# Infectious Bronchitis in Commercial Chickens

Avian infectious bronchitis virus (IBV) is an acute and highly infectious and contagious viral disease of chickens that results in severe economic losses across the poultry industry (Cavanaugh and Gelb, 2008). And while it is not egg transmitted, it is readily transmitted from bird to bird by direct (aerosol route) or indirect contact (e.g., exposure to feces or contaminated equipment or clothing).

It is difficult to differentiate infectious bronchitis from many other respiratory diseases; therefore, **disease confirmation requires the help of a diagnostic laboratory**. Infectious bronchitis is primarily a respiratory disease of chickens, but it can affect other organs, including the kidneys and reproductive tract. IBV is a member of the order Nidovirales, family Coronaviridae, subfamily Coronavirinae, and genus *Gammacoronavirus*.

IBV is an enveloped, single-stranded RNA virus, which has a huge capacity to change by both spontaneous mutation and genetic recombination (Cavanaugh and Gelb, 2008). As a result, many locations across the U.S. now **have their own indigenous IBV strains** and variants, such as Massachusetts, Connecticut, Arkansas 99, Georgia 08, Georgia 13, and, more recently, Delmarva 1639.

We know that many new variants do not persist for long periods of time; however, a few do persist and become of great economic importance, particularly in local geographic areas.

## Brief History

The first observed case of infectious bronchitis in the United States was reported in North Dakota in 1930, with the first documented description of the disease being published by Schalk and Hawn in 1931. Beaudette and Hudson (1937) reported the first isolated strain of IBV. Early descriptions of the disease were similar to a mild case of infectious laryngotracheitis (ILT) (Bushnell and Brandly, 1933).

However, using neutralization studies in chicks, Beach and Schalm (1936) demonstrated that the virus that caused IB was different from the virus that caused ILT. After Beaudette and Hudson (1937) found that IBV could be propagated in the allantonic cavity of embryonating eggs, Delaplane and Stuart (1941) suggested that IBV propagated in embryonating eggs might have immunizing value, leading to the first IB vaccine reported by van Roeckel et al. (1942).

Another major discovery was made when Jungherr et al. (1956) reported that an IBV isolated in Connecticut did not cross-protect chickens against challenge with the original Massachusetts isolate (Jackwood and de Wit, 2020). Additional discoveries followed throughout the 1950s and 1960s, and, during the 1990s, several laboratories were able to successfully identify the type of IBV using molecular techniques. This allowed for the rapid identification of many isolates and the comparison of viruses from around the world (Jackwood and de Wit, 2020).

The poultry industry has been aware for many years that there are numerous different variants, types, and subtypes of IBV; many more will likely be discovered in the future because of the constantly changing nature of the virus. This extensive genetic diversity within IBV results from the **high level of mutation and recombination** that occurs because IBV is a single-stranded RNA virus. As a result, the virus has limited ability to “fix” or “correct” replicates that differ from the original, resulting in a constant supply of new IBV field strains for which no vaccine currently exists.

In addition, RNA viruses can change much more rapidly than DNA viruses, further adding to the number of new variant strains. Any of these new mutations or recombinations that have an advantage over the previous version will likely persist in chickens and multiply until they are capable of causing disease. Regardless of the cause (mutation, recombination, or both), it is this constant development of new IBV variants, types, and subtypes for which no vaccine exists that makes IBV extremely difficult for the poultry industry to control. This is exacerbated by the fact that the multiple **different genetic types of IBV don’t provide good cross-protection against each other**. Therefore, selection of the appropriate vaccines requires knowledge of which IBV types are circulating in an area and causing disease in the field.

Today, the best strategy we have for managing the disease is the use of modified live IBV vaccines. However, it's critical to know what strains of IBV are in the area to best match the vaccines to the virus.

## Importance of Coronaviruses and IB Infection

While avian IBV has no known human health significance, the COVID-19 virus that has currently captured the world's attention from a human health standpoint is also a coronavirus. **Coronaviruses primarily infect the upper respiratory or gastrointestinal tract** of mammals and birds. A large percentage of common colds are thought to be caused by coronaviruses.

In addition, SARS-CoV, which causes severe acute respiratory syndrome (SARS), is also a coronavirus. SARS-CoV is somewhat unique among coronaviruses in that it causes both upper and lower respiratory tract infections and may also cause gastroenteritis. Middle East respiratory syndrome (MERS) is also caused by a coronavirus (MERS-CoV) and results in a lower respiratory tract infection.

In addition to infectious bronchitis in chickens and the coronaviral diseases in humans, coronaviruses also cause a wide range of diseases in domestic livestock and pets. Porcine coronavirus and bovine coronavirus can both result in diarrhea in young pigs and calves, respectively. There are two types of canine coronavirus, one that causes gastrointestinal disease and one that causes respiratory disease. Feline coronavirus also has two forms. Feline enteric coronavirus causes few serious problems and is of minor significance. However, mutation of this virus to feline infectious peritonitis can be associated with high mortality.

The IBV in poultry is found worldwide and is transmitted to susceptible poultry by inhalation, direct contact with infected birds, or contact with contaminated litter, equipment, or other objects (Jackwood and de Wit, 2020). Chickens are the most significant natural hosts of the IBV but quite possibly not the only hosts. Evidence suggests that other species such as geese, ducks, and pigeons may play a role in the spread of IBV strains around the world (Felippe et al., 2010; De Wit et al., 2011).

Little is known about the role that wild birds may play in the spread of IBV. This only emphasizes the importance of a strong biosecurity program and the role biosecurity plays in disease prevention. Keep in mind that the IBV virus does not infect humans. Therefore, **you cannot catch infectious bronchitis from your chickens**. In addition, because the COVID-19 virus is in the same virus group as SARS-CoV, Jackwood (2020) indicates it is **highly unlikely that the COVID-19 virus will infect or cause disease in poultry**, but because the virus is still so new, that still remains to be scientifically proven.

As mentioned previously, IBV is extremely contagious and, in infected flocks, the morbidity rate can reach 100 percent, but the **mortality rate depends on the virus strain, the presence of secondary infections, flock age, immune status, and management and environmental factors** (Awad et al., 2014). The mortality rate may typically be 25–30 percent for young chickens but may approach 80 percent, depending on the virulence of the strain. Some strains are nephropathogenic (harmful to the kidneys) and can cause high mortality because of kidney failure in susceptible birds (Jackwood and de Wit, 2020). The nephropathogenic form of IBV mostly occurs in broiler chickens but can affect young growing pullets and even layers (Awad et al., 2014).

In layer and breeder flocks, **IBV infection may result in reduced egg production** approaching 70 percent and a severe decline in eggshell quality. The virus can replicate in the oviduct and cause permanent damage in young hens, resulting in reduced egg production throughout the production cycle and some hens that fail to come into production (Jackwood and de Wit, 2020).

Clinical signs of IBV include gasping for breath, coughing, sneezing, rattling (tracheal rales), watery eyes, and nasal discharge. Unfortunately, these are the **same clinical signs seen with many other respiratory infections**. This is where the help of the diagnostic laboratory is needed to confirm the disease agent responsible for the infection. The coughing, sneezing, and rattling will become quite common as the infection rapidly spreads throughout the house. Chicks will often appear depressed and act cold and huddle under the heat source. As a result, feed intake and weight gain are often greatly reduced.

## Biosecurity and Beyond

As with many other diseases, **biosecurity is critical** to keeping your farm free from IBV. Consistently practice a strong biosecurity program on your farm, and immediately report sick birds to your service technician. Limit who comes and goes on your farm and know why they are there. Constantly use footbaths and change the disinfectant regularly to maintain its effectiveness. Maintain a strong rodent control program, as rodents can carry a variety of different diseases.

It's best not to share equipment with friends and neighbors, but, if you do, make sure the equipment is cleaned and disinfected before it leaves your farm and before it returns. Change clothes and boots before returning to your flock if you must leave the farm and visit the feed store, poultry supply store, café, or other locations where other poultry growers may congregate. You can't afford to track something back home to your flock.

Beyond biosecurity, a **sound vaccination program**, when done correctly, can be beneficial. The commercial poultry industry uses vaccination programs for both breeder birds and broilers. Finding the right program can be challenging. **The best vaccination program will do no good if vaccine quality is compromised**. Common pitfalls that can affect vaccine quality include improper vaccine storage (too hot or cold) and handling, improperly mixing the vaccine at the hatchery, and malfunctioning/clogged nozzles or incorrect air pressure in the spray cabinet, resulting in only some of the chicks in each box being vaccinated. The IBV is quite fragile compared to other viruses. The **vaccine MUST be mixed with high-quality, chemical-free, cold water, and hatchery employees MUST understand this** to protect the live, attenuated virus that is included in the vaccine.

Sound vaccination programs should lessen the IBV threat. However, stress put on the flock by poor management or a poor house environment can cause failure of even the best vaccination program. Good basic management on the farm will go a long way in protecting your flock. Should your flock become infected with IBV, several environmental factors can make a bad situation worse:

- Cold house temperature
- Wet, damp litter
- Poor water quality (minerals, bacteria, pH)
- Poor air quality (too much dust or ammonia)
- High stocking densities

Flocks that break with IBV and are also struggling with poor management factors are open to secondary infection from other sources such as *E. coli* or *Mycoplasma*. This can worsen the situation and increase morbidity and mortality. In laying flocks affected by the disease, a reduction in egg production of 5–10 percent that may last for 10–14 days is possible. However, when additional complicating factors are present, production drops of 50 percent or more may be seen (Tabler et al., 2018).

Eggs produced after the infection may have thin, soft, rough, wrinkled, or misshapen, irregular shells and thin, watery albumen. Egg production and quality may improve somewhat after the initial infection but will likely never return to normal. In addition, a loss of pigmentation may be noted in brown-shelled eggs.

If you are thinking that "no antibiotics ever" (NAE) programs may have increased the IBV problem, think again. It may be easy to question NAE programs for some things, but, in this case, **birds in NAE production programs do not appear to be any more at risk for IBV than birds in traditional programs**. In fact, NAE flocks raised under a good management program may be better off than traditional flocks because stocking density is likely less for NAE flocks, thereby reducing the stress level on the birds. Regardless of the program (NAE versus traditional), IBV does not appear to be impacted by the use (or non-use) of antibiotics. NAE and traditional flocks are equally at risk of contracting the disease.

## Summary

Currently, there is no cure or treatment for IBV. However, growers can take steps, such as maintaining good air quality and dry litter and providing additional heat to keep birds warm, to reduce stress and limit losses from IBV. Careful use of the limited number of vaccines currently available, in combination with good on-farm management practices, is the best control method at this point. **Disease prevention should be your overall goal, and prevention is best maintained by a strong biosecurity program**. Managing infectious bronchitis is the responsibility of both the grower and the integrator.

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**Publication 3449** (POD-04-20)

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Produced by Agricultural Communications.