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IMMUNIZATION OF CHICKENS WITH IRRADIATED LARVAE OF *STRONGYLOIDES AVIUM*

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SUMMARY

Thirty chickens were vaccinated, by subcutaneous route, with about 12,000 larvae of *Strongyloides avium* previously irradiated with 140 kiloroentgens. Thirty days later, both vaccinated and control chickens (8) were infected with about 1,500 normal larvae.

The mean numbers of worm recovered from vaccinated and non-vaccinated chickens (controls) were 6 (0.4%) and 262 (17.4%), respectively. The worms recovered from the former chickens displayed underdeveloped genital apparatus, no eggs having been observed in their uterus.

The chickens under experiments were thus seen to have got immunized with a single dose of the vaccine.

INTRODUCTION

Several investigators have reported the immunization of hosts by irradiated larvae of certain nematodes. JENNINGS et al. [8] studied the action of X rays on the larvae of *Nippostrongylus muris*. JARRET et al. [8] succeeded in their attempt to vaccinate calves with irradiated larvae of *Dictyocaulus viviparus*. MILLER [12] made the same experiment, on dogs, with irradiated larvae of *Ancylostoma caninum*. RADKE & SADUM [14] and SZUMLEWICZ-PERLOWAGORA & OLIVER [15] also studied the action of irradiation on *Schistosoma mansoni*.

CHAIA & MURTA [2] immunized rats with irradiated larvae of *Strongyloides (ratti + venezuelensis)*.

The present paper studies the vaccination of chickens with irradiated larvae of *Strongyloides avium*.

MATERIAL AND METHODS

In this experiments there have used thirty-eight chickens, one month old, with no helminth infection. Thirty chickens were vaccinated, by subcutaneous route, with about 12,000 larvae of *Strongyloides avium* irradiated with 140 kiloroentgens, the remaining ones (8) being taken as controls.

One month later, both vaccinated and control chickens were infected, by subcutaneous route, with about 1,500 normal larvae of *Strongyloides avium*. Eight days after infection the chickens were sacrificed and their caecum examined by McGEE et al. [11] technique, the worms being counted under a dissecting microscope and examined with a microscope (× 160).

Strongyloides *Strain* — The *Strongyloides* strain used in this experiment was from feces collected on the caecum of some chick-

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ens from the Market of Belo Horizonte. The feces were mixed with wet, granulated animal charcoal and left at 26°C for 2 days, after which filarioid larvae were removed from the coals by BAERMANN's [1] method.

Several 0.1 ml-samples of such larvae were left, drop by drop, on a glass slide and counted under a dissecting microscope. This *Strongyloides* strain has kept in laboratory by successive infections of chickens (each 3 months).

Worm Examination — The worms were collected by the method of McGEE et al. [11] and then fixed in Ble's fixative, placed in 70% alcohol with 5% glycerin added and, finally, mounted in jelly glycerin, a technique employed by LITTLE [10]. The worms were examined in microscope (× 160).

Irradiation of Larvae — The larvae were placed into plastic tubes in volumes, at most, 1 cm high and, then, irradiated with Gama-cell 220. This apparatus displays the following characteristics: Cobalt-60, half life-5.2 years with a dosage of 287 kilorads per hour in irradiating position, thus giving an average of 4,715 kiloroentgens per minute. The present activity of the apparatus is 3,457 curies. For gamma emissions, the roentgen is considered similar to the rad, with approximate variation of 5%.

RESULTS

The mean numbers of worms recovered from both vaccinated and control chickens were 6 (0.4%) and 262 (17.4%), respectively. The chickens that had been vaccinated showed underdeveloped genital apparatus. There has also been observed the absence of eggs in the uterus of such worms. Table I may be referred to for further data.

DISCUSSION

LEVIN & EVANS [9] reported that *Trichinella spiralis* worms from irradiated larvae had proved to be sterile. This very same fact was observed in ancylostomiasis (dogs) by MILLER [12] and in strongyloidosis (rats) by CHAIA & MURTA [2].

SZUMLEWICZ-PERLOWAGORA & OLIVER [15] remarked temporary paralization in the development of *Schistosoma mansoni* worms.

JARRET et al. [7] achieved immunization in calves with irradiated larvae of *Dictyocaulus viviparus*. MILLER [13] succeeded in vaccinating dogs with irradiated larvae of *Ancylostoma caninum*. CHAIA & MURTA [2], too, achieved immunization in rats by vaccinating them with irradiated larvae of *Strongyloides* (*venezuelensis* + *ratti*).

In the present experiment the Author also observed that chickens vaccinated with irradiated larvae of *Strongyloides avium* got

TABLE I

Results obtained in chicken vaccinated with 12,000 of irradiated larvae (140 kr) and infected later on, with normal larvae of *Strongyloides avium*

Group	Chicken used in the experiment: no. of chicken	no. of larvae infected per chicken	Worms recovered 8 days after infection: Mean number	Mean %
A	30	1,500	6 *	0.4
B	8	1,500	262	17.4

A — A chicken infected 30 days after having been vaccinated
B — Control chicken
* — Most worms were immature

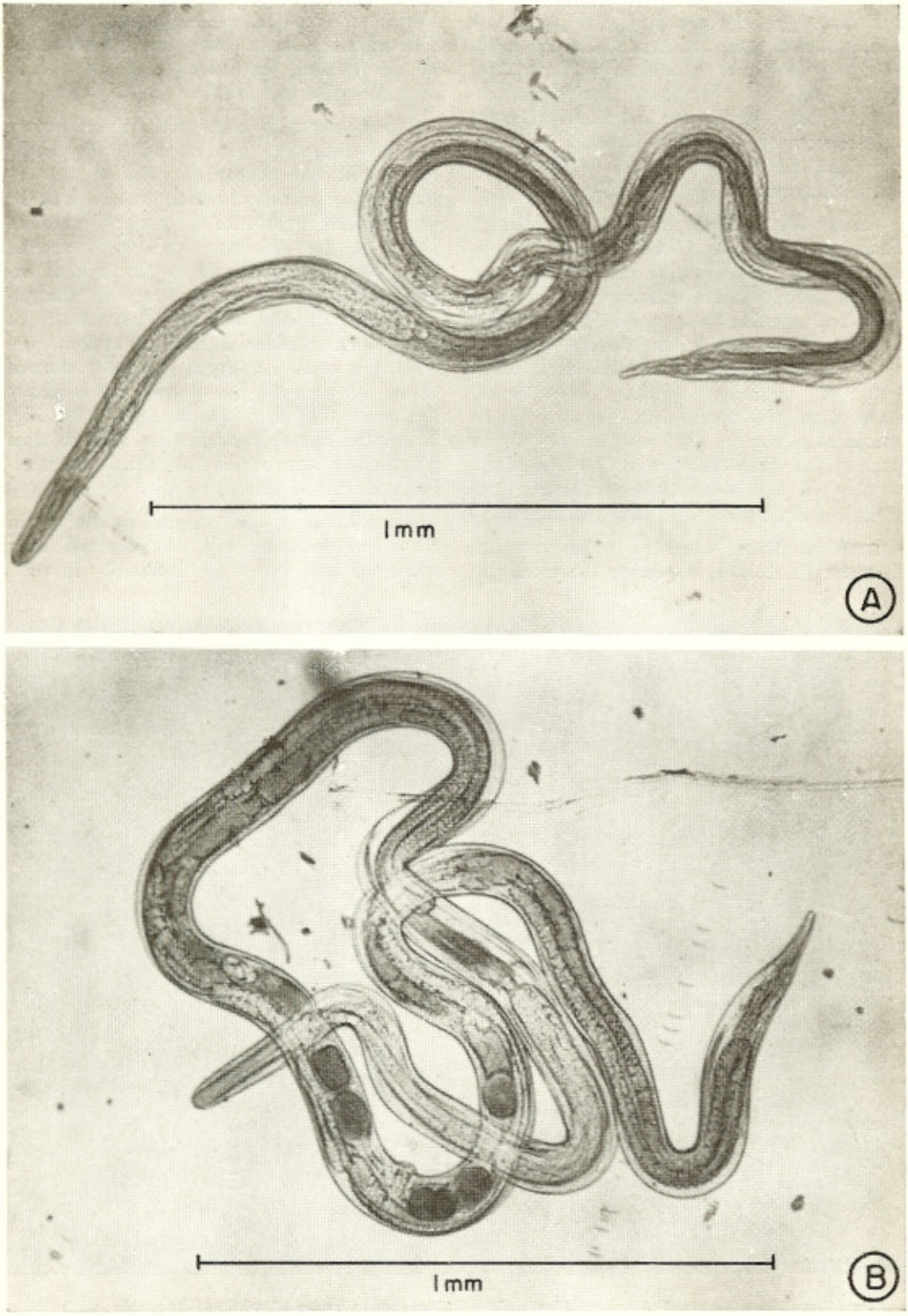

Fig. 1 — Parthenogenetic females of *Strongyloides avium*. A) Worm from vaccinated chicken; B) Normal worm

immune, since the percentage of worms recovered from these animals was much lower (0.4%) than that obtained in the control group (17.4%). Moreover, the worms recovered from vaccinated chickens presented underdeveloped genital apparatus, no eggs, therefore, having been found in the uterus of parthenogenetic females (Fig. 1, A).

CRAM [3] observed, for the first time (1929), *Strongyloides* worms in the caecum of chickens (*Gallus gallus*) and named this new species *Strongyloides avium*. TRAVASSOS [17] described another new species of strongyloides — *Strongyloides oswaldoei* — that he observed to be present in the small intestine of chickens (*Gallus domesticus*). CRAM [4], in the same year, detected *Strongyloides avium* in the caecum and lower part of the small intestine of 2 white birds, namely, in the junco (Junco hyemalis hyemalis) and in the coot (Fulica americana).

Later on CRAM [5] observed, to his surprise, that the filarioid larvae from the small intestine of chickens when employed to infect other chickens were found, afterwards, to be located, exclusively, on the birds' caecum under the form of adult worms.

We are strongly convinced the species we are experimenting with to be *Strongyloides avium* for the following reasons: a) although the parasite location on the host be of no great importance, it is worth mentioning that the specimens we were dealing with were always found to be located, exclusively, on the host's caecum; b) the parasitic female described by TRAVASSOS [17] as being *Strongyloides oswaldoei*, besides presenting a small esophagus, generally showed about 50 eggs in its uterus, which shows the species we are experimenting with Fig. 1, B to be *Strongyloides avium*, since it does not display any of the two chief characteristics described above.

Some pathological aspects occurring in *S. avium* infection can be observed only when the host is heavily infected. In such

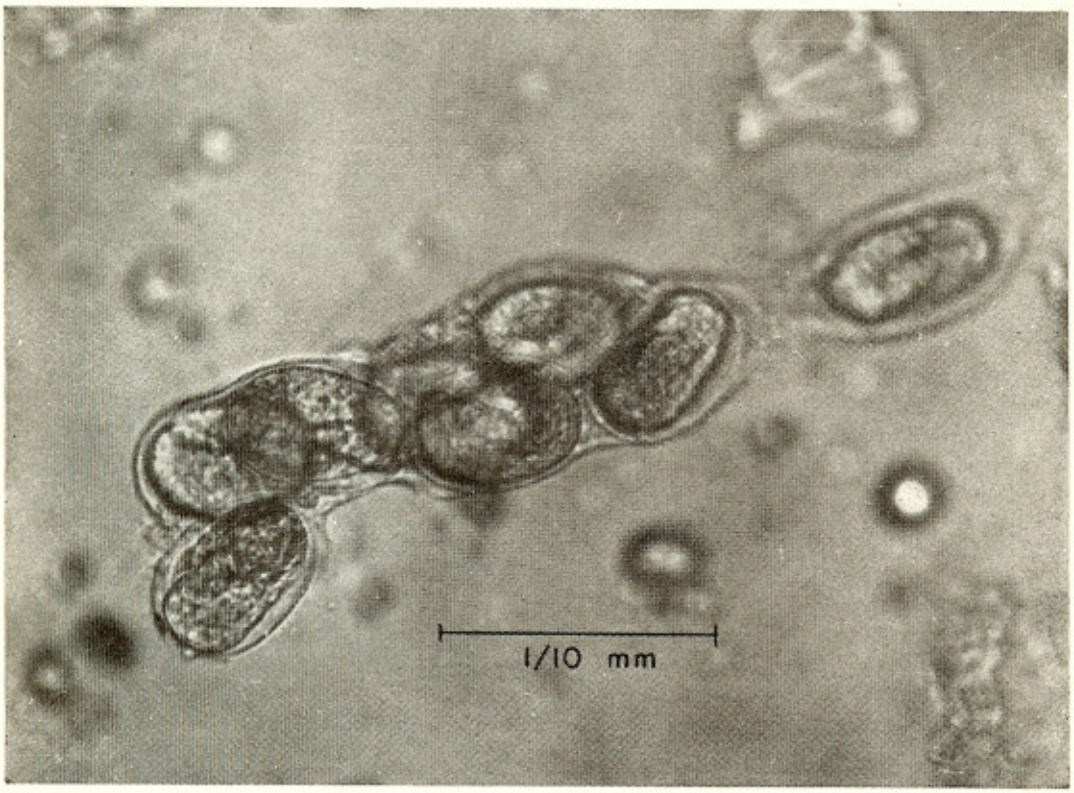

Fig. 2 — Eggs of *Strongyloides avium*. These eggs were eliminated together with fragments of intestinal mucosa

a case the host very frequently ejects diarrheic feces with a lot of mucus and blood, the eggs being eliminated together with fragments of the intestinal mucosa (Fig. 2).

Although *S. avium* does not prove to be such a problem as to discourage the breeding of chickens, since in modern coops the birds are hardly in contact with the soil, nematode infection being then avoidable, we find it interesting to immunize the chickens against such infection by using a vaccine from irradiated *Strongyloides avium*.

RESUMO

Imunização de pintos com larvas irradiadas de Strongyloides avium

Trinta pintos foram vacinados por via subcutânea, com uma média de 12.000 larvas de *Strongyloides avium*, as quais foram irradiadas com 140 kiloroentgens. Trinta dias após a vacinação, os pintos vacinados e os contrôles foram infetados com uma média de 1.500 larvas normais.

Os números médios de vermes recuperados nos pintos vacinados e nos contrôles foram, respectivamente, de 6 (0,4%) e de 262 (17,4%). Os vermes provenientes dos pintos vacinados não apresentaram com o aparelho genital desenvolvido e, conseqüentemente, não foi observada a presença de ovos no útero.

Os pintos ficaram imunizados apenas com uma única dose da vacina.

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