Infectious bronchitis: key points for broiler production

Avian infectious bronchitis virus is a coronavirus that contains a single stranded positive sense RNA genome. This genome is encased in a lipid envelope with glycoprotein spikes on the surface of the virus particle.

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Other structural proteins that make up the virus are the integral membrane glycoprotein, the envelope glycoprotein and the internal nucleocapsid protein that surrounds and protects the viral RNA genome.

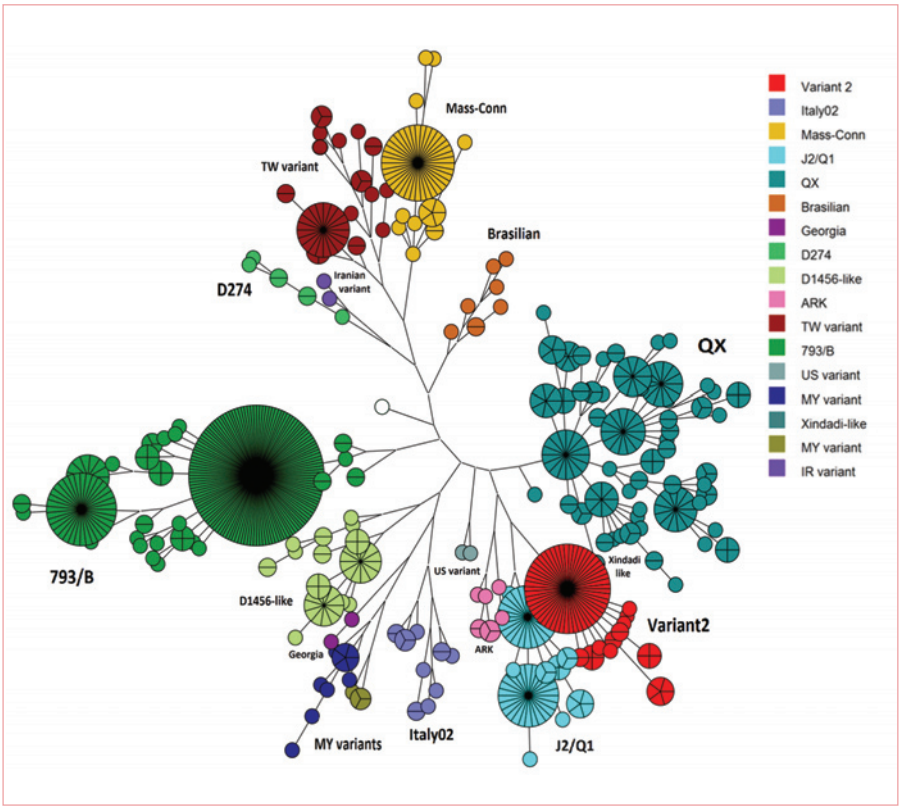
The spike glycoproteins are different for different types of the virus to organise the coronavirus classification.

Added value of coronavirus classification

The first step is the coronavirus strain identification. So, as shown in Fig. 1, we can identify some major groups (with different colours). The objectives are:

- To help the Veterinary Technical Support team with the diagnosis when the symptoms (respiratory symptoms and lesions, diarrhoea (with kidney lesions) or false layer development could suggest coronavirus infection.
- To have information about cross-protection between this strain group (or sometimes the individual strain) and the vaccine strains of the vaccination programme.

Fig. 1. Coronavirus strains classification.



Major symptoms and lesions in production

Coronavirus tropism can be seen in different organs: trachea, kidney and the reproductive system. The symptoms appear quickly after infection (24-48 hours only) and could be short (respiratory symptoms, diarrhoea), medium (egg drop) or long term (false layer).

The amplitude and the length also depend on the quality of immunisation with the vaccination programme.

Bear in mind that:

- Everything could be infectious bronchitis and coronavirus infection when the Veterinary Technical Support team are

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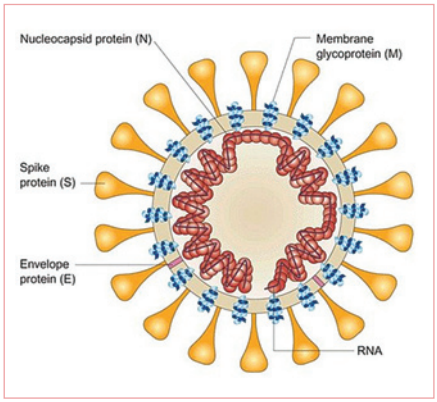
Fig. 2. The avian coronavirus.



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carrying out a broiler farm visit, slaughterhouse condemnation and lesions checking.

- When the Veterinary Technical Support team suspect coronavirus disease, it could be mutual with other pathogens, such as H9, AmPv, bacteria, fungus or a technical issue (parameter for respiratory symptoms or other specific intestinal aetiology for digestive symptoms).

Cross-protection demonstration and ciliostasis score

Scientific teams around the world are using the ciliostasis method and scoring to demonstrate and quantify the quality of immunisation and protection against coronavirus strain on the trachea epithelium. Only respiratory protection can be evaluated and quantified.

The protection was evaluated at five days post-challenge based on prevention of ciliostasis (evaluation according to the European Pharmacopoeia) and reduction of challenge virus replication in the trachea (measured by RT-Real Time PCR).

The ciliostasis give two major pieces of information:

- Duration of protection.
- Protection evaluation.

The ciliostasis technique is standardised; the ciliostasis scoring shows the movement of trachea epithelium cilia; the cilia mobility show the trachea epithelium integrity with a high ciliostasis score and a high protection level.

To add Real Time Rt-PCR process to evaluate reduction of mean virus load in trachea.

The concept of cross-protection by combining a Massachusetts and a 793B serotype vaccine was discovered in the 1990s by Jane Cook in the UK.

The ciliostasis technique could be used to evaluate protection duration (Table 2).

Immunisation and impact

Coronavirus are very sensitive to cleaning products (detergent, disinfectant) so the downtime period is efficient to destroy it at the farm level.

No vertical transmission (direct and indirect) is detected. But the contamination between farms with different support (equipment, people, wind) is the best way of infectious bronchitis dissemination and the unique prevention could be an optimal immunisation of all poultry production in the area.

Bad or inefficient immunisation can contribute to contamination and high excretion. The high contamination and shedding produce high dissemination.

Professor De Wit modelled this approach with 'R' coefficient to explain it. The vaccinated groups (R=0.69) and the unvaccinated groups (R=19.95) have a strong and direct impact on the probability percentage of the number of contact infections.

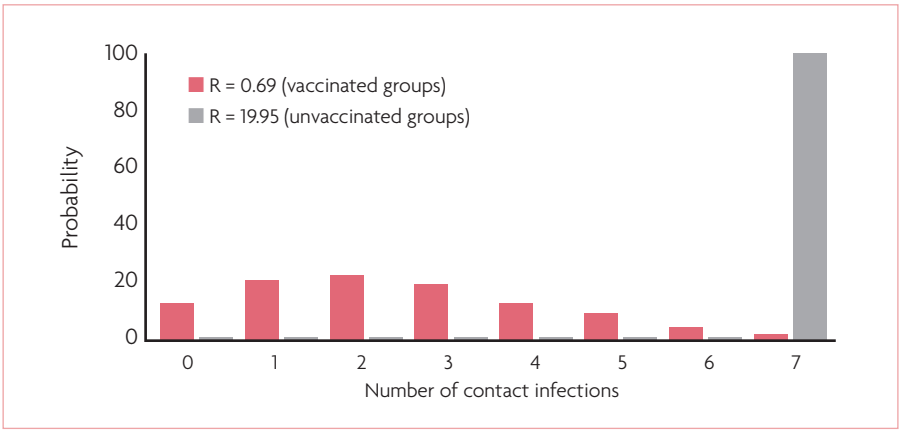

Fig. 3. The final size distribution of the stochastic SIR (S_0 = 7, I_0 = 7) model for two values of the reproduction value R.

	3 weeks			6 weeks			9 weeks		
	Ciliostasis		Shedding reduction	Ciliostasis		Shedding reduction	Ciliostasis		Shedding reduction
	Vaccinated	Control		Vaccinated	Control		Vaccinated	Control	
793 B	2.4	39.3	4.1*	3.15	40	7*	0.1	26.7	7.7*
M 41	4.9	40	4.2*	5.75	40	6.7*	3.85	39.8	3.7*

Table 2. Immunisation is evaluated with ciliostasis and shedding reduction.

High contagiousness + high shedding = high dissemination.

Conclusion

With this knowledge about coronavirus and understanding parameters about immunisation, the Veterinary Technical Support team can focus on the specific critical points directly affected by choice and actions.

On the farm, it is very difficult to manage biosecurity measures when the contagiousness of the virus and shedding are at their highest. Infectious bronchitis virus is quickly widespread.

The objectives are to evaluate coronavirus pressure around the broiler farm and in the country and to secure the vaccine application and vaccination programme. ■

Table 1. Cross-protection induced from hatchery vaccination.

	Challenge (genetic group) represented by challenge strain		Protection		Reference of study
Vaccination (at day 1)	Common name	Genotype	Trachea ciliostasis protection	Reduction of mean load in trachea	
Cevac IBird + Cevac Bron 120L	Qx	GI-19	95%	4.7log10	Ceva Phylaxia SSIU P048-2018
Cevac IBird + Cevac Bron 120L	Taiwanese I	GI-7	100%	4.6log10	Ceva Phylaxia P049-2018
Cevac IBird + Cevac Mass L	Malaysian variant	Unique variant	100%	3.9log10	Ceva Phylaxia SCI260-2015

References are available from the author on request