

TECHNICAL BULLETIN



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Control of Lymphoid Leukosis Through Eradication of the Virus from Breeding Stock

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Introduction

Lymphoid leukosis (LL) is a disease characterized by tumors of the liver, spleen and various other organs. Generally, the bursa of Fabricius is also enlarged. The onset of disease occurs after 16 weeks of age, in most cases. Mortality from LL is not often a serious problem, but even when birds are not sick enough to die, the disease may affect the bird's immune system and generally depress performance.

The causative agent of LL is the avian leukosis virus (ALV). This is an RNA virus, which acts by transcribing its genetic code into DNA, which is then inserted into the chicken's genome. The bird's infected cells then do the work of virus reproduction, that is, they treat the viral gene as their own and produce more LL virus.

ALV can infect a bird either "vertically," through the hatching egg, or "horizontally," from other birds in the same flock. Breeder hens passing ALV through the hatching eggs are said to be "shedders." The immune system of a chick infected through the hatching egg fails to recognize the virus as a foreign agent and the bird will remain a carrier of LL virus for the rest of its life. Bird to bird, or horizontal, infection will normally cause the production of antibodies. Virus infection in horizontally exposed birds with mature immune systems will be short lived though the virus may persist in a flock for a period of time as it cycles through the population. If the horizontal infection occurs in the first few days of life, before the immune system has become competent, the chicken may not respond with antibody production. Therefore, it may be viremic for the rest of its life, just like a vertically infected chick.

Table 1. Comparison of performance from progeny of parent females shedding the avian leukosis virus against those which were not

Average of tests conducted at Hy-Line International in two successive years

	<u>Eggs Per Hen Day to 285 Days of Lay</u>	<u>% Mortality</u>		<u>Body Weight at 35 Weeks</u>	<u>Egg Weight at 45 Weeks</u>
		<u>10 Days to 20 Weeks</u>	<u>Laying House</u>		
Advantage for Progeny of LL negative parents	35 eggs more	8.4% less	11.6% less	104 gm more	2.1 gm per egg more

Effect of virus positive dams on their offspring:

In 1974 and 1975, tests were conducted at Hy-Line International to see what the effect was of using parent hens which were shedding ALV. In each year, eggs from a parent flock were checked for the presence of virus in the egg albumen. Hens laying virus positive eggs were separated from negative hens and hatching eggs were saved from each group. Pullets from each source were placed side by side at three locations in the first year at two locations the following year. Performance comparisons from these flocks are summarized in Table 1.

The difference in the performance of progeny of positive and negative dams was dramatic. Pullets from ALV negative parent stock laid 35 more eggs per hen day (survivor's production), had less growing and laying mortality, larger body weight, and averaged 2.1 grams per egg (0.9 ounces per dozen) larger egg weight. The progeny of negative dams also had better shell quality.

Results of a study conducted in Canada (Gavora et al., 1980, Poultry Science, vol. 59, pages 2165-2178) are shown in Table 2. This experiment was inspired by the finding that populations selected for egg production had lower ALV shedding rates than control populations. In experiments repeated in two consecutive years,

these workers found that hens which were not shedding the avian leukosis virus produced an average of 21 more eggs than positive "shedder" hens. The positive hens also had later sexual maturity, smaller egg size, thinner shells and higher mortality. It was also found that positive breeders had poorer fertility and hatchability.

In a more recent study conducted at Hy-Line International, chicks were hatched from two breeder flocks, one with a very low shedding rate (0.4%), and the other with no shedders. The former flock carried LL antibodies (29%), while the latter was antibody negative. The chicks from each parent flock were reared in isolation from those of the other flock. At eight weeks of age, half of the pullets from each parent source were exposed to birds known to be carriers of ALV. The results, in Table 3, showed substantial improvement in rate of lay and livability for the birds from LL negative parents. All birds which died were posted. Lymphoid leukosis tumors were found only in progeny of the LL positive parents. Infection with ALV at eight weeks of age had no effect on the progeny, indicating that their immune systems recognized the virus as a foreign agent at this age and eliminated it.

Eradication of avian leukosis virus from

Table 2. Comparison of performance of hens shedding the avian leukosis virus with those which were not

Average of tests in two successive years reported by Gavora, et. al. (1980)

	<u>Eggs Per Hen Day in 365 Days of Lay</u>	<u>% Mortality in the Laying House</u>	<u>Egg Weight at 240 Days</u>
Advantage for hens which were not shedding LL virus	21 eggs more	10.2% less	1.3 grams per egg more

Table 3. Performance of ALV Exposed Pullets

Parental Status For ALV	Age of Progeny Exposure to ALV	% Mortality to 39 Weeks of Age		% Hen Day Production
		Total	LL Tumors	
Negative	Not exposed	3.0	0	72.0
Negative	Eight weeks	4.0	0	71.9
Positive	Congenital	12.0	5.0	65.6
Positive	Congenital & re-exposure at eight weeks	15.0	4.0	64.5

Hy-Line breeders:

In 1975, Hy-Line International began a program to remove ALV shedders from its breeding populations. In each generation, every hen which was used to reproduce pedigreed stock was first tested for the presence of ALV in her hatching eggs by the technique known as complement fixation (CF). Positive chickens were not used.

Most of the breeding populations quickly dropped to low shedding levels, but the virus was not eradicated, even after several generations of repeated testing. In 1985, a more intense eradication program was initiated.

This program included the use of the ELISA technique in place of CF, and testing of males, using tissue culture. All Hy-Line foundations stocks, through the grandparent level, have been free of ALV since mid 1989. The expensive and labor intensive ALV eradication effort worked! Since 1990, all Hy-Line parent stock will have come from LL free grandparent, and are themselves free and producing LL negative commercial progeny.

Conclusion:

Avian leukosis virus can be passed through the hatching egg and reduces the productivity and livability of the chickens which carry it. The virus has been eradicated from Hy-Line breeding stock.



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