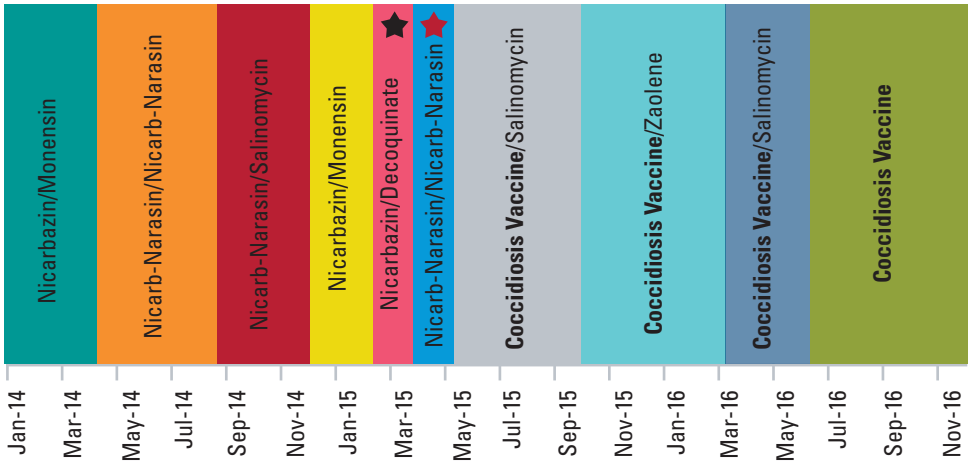
TECHNICAL BULLETIN

Coccivac®-B52 to control a field outbreak of *E. mivati*

Picture 1. Mucosal surface of the duodenal loop. The white streaks are oriented transversely across the intestine in an arrangement often described as ladder-like typical of *E. acervulia.*

Eimeria mivati, one of nine species of *Eimeria* known to cause coccidiosis in chickens, has experienced controversy among poultry pathologists. Some believed it to be a distinct *Eimeria* species that poses a threat to broilers, while others have been doubtful and consider it either a variant of *E. acervulina* or a mixture of the *E. acervulina* and *E. mitis* species. *E. mivati* was first described in 1959 by Edgar and Siebold as a parasite of the upper small intestine, which moved down the intestine as the infection progressed. With the shift from in-feed anticoccidials to vaccination of chickens for coccidiosis control, an *E. mivati* challenge has to be considered. It has been reported that *E. mivati* is pathogenic to chickens, resulting in impaired feed utilization, impaired growth and, sometimes, mortality depending on the level of challenge.

A poultry broiler company in the Southeast US was experiencing loss in performance (body weight and feed conversion), uniformity, gangrenous dermatitis and some mortality. During the first visit, 14 to 30 day old necropsied broilers showed gross lesions which appeared similar to *E. acervulina*, however, gross lesions extended to the midgut (Picture 1). Incidence of 10% and 17% was observed for gross *E. acervulina* and microscopic *E. maxima* in the evaluated broilers, respectively. These results were considered normal for the implemented in-feed anticoccidial program, however, overall performance continued to get worse. As a consequence of the poor performance, the broiler company decided to change their anticoccidial program. Graph 1 shows the history of the anticoccidial program from January 2014 to October 2016. A second visit and posting session was performed 3 weeks later to evaluate the new in-feed anticoccidial program.



Graph 1. Historical anticoccidial program from 2014 to 2016.

★ **1st cases**

★ **Severe cases**

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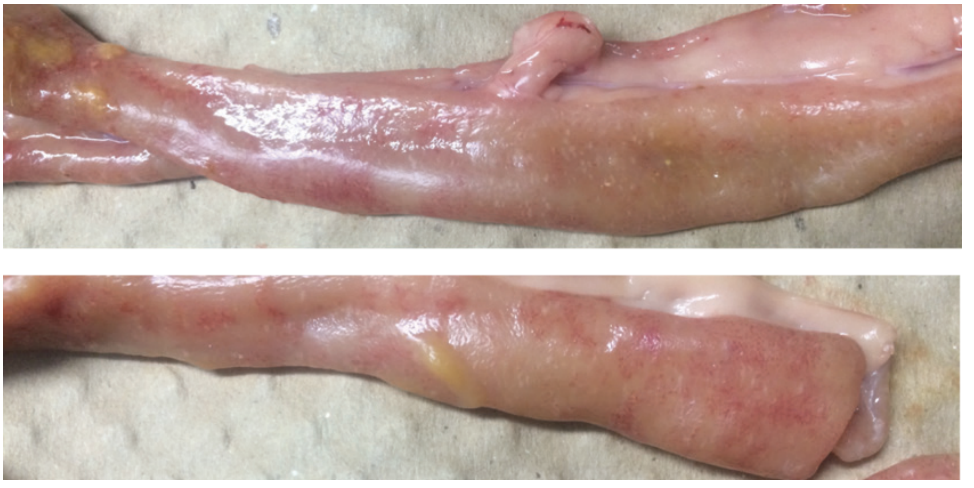
Results showed (Score +1) *E. mivati* lesions mixed with *E. acervulina* in the upper duodenal loop with only few lesions below the dudonenal loop (Picture 2).

Picture 2. Midgut of 21 day old broiler with *E. mivati*. Most of the white lesions are more rounded than observed with *E. acervulina*.



Microscopic evaluation of midgut scrapings confirmed the presence of *E. mivati*.

Since the overall performance of the affected flocks continued to be negatively affected, the broiler company decided to change the in-feed anticoccidal program again. After the change, production indicies did not improve, with flock uniformity getting worse, a feed conversion increase of approximately 4 points, body weight decrease and increased incidence of gangrenous dermatitis. Severe lesions of *E. mivati* in the loop and below Meckle's diverticulum were observed (Pictures 3 and 4).

The incidence of the necropsied birds during Merck Animal Health technical visits are summarized in Table 1. Intestinal samples were collected for further

Picture 3. Midgut of 18 day old broiler. Most of the lesions are more rounded than lesions commonly observed with *E. acervulina*.

Picture 4. Midgut of 28 day old broiler with rounded white lesions more consistent with *E. mivati*.

evaluation by Dr. Steve Fitz-Coy (Merck Animal Health). Microscopic evaluation of midgut scrapings confirmed the presence of *E. mivati* (Table 1).

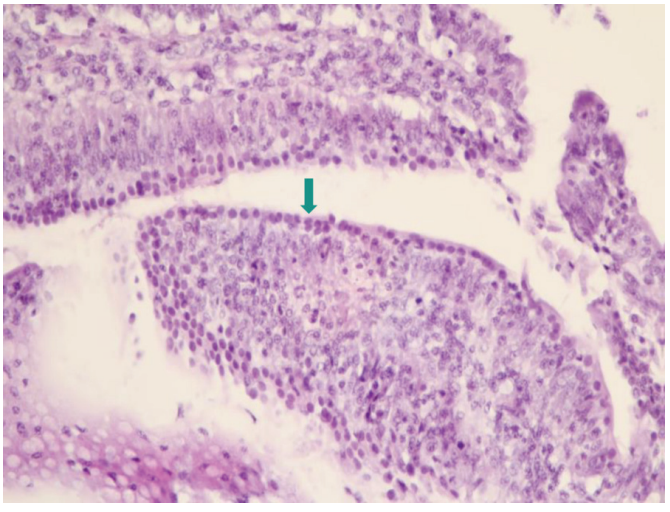
Table 1. Microscopic evaluation of midgut scrapings confirmed the presence of *E. mivati.*

Farm ID	Age Days	Upper SI			Middle SI			Lower SI		
		Ea	Em	E max	Ea	Em	E max	Ea	Em	E max
Farm A	17	3+		2+			1+		1+	
Farm B	17	2+			2+				1+	
Farm C	20	3+				2+	2+		1+	
Farm D	20		2+			3+	2+		1+	
Farm E	20	4+					1+		1+	

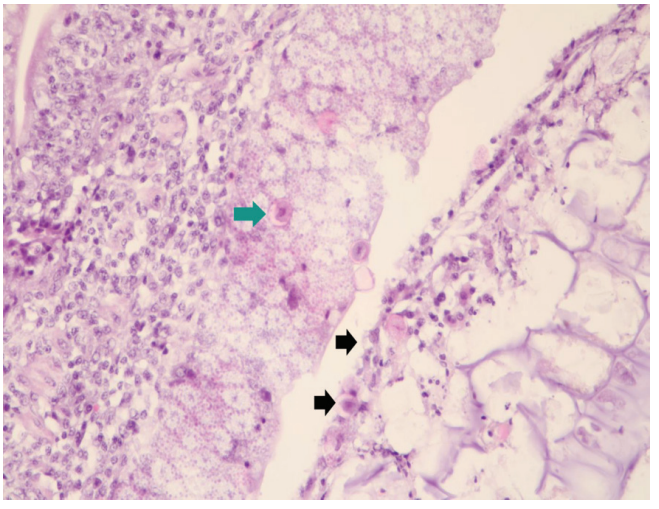
*Ea= *E. acervulina*, Em= *E. mivati,* Emax= *E. maxima*

Futhermore, tissue samples were collected for histopathological evaluation by Dr. Fred Hoerr (Veterinary Diagnostic Pathology, LLC). Clusters of developing coccidia in the middle and distal third of the villus were observed. One characteristic of *E. mivati* is the localized colonization of the tips of the duodenal villus versus *E. acervulina*, which colonizes both the tips and lamina propria of the villus (Picture 5). The small oocysts observed histologically in Picture 6 are morphologically consistent with *E. mivati* known to colonize the villus. Additionally, the distribution and appearance of gross lesions in the intestine may be helpful in diagnosing the correct *Eimeria* species.

Picture 5. Middle small intestine of a 14 day old broiler. Arrow points to clusters of gametes, and oocysts observed within the epithelial layer.



Picture 6. Middle small intestine of a 20 day old broiler with intraepithelial parasite undergoing gametogeny and small oocysts in the epithelium (green arrow) and free in the lumen (black arrow) occuring on the distal portion of the villus. The size of the oocyst and the location is consistent with *E. mivati.*



CONCLUSION

After confirmation of the *E. mivati* outbreak, the company decided to change to a coccidial vaccination program instead of an in-feed anticoccidial program. Coccivac®-B52 was selected, because this is the only commercial coccidiosis vaccine in the US that contains a strain of *E. mivati*. Coccivac®-B52 is a live oocysts vaccine isolated from chickens, prepared from anticoccidial-sensitive strains of *E. acervulina, E. maxima, E. maxima* MFP, *E. mivati and E. tenella* and may be administered to chickens at 1 day of age via coarse spray. After continued use of Coccivac®-B52, the *E. mivati* outbreak was controlled with no new cases observed in the field. Additionally, performance improved in vaccinated flocks achieving historical records resulting in the broiler company's decision to continue the Coccivac®-B52 vaccination program into the fall of 2016 (Graph 1) with sustained positive performance.

In the past, *E. mivati* was controlled with most in-feed anticoccidials, however, with this recent outbreak it's safe to assume that *E. mivati* resistance to in-feed anticoccidials has been developing during the years as has been the case with other *Eimeria* species affecting chickens.

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