2-8 Highly pathogenic and low pathogenic avian influenza

What is Avian Influenza?

Avian influenza is a disease of avian species caused by influenza A viruses. According to the Act on Domestic Animal Infectious Disease Control, the disease is classified into three types depending on virulence and probability of mutation. "Highly pathogenic avian influenza (HPAI)" is defined as the highly virulent type with a high fatality rate, and "Low pathogenic avian influenza (LPAI)" is infection H5 and H7 subtype viruses but low virulent type. Other avian influenza subtypes are classified as "avian influenza."

HPAI outbreaks (subtype H5) occur worldwide, and in Japan, a number of HPAI outbreaks are observed from late fall to early spring (see Special Feature 1).

On the other hand, in the case of LPAI, although the disease itself is highly contagious, infected poultry rarely shows clinical signs that delay detection. In other countries, mutations from LPAI into HPAI have been reported.

There is no treatment for infected birds, and a stamping-out policy is applied once an infection is confirmed on a poultry premise. Early detection and notification of infected poultry are essential to prevent the spread of disease.

Surveillance Methods

In addition to passive surveillance, in which diagnostic testing is conducted in response to the reporting of unusual conditions such as increased mortality, two types of active surveillance are conducted to detect infection.

(1) Fixed-point surveillance

Farms with a relatively high risk of infection, such as those located near stopover sites of migratory birds, are selected for continuous monitoring. Selected farms are tested for avian influenza (virus isolation and serum antibody test) once a month.

(2) Enhanced surveillance

Serum antibody tests are conducted on selected farms from October to May of the following year, the migration season for wild birds. Farms are selected based on the number of farms in each prefecture.

Surveillance results

All samples collected either in fixed-point surveillance or enhanced surveillance from January to December 2022 were negative for avian influenza. In addition, for early detection of avian influenza, the Ministry of the Environment is conducting wild bird surveillance for avian influenza by testing the feces and carcasses of wild birds, especially waterfowl in winter. https://www.env.go.jp/nature/dobutsu/bird_flu/

Table 2-8-1 Number of avian influenza outbreaks in poultry

	2020	2021	2022
HPAI*	33	29	66
LPAI	0	0	0

*If winter to the following spring is defined as a "season", the number of outbreaks during the season is as follows.
2020-2021 season: 52 cases
2021-2022 season: 25 cases
2022-2023 season: 84 cases

Table2-8-2 Avian influenza surveillance in 2022

		# of farms	# of birds
Fixed point surveillance	Virus isolation	5,394	53,950
	Antibody test	4,913	50,020
Enhanced surveillance	Antibody test	1,327	13,247

2-9 Arbovirus infection in cattle

What is arbovirus infection in cattle?

Arbovirus infection is a general term to describe viral infections transmitted to humans and livestock by infected arthropods such as mosquitoes, ticks, and biting midges. Most arbovirus infections in cattle are transmitted by tiny blood-sucking insects called *Cullicoides* biting midges. The major arbovirus infections in cattle in Japan are Akabane disease, Aino virus infection, Chuzan disease, Ibaraki disease, bovine ephemeral fever, and bluetongue. Akabane disease, Aino virus infection, and Chuzan disease are associated with abortions, miscarriages, premature births, stillbirths, and births with congenital abnormalities when pregnant cows are infected with the viruses. In addition, some strains of the virus that cause Akabane disease infect calves and develop neurological clinical signs such as paralysis associated with encephalomyelitis, which is called postnatal infection. Both Ibaraki disease and bovine ephemeral fever cause various clinical signs associated with fever when infected. In particular, Ibaraki disease is characterized by difficulty in swallowing, while bovine ephemeral fever is characterized by the inability to stand and decreased milk production. Cattle affected with bluetongue develop erosions and ulcers on the tongue, lips, nasal cavity, and oral mucosa. In cattle, the infection is often subclinical. It is more likely to develop clinical signs in sheep. These arbovirus infections are most likely to occur during summer and fall when blood-sucking insects are more active.

Table2-9-1 Number of cattle infected with arbovirus

		2020	2021	2022
Akabane disease (perinatal infection)	(farms)	1	0	1
	(animals)	1	0	1
Akabane disease (postnatal infection)	(farms)	0	0	0
	(animals)	0	0	0
Aino virus infection	(farms)	0	0	0
	(animals)	0	0	0
Chuzan disease	(farms)	0	0	0
	(animals)	0	0	0
Ibaraki disease	(farms)	0	0	0
	(animals)	0	0	0
Bovine ephemeral fever	(farms)	0	0	0
	(animals)	0	0	0
Bluetongue(cattle)	(farms)	0	0	0
	(animals)	0	0	0
Bluetongue(sheep)	(farms)	2	2	0
	(animals)	6	5	0

Objectives and methods of surveillance

Arboviruses are considered to be introduced into Japan each season by vectors carrying the virus, which travel on wind currents from the East and Southeast Asian region. Thus, surveillance is intended to detect the entry of the virus into Japan at an early point, thereby enabling increasing awareness, facilitating vaccination, supporting proper diagnosis for abortions, and taking other countermeasures. Surveillance is conducted in the following two ways.

(1) Sero-surveillance

Arbovirus infections are more likely to occur from summer to fall when blood-sucking insects are more active. Thus, a total of four consecutive antibody tests are conducted from June to November in order to assess the entry of the disease by looking at seroconversion. The target diseases are Akabane disease, Aino virus infection, and Chuzan disease. Based on the current disease situation, surveillance is conducted throughout Japan for Akabane disease, and in western Japan for Aino virus infection and Chuzan disease.

(2) Virus antigen surveillance

Virus antigen surveillance using PCR is conducted in Kyushu and Okinawa regions, where arboviruses are more likely to be introduced, to detect virus invasion earlier than by sero-surveillance. The target diseases are Akabane disease, Aino virus infection, Chuzan disease, Ibaraki disease, and bluetongue (Table 2-9-2). In the target prefectures, a total of four consecutive PCR tests are conducted from June to November.

Surveillance results

(1) Sero-surveillance

In FY2022, sero-surveillance was conducted on 2,606 cattle from 831 farms. Positive antibody results for Akabane disease were confirmed in Okinawa in September and in Hokkaido and Kumamoto in November (Fig. 2-9-1). The occurrence of Akabane disease was also reported in Hokkaido, in the northern part of Japan, in December. This is the first report of Akabane disease in Hokkaido since 2010-2011.

Positive antibody results for Chuzan disease were confirmed in Ehime in September and in Okayama, Kochi, Nagasaki, Kumamoto, and Okinawa in November (Fig. 2-9-2). As D'Aguilar virus (DAGV) was isolated from a seroconverted cattle in Nagasaki, these seroconversions observed in the western Japan are likely to be caused by the DAGV infection, which is closely related to Chuzan virus.

A positive antibody result for Aino virus infection was confirmed in Yamaguchi in November (Fig. 2-9-3).

(2) Virus antigen surveillance

In FY2022, virus antigen surveillance was conducted on 150 cattle from 61 farms. In Okinawa, the southern islands of Japan, PCR positive results were confirmed for a Simbu serogroup virus in July and for bluetongue virus in July and November (Fig. 2-9-4). The results of genetic analysis showed that the viral genes of the Simbu serogroup virus detected were identified as those of the Sathuperi virus.

The bovine arbovirus infection surveillance results conducted in previous years can be found below.
https://www.naro.go.jp/laboratory/niah/arbo/index.html

Table 2-9-2 Arboviruses subject to surveillance

Virus group	Virus (Viruses subject to genetic surveillance underlined)
Simbu serogroup virus	Akabane virus, Aino virus, Peaton virus, Sathuperi virus, Shamonda virus
Epizootic hemorrhagic disease virus	Epizootic hemorrhagic disease viruses including Ibaraki disease virus
Palyam serogroup virus	Chuzan vius, D'Aguilar virus
Bluetongue virus	Bluetongue viruses

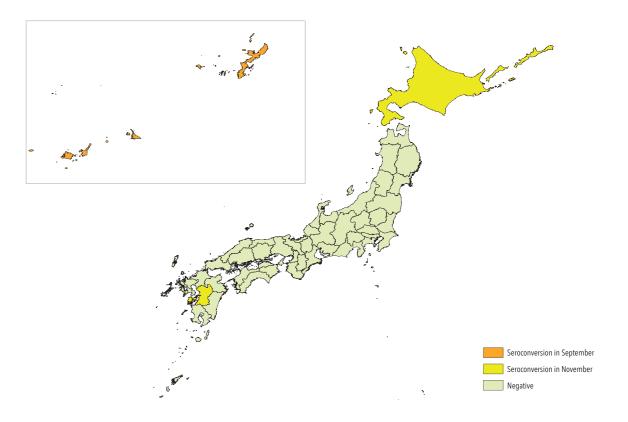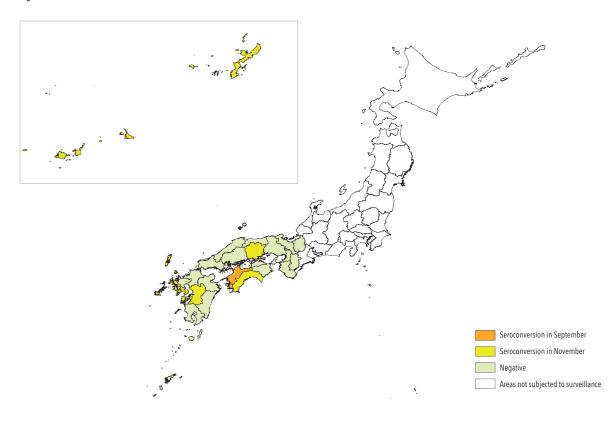Fig.2-9-1 Results of sero-surveillance for Akabane disease in FY2022

Seroconversion in September
Seroconversion in November
Negative

Fig.2-9-2 Results of sero-surveillance for Chuzan disease in FY2022

Seroconversion in September
Seroconversion in November
Negative
Areas not subjected to surveillance

Fig.2-9-3 Results of sero-surveillance for Aino virus infection in FY2022

Seroconversion in November
Negative
Areas not subjected to surveillance

Fig.2-9-4 Results of virus antigen surveillance in FY2022 (Simbu serogroup virus and bluetongue virus)

Positive in July
Negative
Areas not subjected to surveillance

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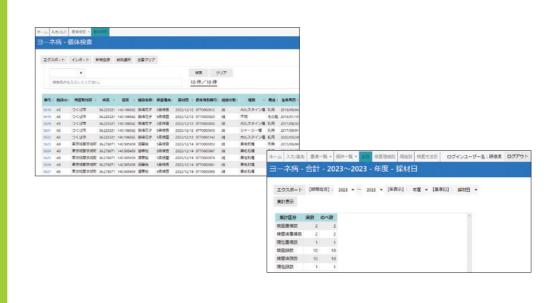## Launch of Livestock Disease Surveillance Reporting System

In Japan, the results of livestock infectious disease surveillance conducted by prefectural governments have been sent to the Animal Health Division of the Food Safety and Consumer Affairs Bureau of MAFF by e-mail, etc. The Animal Health Division has been compiling these files and aggregating data. This method, however, is complicated and time-consuming at both the prefectural and national levels, making it impossible to utilize the surveillance data fully.

Given this situation, MAFF started to develop an internet-based reporting system, "Livestock Disease Surveillance Reporting System", in FY 2018 to standardize reporting contents, improve the efficiency of reporting work, and automate tabulation. The system has been partially put into operation since fiscal 2022.

This system is an internet cloud system, and data entered from prefectural information terminals is shared with MAFF in realtime. The system can be linked to other databases, for example, the disease control map system, and can call up information such as the location of a farm based on the farm's facility ID.

In addition, various error-checking functions work when accepting data so that everyone can input data in the same format, and viewing and tallying can be done smoothly. Data can be checked as a list or tabulated by reason of inspection, inspection method, etc., and output as a file.

As this system goes into full-scale operation in the future, it is expected to reduce the workload of compilation and reporting of surveillance data, and to be used for more efficient and systematic tabulation and analysis.