptor cause transmission of the neural signal, and has an important role both in insects and humans. As shown in the diagram, neonicotinoid act as agonist (false-neurotransmitter) which binds with the acetylcholine receptor (see note). This will make the neural transmission switch stay on, causing abnormal excitability. Organophosphorous pesticides block the hydrolysis of acetylcholine and disturb normal neural transmission. Therefore, if one is exposed to both substances, the toxicity possibly increases, even despite a low dosage, due to combined effects.

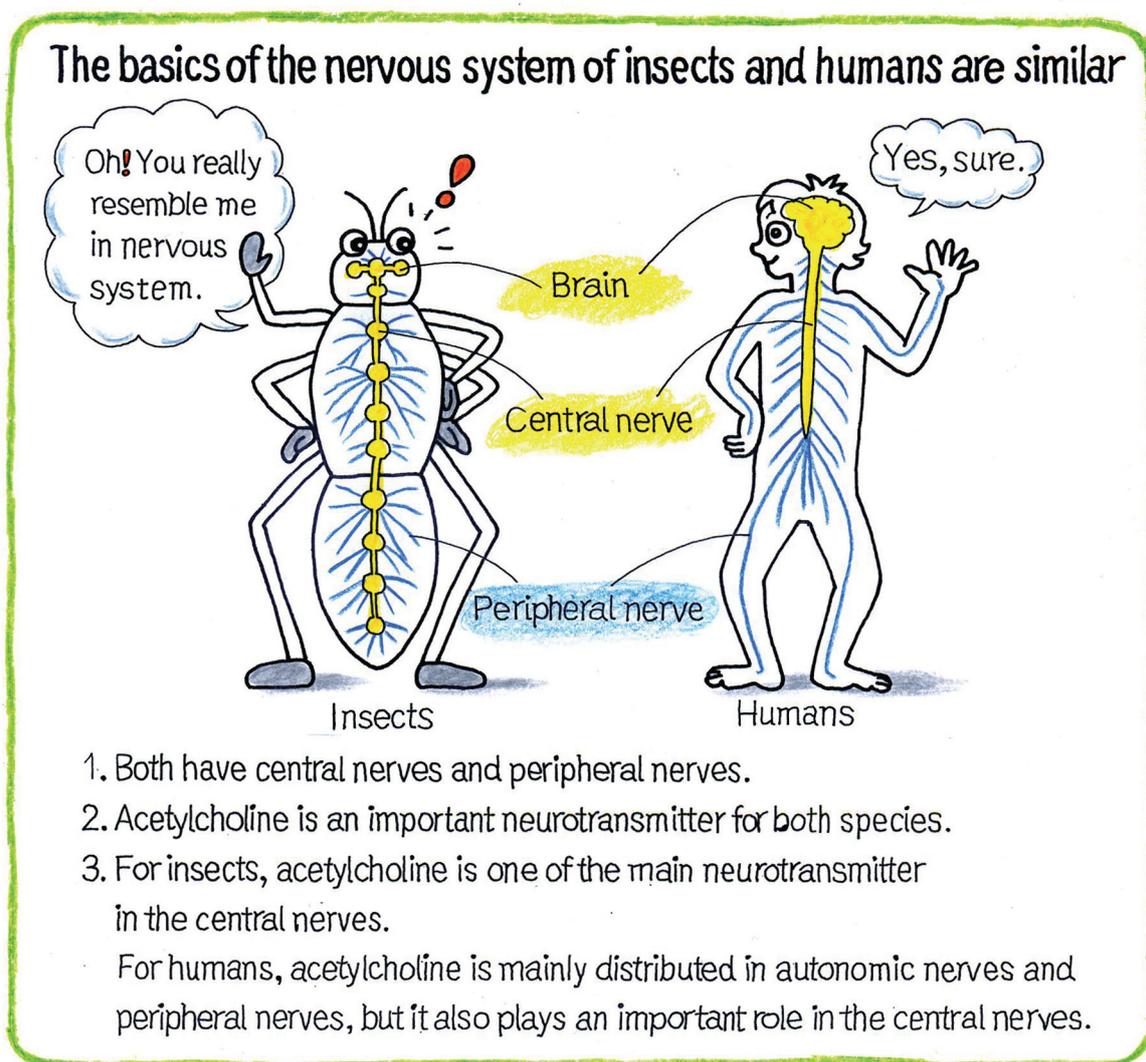
### Honeybees losses?

Acetylcholine is one of the main neurotransmitters for the central nerve of all insects, and its receptors are similar between the insects. Neonicotinoids, therefore, may be toxic for insects that are important to an ecosystem such as honeybees. It is thought that a small exposure of neonicotinoids by the honeybees will disrupt the function of the central nerve, resulting in loss of directionality, and disabling them from being able to return to their hive.

Acetylcholine and its receptors are important bioactive substances from single-cell organisms to higher animals. Therefore, there are concerns over the influence this chemical may have towards the ecosystem, including all insects and many organisms.

Note) There are two types of acetylcholine receptors, nicotinic and muscarinic receptors. This leaflet shows nicotinic receptors for the acetylcholine receptor.

## Is it true that it is safe for humans?



*Illustration: Saori Yasutomi*

### **They affect human nerves?**

Neonicotinoids is thought to be safety and low toxicity for humans, but is it true? In humans, acetylcholine and its receptors play important roles not only in autonomic nerves and peripheral nerves, but also in central nerves, such as memory, learning, and emotion. Furthermore, it is being discovered that acetylcholine and the receptors are important for the immune system and the development of brain. It is known that the binding property of neonicotinoids to acetylcholine receptors in mammals is low compared to insects.

Although it is true that people do not die at a concentration level where insects die, the safety to humans is unjustified. As noted in page 9, there are several cases of human damage that are possibly caused by neonicotinoids.

### **Nicotine-like adverse effects?**

Recently, several scientific reports have revealed that neonicotinoids have nicotinic effects towards mammalian neurons. The toxicities of nicotine against humans have become clearer, and especially for developmental processes in fetuses and children, even at low dosage. If neonicotinoids have similar effects to nicotine, it can affect us significantly even at low dosage. Evaluation tests of pesticides for registration do not include developmental neurotoxicity and combined toxicity, and nor toxicities against higher brain functions of humans. Therefore, there remain concerns about neonicotinoids toxicity over humans. A recent research in USA reported that children who took just a small dosage of organophosphorous pesticides will increase the probability of having developmental disorders such as ADHD by two times. The combined effects of neonicotinoid and organophosphorous pesticides are also a concern.

## **Policy Recommendation by Japan Endocrine-disruptor Preventive Action (JEPA) to Demand the Ban of Neonicotinoid**

1. Based on the pesticides regulatory law Article 6, clause 3, the minister of Agriculture, Forestry and Fisheries should cancel the registration of 7 types of neonicotinoid pesticides, and should prohibit the sales of such products based on Article 9, clause 2.
2. The Minister of Health and Labor should immediately review the maximum residue levels of acetamiprid and imidacloprid to be as stringent as in Europe and the US.
3. The Minister of Health and Labor should take measures to ban the use of neonicotinoid pesticides in homes.
4. Japanese government should immediately carry out extensive research for the cause of m honeybee losses as well as research on damage caused by neonicotinoid pesticides.
5. Japanese government should immediately carry out research on how neonicotinoid pesticides influence the ecosystem and peoples' well-being. Especially, research concerning the influence of combined effect with organophosphorous pesticides, as well as the influence such substances have on the development of children's brains, should be carried out.
6. Japanese government should immediately carry out research regarding how neonicotinoid is used in our daily lives and if damage is being caused by the use of such substances, as well as the state of health issues from taking food where residues of pesticides remain.

## **JEPA's Activities for the Neonicotinoid Issue**

**July, September, November, 2009:** Public study session regarding neonicotinoid pesticides

**February, 2010:** Submitted the "Emergency recommendation to cancel the registration and sales of neonicotinoid pesticides". Request submitted to the vice secretary-general of the Democratic Party of Japan (responsible for Agriculture, Forestry, and Fisheries / Labor and Welfare)

**April, 2010:** Legislators meeting to call for the prohibition of neonicotinoid was held (at the Office building for the House of Representatives)

**July, September, November, 2010:** Public study session regarding neonicotinoid pesticides (Tokyo, Sapporo, Fukuoka)

***Please give us any opinions with regards to the action to ban the use of neonicotinoid. Let's act together!***

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