VI. SUMMARY

The first chapter describes the effects of *Lactobacillus acidophilus*, *Andrographis paniculata* and *Sargassum wightii* on the growth performance of Lahore pigeons. The basic feed being used for growing pigeons in Kanyakumari district has inadequate amount of zinc, manganese, methionine, cystine and lysine, which have to be corrected by providing suitable supplements for effective performance of pigeons.

Lactobacilli and *Sargassum* powder increase the survival percentage of pigeons whereas *Andrographis* powder has some negative effect on the survival percentage.

Lactobacilli and *Sargassum* powder increase in the length and width of pigeons due to their dietary supplementing property, of which *Sargassum* is more powerful in growth promotion than the former. Feeding with *Andrographis* powder decreases the length and width of pigeon by inhibiting certain metabolic routes.

Lactobacilli help the pigeons to acquire 63 g additional weight and *Sargassum* powder help them to get 65g additional weight whereas *Andrographis* powder reduces up to 34g weight compared to the control.

*Sargassum* powder increases the feed intake towards higher dosages but Lactobacilli and *Andrographis* powder show a marked decrease in the feed intake at higher dosages. The FCR of pigeons increases with increasing dosages of Lactobacilli and *Sargassum*, but it decreases with increasing dosages of *Andrographis* powder.
*L. acidophilus* increases growth parameters by improving the availability of nutrients and simple organic compound, which are the products of digestion, to the intestinal epithelial cells. *A. paniculata* shows negative effects on these attributes of pigeons due to its highly bitter active principles that avert the pigeons not to eat adequate amount of feed. *Sargassum* powder has enhanced the growth attributes by supplying adequate amount of minerals, essential amino acids and fatty acids necessary for the growth of pigeons, and by improving the availability of nutrients to the intestinal cells.

The second chapter deals with the dietary effects of *L. acidophilus*, *A. paniculata* and *S. wightii* on the reproductive performance of Lahore pigeons. The maturation period of pigeons is reduced to 178-162 days by Lactobacilli and to 180 -160 days by *Sargassum* powder, but it is extended to 180 -199 days by *Andrographis* powder instead of 180 days in the control.

*L. acidophilus* has enabled the pigeons to produce 1-3 more egg cycles in three years while *Sargassum* powder has enabled them to produce 1-4 more egg cycles, but *Andrographis* powder has reduced 1 -2 egg cycles in 3 years because of metabolic inhibitions.

Lactobacilli reduce 2.2 – 20.1 days in the egg cycle length while *Sargassum* reduces 2.3 – 21.0 days in the egg cycle length compared to the control. However, *Andrographis* powder has extended up to 3.2 more days in the egg cycle length of pigeons. Reduction in the length of egg cycles facilitates the production of more number of egg cycles during the lifetime.
There is no change in the egg cycle length during the three years of study in pigeons fed with Lactobacilli and Sargassum powder. But, Andrographis powder has slightly increased the egg cycle length every year.

Lactobacilli have reduced 1.2 hours in the interval between the first and second egg, Sargassum has reduced 2 hours but Andrographis has increased it 3 -8 hours compared to control (34±4 - 36±2 hours).

Lactobacilli have enabled a pigeon pair to lay 2 more eggs every year and Sargassum powder enabled them to lay 4 more eggs/pair/year. Andrographis has lowered the egg production up to 2.25±0.11 eggs/pair/year.

Average weight of pigeon’s eggs is 14.32±1.2 g. Lactobacilli add about 0.43 g weight to the eggs, Sargassum powder adds 0.60 g weight to the eggs and Andrographis has reduced the weight by 0.5-1.3 g/egg.

Pigeons fed with Lactobacilli and Sargassum powder produced larger sized eggs than the control but those fed with Andrographis powder produced smaller sized eggs than the control.

The fertility percentage of eggs was usually 82.7 - 83.1. During Lactobacilli treatment it was 83.6- 88.4 % while during Sargassum treatment it was 85.2 - 89.0 %. Andrographis powder had reduced the fertility of eggs up to 74.4 %.

Lactobacilli and Sargassum have reduced the egg abnormalities such as small-sized eggs, large eggs and shell-less eggs while Andrographis has increased the egg abnormalities.
Hatching percentage of eggs is increased to 96.4 -97.6\% by Lactobacilli, 96.9
-97.9\% by *Sargassum* and reduced to 94.3 - 90.1\% by *Andrographis*, instead of
96.4\% in the control.

Lactobacilli reduce the embryo death to 3.7 - 3.1\% while *Sargassum* powder
reduces it to 3.5 - 2.8\%. *Andrographis* powder has increased the embryo death to
5.3 - 9.9 \%. Lactobacilli and *Sargassum* powder have notably reduced squab mortality
whereas *Andrographis* powder has increased the squab mortality.

Lactobacilli increase the fecundity to 83 -84.5\%, *Sargassum* powder increased
it to 76.4 - 87\% and *Andrographis* powder had reduced the fecundity to 66.0\%.

The third chapter discusses the immunomodulation in the blood of Lahore
pigeons in response to the dietary supply of *L. acidophilus, A. paniculata* and
*S. wightii*. The PCV of pigeons is increased to 46.9 -49.8\% by Lactobacilli,
47.1 – 53.6\% by *Sargassum*, and reduced to 45.3\% by *Andrographis* powder, instead
of 46.4\% in the control.

The RBC count is increased up to 2.9 -4.1 \( \times 10^6 \)/dL by Lactobacilli, up to
3.3 -4.9 \( \times 10^6 \)/dL by *Sargassum*, and is reduced to 2.4 \( \times 10^6 \)/dL by *Andrographis*,
instead of 2.8 \( \times 10^6 \)/dL in control. Correspondingly, haemoglobin content is increased
by Lactobacilli and *Sargassum* and reduced by *Andrographis*.

Total leucocytes count is increased to 28.72 \( \times 10^6 \)/dL by Lactobacilli,
to 30.71 \( \times 10^6 \)/ µl by *Sargassum*, and to 29.33 \( \times 10^6 \)/ µl by *Andrographis*, instead of
24.54 \( \times 10^6 \)/ µl in the control.
Heterophils count is increased by *Andrographis* and *Sargassum*, but reduced by *L. acidophilus*.

The basophils count of pigeons is increased by Lactobacilli and *Sargassum*, but decreased by *Andrographis*.

The eosinophils count of pigeons is increased by Lactobacilli and *Sargassum*, but reduced by *Andrographis*.

The monocytes count of pigeons is increased by Lactobacilli, *Andrographis* and *Sargassum* powder. Likewise, the lymphocytes count of pigeons is increased considerably by Lactobacilli, *Andrographis* and *Sargassum* powder.

Total serum protein is increased to 5.9 g/dL by Lactobacilli, to 6.2 g/ dL by *Sargassum*, and is reduced to 4.7 g/dL by *Andrographis*, instead of 4.9 g/dL in the control.

Albumin content of pigeon’s blood is increased by Lactobacilli and *Sargassum*, but reduced by *Andrographis* powder.

Globulin content of pigeon’s blood is increased by Lactobacilli, *Andrographis*, and *Sargassum*.

Total cholesterol content of pigeon’s blood is increased to 212 mg/ml by Lactobacilli and decreased to 164 mg/ml by *Andrographis*, and to 160 mg/ml by *Sargassum*, instead of 190 mg/ml in control.
Serum triglycerides content of blood is, instead of 210 mg/ml in control, increased to 262 mg/ml by Lactobacilli, 267 mg/ml by *Andrographis*, and to 280 mg/ml by *Sargassum*.

Lactobacilli up regulates the expression of $\alpha_1$-anti-trypsin, $\alpha_2$-acid glycoproteins and Beta lipoproteins while down regulating the expression of albumins, $\alpha_2$-Macroglobulin, Haptoglobins, Transferin and $\gamma$-globulins.

*Andrographis* powder up regulates the expression of $\alpha_1$-anti-trypsin, $\alpha_2$-acid glycoproteins, Haptoglobins and Beta lipoproteins while down regulating the expression of albumins, $\alpha_2$-Macroglobulin, and $\gamma$-globulins.

*Sargassum* powder has up regulated the expression of $\alpha_1$ anti-trypsin, $\alpha_2$ acid glycoproteins, and Beta lipoproteins while down regulated the expression of albumins, $\alpha_2$-Macroglobulin, Haptoglobins and $\gamma$-globulins.

From the above said results, it is concluded that both *L. acidophilus* and *S. wightii* promote the growth and reproductive performances of pigeons, so that they are suitable feed supplements for pigeons. However, the latter is more powerful than the former. In the meantime, *A. paniculata* significantly affects the growth and reproductive characteristics of pigeons. Therefore, *S. wightii* is believed to be the best feed supplement to pigeons.