

DOMINION OF CANADA
DEPARTMENT OF AGRICULTURE
HEALTH OF ANIMALS BRANCH.

BULLETIN No. 25

**INTESTINAL PARASITES OF POULTRY, THEIR
PREVENTION AND TREATMENT**

BY

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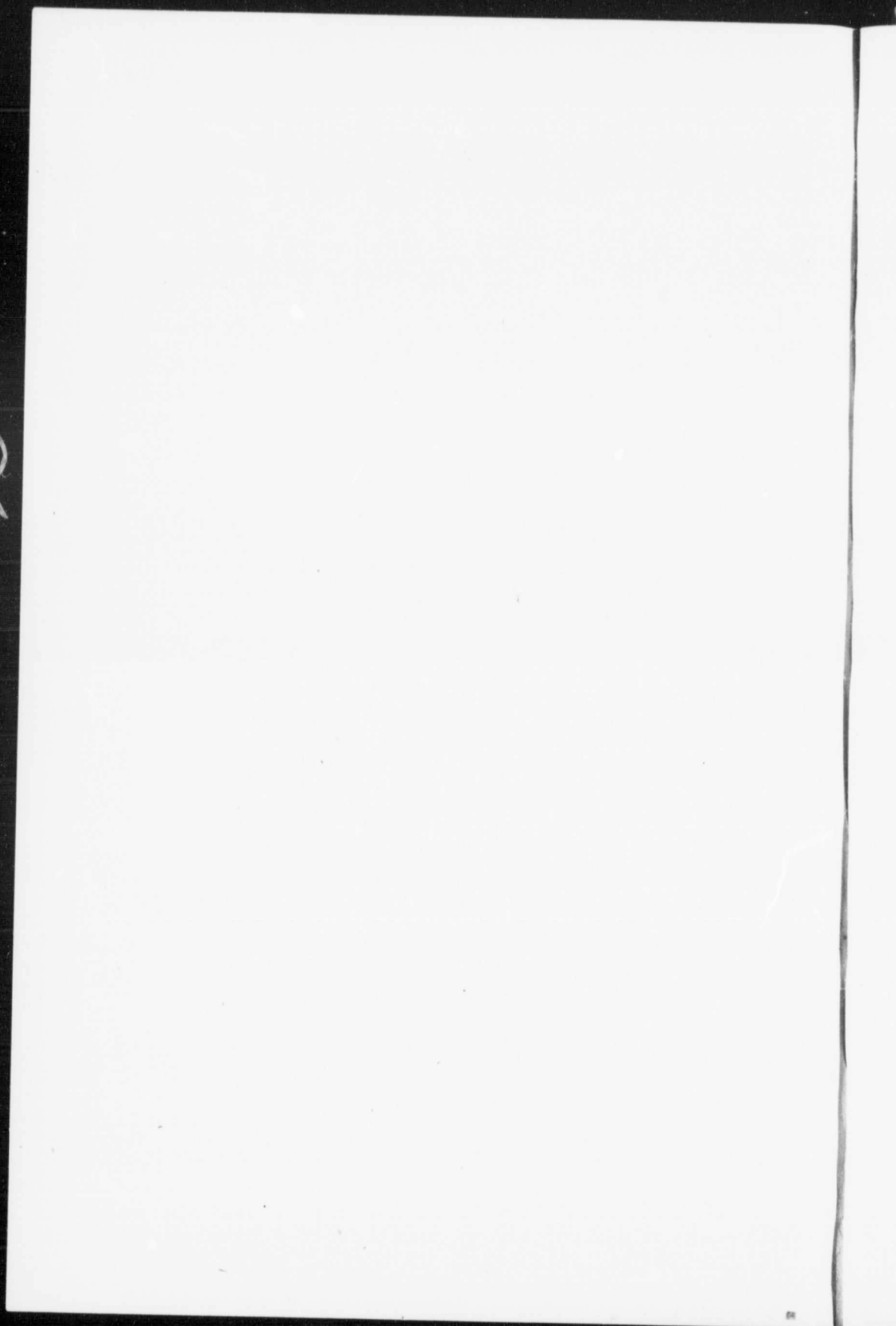
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OTTAWA

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1917



Honourable MARTIN BURRELL,
Minister of Agriculture.

SIR,—I have the honour to submit to you a Bulletin on intestinal parasites of poultry by Dr. A. B. Wickware, of the Biological Laboratory, Ottawa.

For a number of years this Branch has endeavoured to study the disorders affecting poultry with a view of assisting poultry raisers. The increased demand in this connection supplemented by the request of Mr. J. H. Grisdale, Director of Dominion Experimental Farms, has resulted in your permission to specially detail Dr. A. B. Wickware to this work with a view of safeguarding this valuable industry from the severe losses caused by parasites, infectious diseases, etc.

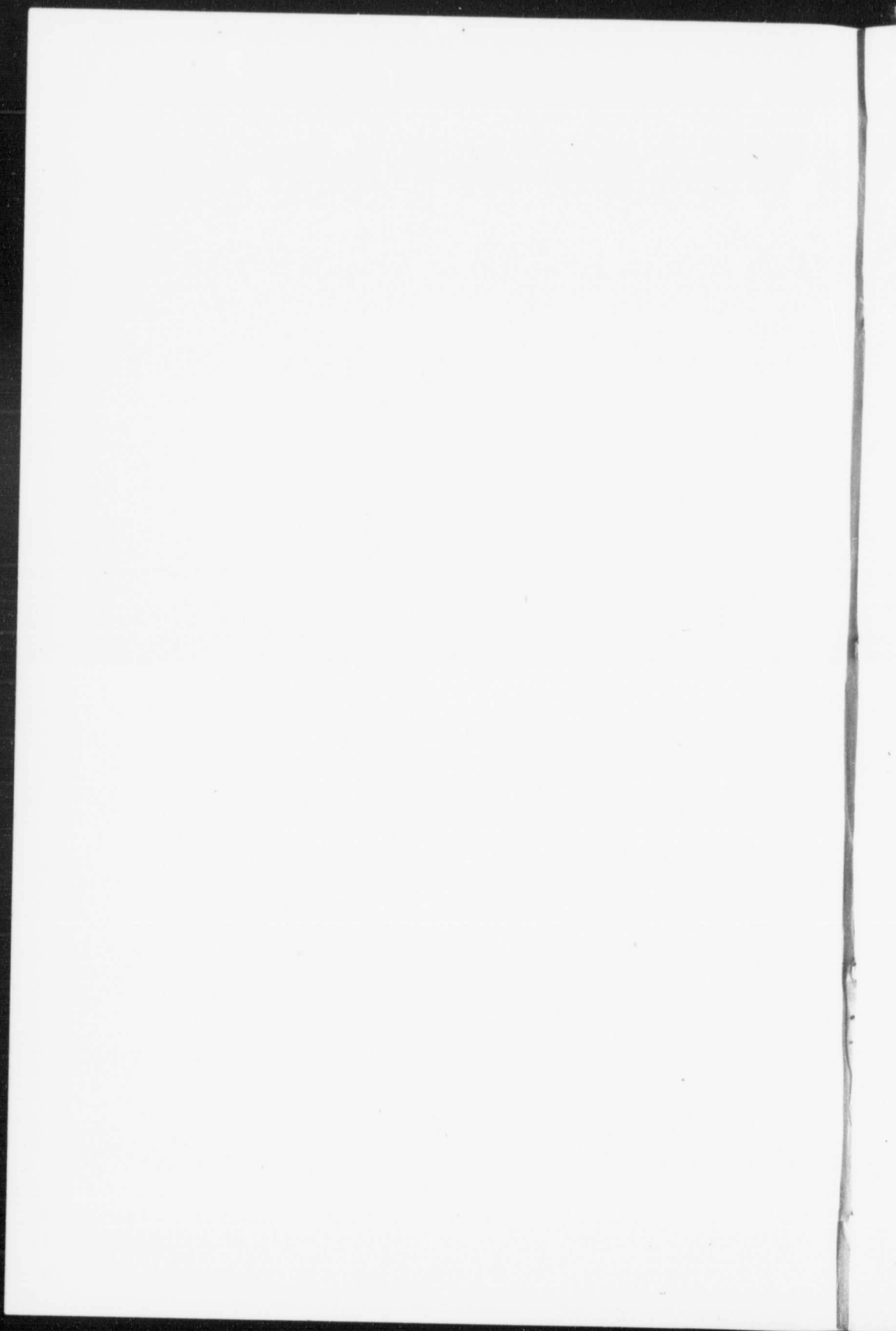
The actual money loss each year from preventable causes is at least ten per cent of the yearly production of the poultry industry. As the yearly production is in the neighbourhood of fifty millions of dollars, an increased effort toward the prevention of this loss is justifiable.

I therefore request that this be printed as Bulletin No. 25.

I have the honour to be, sir,

Your obedient servant,

F. TORRANCE,
Veterinary Director General.

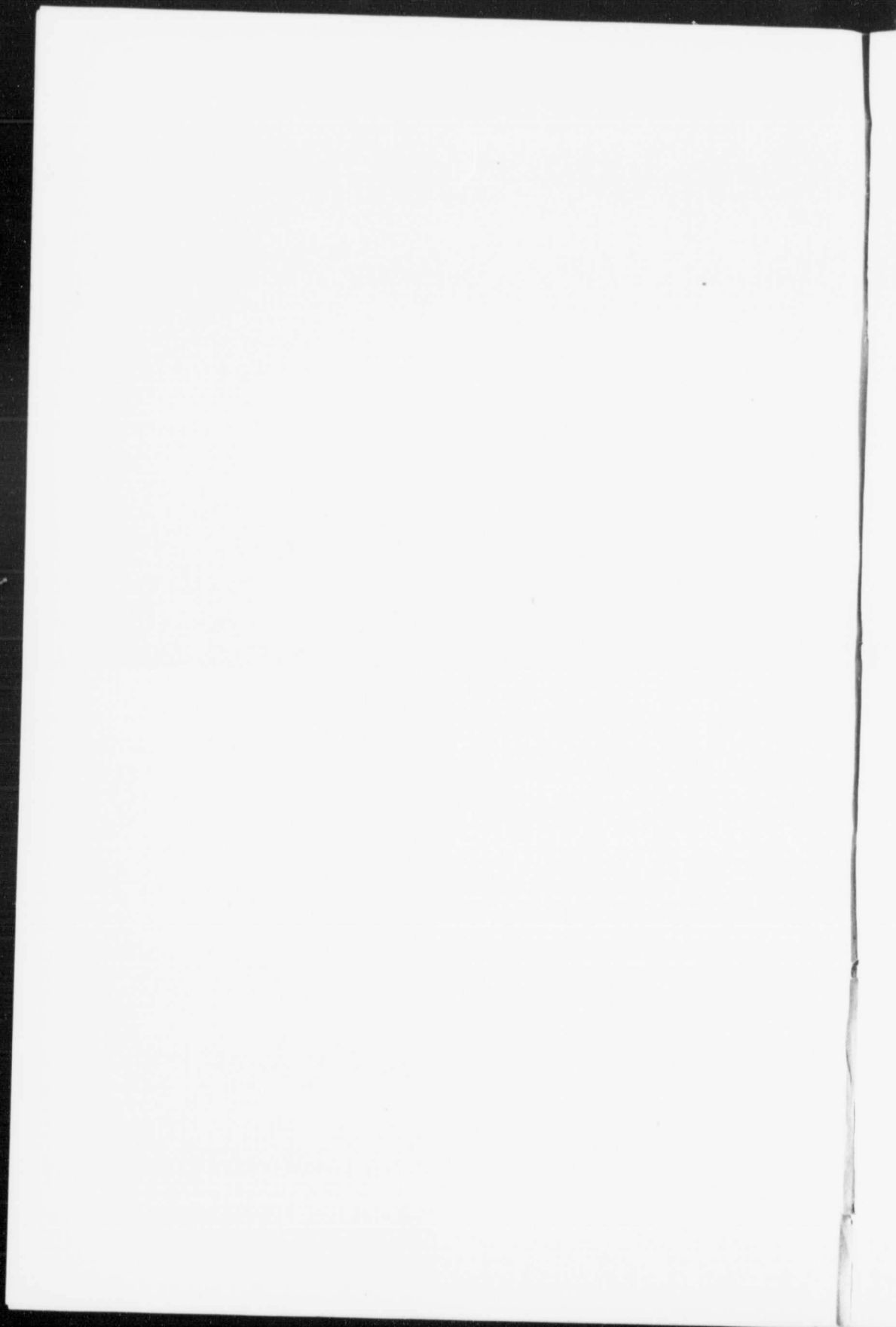


PREFACE.

From a survey of the various disorders of poultry, none appear more troublesome and vexing to the producer than the problem of infestations with intestinal parasites. It is true that other affections of a more devastating nature, such as tuberculosis, occur, but as the cause of general unthriftiness and unproductiveness amongst fowls, these parasitic invasions represent insidious maladies which though not always fatal, render the keeping of infected flocks decidedly unprofitable.

To any one who has been engaged in the routine examination of diseased fowls, the percentage of birds harbouring intestinal parasites strikes the observer as remarkable.

Realizing then, the economic importance of successfully combating these affections, it seems that a bulletin dealing exclusively with these parasites, will stimulate the average breeder to greater efforts along sanitary lines with a view of eradicating these obnoxious pests.



INTESTINAL WORMS IN POULTRY.

It is only within comparatively recent years that poultry diseases have attracted more than passing notice. This was unfortunately due to the fact that poultry culture had only been considered as a subsidiary feature of mixed farming, usually affording pin-money to the farmer's wife. During the last decade, an educational campaign instituted by the Departments of Agriculture, both Federal and Provincial, has led to considerable enlightenment, and now no feature of farming and individual enterprise is receiving more careful study than the rearing of poultry both for market purposes and egg production.

Many and varied are the disorders and affections which are the heritage of poultry, and it is well in advocating their welfare, that one stop to consider how very essential is this industry, and how dependent on it are our domestic needs.

As stated in the preface, no subject seems more pertinent than a résumé of the intestinal parasites of poultry in Canada, and the methods of eradicating as well as preventing infestations with these troublesome worms.

Intestinal parasites are subdivided into three classes:—

1. Tapeworms (Cestodes).
2. Round Worms (Nematodes).
3. Leaf-like Worms or Flukes (Trematodes).

In order of importance as to parasites injurious to the health of fowls and frequency of invasion, we will first consider the tapeworms observed in Canada, dealing with the microscopic and naked eye appearance, symptoms exhibited by infected birds and known methods of prevention, and treatment.

DESCRIPTION OF TAPEWORMS.

The Tapeworm or Cestode, although varying in length and breadth, is rather uniform in shape, being an elongated, flat, ribbon-shaped worm tapering from the anterior extremity or head to the posterior end. It has frequently been described as funnel-shaped, but this appellation appears more appropriate when speaking of each separate proglottis or segment.

These worms vary in length from $\frac{1}{50}$ of an inch (.5mm.) quite incapable of being seen without a microscope to those four to five inches (130 mm.) long, and easily discernible with the naked eye. The smaller forms are found in the duodenum or first portion of the small intestine, while the larger worms usually frequent the ileum or lower end of the small bowel. Each worm consists of a head and neck (Scolex) and a number of segments which enlarge as they converge towards the posterior extremity. The head is usually armed with a formidable set of hooks together with four suckers the latter in some species being surmounted by a limited number of spines or hooklets. It is by means of this armament that the worm is able to attach itself firmly to the mucous membrane or lining of the intestine and in many instances so fortify itself as to stubbornly resist medicinal efforts at removal. In colour it is white or creamish-white and can readily be distinguished from the darker surrounding tissues and bowel content.

LIFE HISTORY OF A TAPEWORM.

The life history of numerous tapeworms found in man and certain of the lower animals has been fully worked out, and from present knowledge it is probable that the tapeworms of chickens follow a similar course of development.

When a fowl is infected, the tapeworm developing in the intestine produces segments which are filled with ripe eggs. These segments are voided with the droppings and the eggs are set free. The eggs usually find their way, through mechanical or other means into damp places where they are taken up with the food, in the drinking water or directly from the droppings by insects or other animals which are spoken of as secondary hosts. The tapeworm does not then develop into the original mature type found in the fowl, but the eggs, after reaching the stomachs of the secondary host are acted upon by the digestive juices, the shells are dissolved and the young forms or embryos set free. These young forms then burrow through the stomach or intestinal wall to pass into a resting stage (Cysticercoid, see Plate III, Fig. 1) in some organ or tissue such as the liver or muscles of this intermediate host. In the event of this host being a fly or other insect, it in turn is taken in as food by a fowl. On reaching the stomach, the head of this young worm is extruded from the small bladder-like sac which ruptures, and attaches itself to the inner lining of the intestine, where it commences to develop. After reaching the mature stage, ripe segments are again formed and the complete life cycle is once more carried out.

The resting stage or cysticercoid consists of a small bladder about the size of a pea filled with watery fluid, and each of these bladders contain a young tapeworm consisting of only a head and neck. In order to develop into a mature worm, this little sac must be eaten by a fowl.

MODE OF INFECTION.

Tapeworm parasites are developed from ova or eggs which are voided with the droppings either separately or contained in an engorged segment. The latter, when the ova are ripe, becomes detached from the main body of the worm which, as previously stated, is composed entirely of numerous segments, joined together. Nearly every tapeworm requires an intermediate host for development, or in other words must complete part of its life, while developing from the egg, in some other animal body such as snails, earthworms, etc. The complete life history of the majority of tapeworms in poultry is imperfectly understood owing to the small amount of time previously devoted to this research. Recently, however, this problem has been receiving considerable attention, and when studies are completed will undoubtedly tend to remove many obstacles in the way of prevention.

During recent investigations into the life histories of certain species of tapeworms, it has been found possible to transmit and infect other fowls through the feeding of flies and earthworms which had previously been allowed to come in contact with contaminated droppings. It has been proven that certain definite stages of the life cycle are passed in these intermediate hosts. It can roughly be understood from the foregoing how an endless chain is established in the life cycle of these parasites and how readily infection of other fowls takes place when brought into contact with diseased birds, or placed in quarters and runs contaminated with droppings containing ripe eggs.

SYMPTOMS OF TAPEWORM INFECTION.

Flocks of fowls infected with tapeworms may show general infection, or a few birds only may be found presenting an abnormal appearance. The disorder does not confine itself to any particular breed, although improper selection of fowls for breeding purposes probably renders them more susceptible or liable to infection.

The first symptom noticed in cases of moderate infection is a ravenous appetite accompanied by an excessive desire for water. Where the infection is heavy, however, food may be entirely refused by one or a large number of fowls. There is general

unthriftiness of the birds, reduction in the egg yield, and a gradual wasting away of the flesh until the affected individuals become weak and emaciated. A yellowish-white diarrhoea may be present but not always a constant symptom, and in the discharges, which are voided more frequently than usual, if examined carefully, can usually be found ripe segments ready for further development. The birds appear anaemic or bloodless; their combs and wattles changing from the ordinary bright red to an almost complete white or faint pink. In fowls, such as Leghorns, a shrinkage of the comb is sometimes noticeable, similar to that observed during the period of moulting. The feathers also present a change from the normal glossy sheen to a dry harsh appearance with more or less shedding. The birds mope around with drooped wings, separate themselves from the remainder of the flock, and may linger in this condition for an indefinite period, or in many cases die. Frequently, the eyes have an unnatural stare, lameness may be observed, and in certain instances a partial paralysis or impaired use of the legs is present.

A few outbreaks have been observed where the fowls retained a thrifty appearance in spite of the presence of the small microscopic parasite shown in Plate I, fig. D. On opening several of these birds, the large amount of fat throughout the abdominal or bowel cavity made one skeptical as to the finding of any grave disorder. On slitting open the intestine, however, a marked inflammation of the first or duodenal portion was observed, and in one instance a large ulceration which had almost resulted in perforation of the bowel. On microscopic examination, miniature tapeworms were found in large numbers, thus accounting for the diarrhoea and general listlessness noted.

These in general are the symptoms or indications of parasitic invasions, but appearances are sometimes very deceiving and no symptom or group of symptoms can be outlined which are absolutely characteristic of the presence of intestinal worms. The symptoms presented may be very suggestive, but suspicions must be verified by finding mature worms in the lumen or interior of the intestine or segments in the droppings. The worms can best be demonstrated by slitting open the bowel under water placed in a small pan or dish and carefully washing out the contents, when the parasites can be observed adhering to the inner lining.

A few organic diseases, such as tuberculosis, present similar symptoms, and one can only tell the difference between these affections by opening the fowls, carefully examining each organ and slitting open the entire bowel for observation. In acute cases of tuberculosis, the liver and spleen are dotted with white spots varying in size from a pin-head to a pea, while in chronic cases large areas or tubercles may be found as large as beans. These changes are not present in tapeworm infestations, the bowel only showing an alteration.

DESCRIPTION OF ROUND WORMS.

Unlike tapeworms, which have no separate sex, both male and female organs of reproduction being combined in each individual worm, Round Worms occur as male and female parasites. The female, although larger, has the same appearance as the male (see Plate I, figs A and B). These worms vary in length from $\frac{1}{25}$ of an inch (1mm.) to about three inches (75mm.). They are round or cylindrical in shape, tapering at both ends, and throughout life retain the same characteristic appearance, no portion of the body becoming detached as in tapeworms. Reproduction takes place, however, as in the latter by the development of embryos or young worms from eggs passed in the droppings. The life histories of Round Worms are also wrapped in considerable obscurity, but as regards practical knowledge, the fact that cohabitation of normal and affected fowls and inadequate disposal of dead birds and droppings serve to propagate these disorders, is sufficient for successfully dealing with outbreaks.

SYMPTOMS OF ROUND WORM INFESTATION.

The clinical appearances mentioned in regard to fowls affected with tapeworms holds good with reference to birds infested with Round Worms. Depending upon the degree of infection, one may find variations from fowls in apparently perfect health and suffering no inconvenience to those showing the general characteristics of infestations with tapeworms. It therefore appears unnecessary to supplement what has already been written, as in well marked cases the symptoms are almost identical. It is not so easy, however, to detect the presence of Round Worms owing to the fact that eggs of microscopic size are the only portions of Round Worms voided with the droppings. Occasionally, a mature parasite may be passed, but this is not so constant as the elimination of ripe segments from tapeworms, and may be termed the exception and not the rule.

It may, therefore, be taken as a general finding that fowls harbouring even small numbers of tapeworms usually show some deviation from the normal, while Round Worms may be present in large numbers without producing untoward results. Death in many cases may result from mechanical obstruction of the intestines due to the presence of a large mass of Round Worms, but it is not the heavy mortality with which one has to deal. As stated in the preface, general unthriftiness and unproductiveness are the changes wrought, and it is probable that the impaired health of the fowls is due, not so much to the actual presence of intestinal parasites, as to the poisons which they produce in the intestine. These poisons (toxins) may be absorbed with serious results to the health of the fowl.

FLUKES OR TREMATODES.

Flukes or Trematodes are leaf-like worms inhabiting the gullet (oesophagus) and intestines. A number of these parasites have been described as present in fowls, but as no serious disorder appears to follow their invasions, it is inadvisable to enter into details regarding this type of worm. While infestations may, and probably do occur in Canada, no single parasite of this class has been recorded in fowls coming under our observation.

PREVENTION AND TREATMENT.

As heretofore stated, all breeds of fowls are susceptible to infection, some undoubtedly to a greater degree due to lack of virility from improper selection of breeders. It is therefore essential that birds showing marked vigour and perfect type development be used as breeders. By proper methods of selection a strain of fowls with a high degree of resistance may be bred which will prove more or less refractory to invasions with intestinal worms. It must not be inferred, however, that by this means alone can infection be prevented, but as a starting basis for establishing immunity to numerous disorders, perfect physical development and constitutional vigour offer the prime requisites.

In dealing with Tapeworm and Round Worm infestations two methods of procedure are presented for consideration: Prevention and Treatment. To be beneficial both must be assiduously applied so interdependent are they and so worthless when one is adopted to the utter exclusion of the other. Preventive measures are more than half the battle and must be diligently carried out if lasting benefits are to accrue. As a first measure, the flock must be carefully examined and all birds showing suspicious symptoms isolated from the others. The isolated fowls together with the remainder of the flock should then be treated with the chosen medicinal preparation. It is advisable to keep them closed in the quarters during treatment where proper disinfection of the droppings may be carried out.

Providing fresh runs are available, it is advisable to place the treated birds in new surroundings. This is practicable in rural districts and should be carried out where possible, but in regard to the average city breeder, the allotted ground for fowls is ordinarily very small and must be used throughout the entire year.

The runs should be ploughed or thoroughly spaded and saturated with a strong solution of unslaked or quick lime to which may be added a 5 per cent solution of a good disinfectant. A lime solution may be made by adding 50 pounds of stone lime to the barrel of water, and should be applied full strength with a spray pump, brush or old broom to all parts of the quarters and runs occupied by the fowls. The floors should then be covered with a thin layer of coarse sand and air-slaked lime in the proportion of one part lime to ten parts sand. The ground should also be covered with air-slaked lime as drying usually destroys the eggs which are still present. During the course of treatment, the utensils should be cleansed every day to prevent reinfection, and the droppings either burned or disinfected. In regard to the droppings, the surest method of destroying the ova is by burning, and this is advocated wherever possible.

MEDICINAL TREATMENT.

Various drugs and decoctions have been advocated for ridding fowls of intestinal worms and while some of these are fairly beneficial, others are utterly useless. For some months investigations have been under way for determining the relative value of most of the drugs recommended as specifics for tapeworms, but unfortunately the results in our hands have not been as gratifying as was anticipated.

In order to meet the popular demand, a treatment must not only be effective but must also be practicable, and many of the drugs advocated are not easily procurable, and even when available, a number of these remedies apparently lose strength if kept for any length of time.

One remedy usually in every household, which thus far has given the best results, is turpentine in doses of one to two teaspoonsful for each fowl.

There are two methods of administering turpentine and these are outlined as follows:—

First: Probably the best method of giving turpentine is by placing it directly in the crop by means of a small piece of hollow rubber tubing. This method of administration is, in reality, very simple, although at first glance apparently difficult. The affected fowl is held by an assistant while the operator grasps the head firmly with his left hand, pulling the neck of the bird out straight so that the top of the head will be in line with the neck. The tube is being then oiled, gently passed into the mouth and gradually worked down the gullet into the crop. After a few attempts the operation is easily performed. The turpentine may then be passed through the tube by employing a small medicine dropper. The rubber tubing which should be about one-quarter of an inch in diameter can be procured together with the medicine dropper at any drug store.

Second: The drug may also be given by using the medicine dropper alone or by employing a teaspoon. The only drawback to placing turpentine directly in the mouth is the extreme irritant effect which is followed by very alarming symptoms. Frequently the treated birds will shake their heads, manifest a shortening of breath and throw themselves violently around for a few minutes. This soon passes off and the fowls assume a normal appearance. The irritating effect may be considerably lessened by mixing the turpentine with an equal amount of olive oil and this mixture is recommended when administration is made with a teaspoon or medicine dropper. It should be thoroughly shaken before using. A certain amount will probably be lost should the bird struggle during treatment. The principle feature is to be assured that each fowl

receives a full dose and if carefully handled very little difficulty should be experienced. One thing must always be borne in mind, however, and this is a possibility of some of the turpentine entering the wind-pipe if given during a violent struggle or if administered too quickly.

Once again: Take time and allow the birds to swallow naturally and the trouble will be slight.

In the case of Leghorns and other fowls where the gills are particularly large and apt to become covered with turpentine, they should be washed in warm water immediately after treatment. This is unnecessary if oil is also used.

Before administering the turpentine the fowls should be fasted for twenty-four hours, during which period a dose of Epsom salts should be given to help clean out the bowels. The salts may be dissolved in warm water, allowing one teaspoonful for each bird, and mixed with sufficient mash to take up the full amount. The mash should then be given to the fowls, being evenly distributed in order that each bird will receive a full dose. The proper way is to start fasting the fowls in the morning and in the evening administer the salts. The following morning the turpentine should be given and in three or four hours this should be followed with another laxative dose of salts given in a mash as previously described.

From present knowledge the danger from infection is slight during the winter months, and although the majority of fowls harbour a certain number of mature parasites, many apparently regain their full vigour. This is probably due to the fact that intermediate hosts such as flies, snails, etc., do not flourish during the winter months and constant reinfection is impossible with the young embryo forms. This is a very important feature as it enables the poultry man to subject his flock to a couple of treatments prior to introducing the fowls into winter quarters. Undoubtedly, however, losses from these parasites do occur throughout the winter months and the egg yield is appreciably lessened from the fact that the worms produce a constant irritation and absorb a great part of the nourishment taken by the fowl. With the advent of warm weather untreated fowls harbouring worms are able to again infect the runs, etc., with consequent injurious results to the young chicks. Throughout the year and particularly during the summer it is beneficial to give a dose of Epsom salts at least once a month and this is advocated as a general measure to any breeder experiencing trouble.

The periodic dosing of fowls with a mild laxative stimulates all the digestive organs, removes poisonous products from the bowels and invigorates the birds thus aiding them in throwing off some of the mature worms.

Other remedies have been advocated for the treatment of worms, and may be briefly mentioned although personally not recommended at the present time for general use.

Powdered Pomegranate Root Bark in doses of $1\frac{1}{2}$ grains for each fowl.

Powdered Areca Nut in doses of 20 to 30 grains.

Thymol in one grain doses.

Tobacco decoction made by boiling a portion of a plug of chewing tobacco or tobacco stems in water may be used.

Santonin in one grain doses.

The first four remedies are employed in the treatment of tapeworms while Santonin is used when dealing with round worms.

Turpentine, however, is used in both the treatment of tapeworms and round worms and is therefore recommended for general use.

Tapeworms are frequently very resistant to treatment owing to their method of invaginating or burying the head in the intestinal wall. As a result of their complex nature, redevelopment takes place from the head, and unless one succeeds in removing this, the results are apt to be disappointing.

It is advisable to subject the flock to at least two treatments with an interval between the first and second of possibly three weeks. This more completely ensures

the removal of any worms which may have developed subsequent to the first treatment and prevents contamination of fresh runs and quarters if such are available for use. During treatment the floors should be covered with sand nine parts and air-slaked lime one part to destroy any eggs which may remain after removal of the droppings.

Special stress has been laid upon the Tapeworms and Round Worms found in the intestinal portion of the alimentary canal, due to the ravages caused by these parasites. Other species of Round Worms occur in the first portions of the digestive tube as well as in the gizzard, but as they are not common, no further mention of them will be made at the present time.

In outlining any mode of treatment or method of prevention for the eradication of various disorders, it must be borne in mind that filth is the most potent factor in predisposing flocks to disease. It is therefore essential, and is recommended as a first measure, that modern quarters be provided where the breeding and rearing of fowls is to be undertaken. Plans and specifications for different designs of poultry houses can be secured by applying to the Poultry Division, Central Experimental Farm, Ottawa, Ont., and by erecting one of these houses equipped with dropping boards, and all facilities for feeding, etc., the attendant labour of keeping the fowls in the best sanitary surroundings will be reduced to a minimum. As a further precaution it is advisable that flocks, even when in apparent health, be moved to fresh runs at least every two years and the old yards ploughed and sown to rape or other green crop. Such a procedure is particularly serviceable in rendering the ground unfavourable for the development of parasites.

INSTRUCTIONS FOR SENDING MATERIAL.

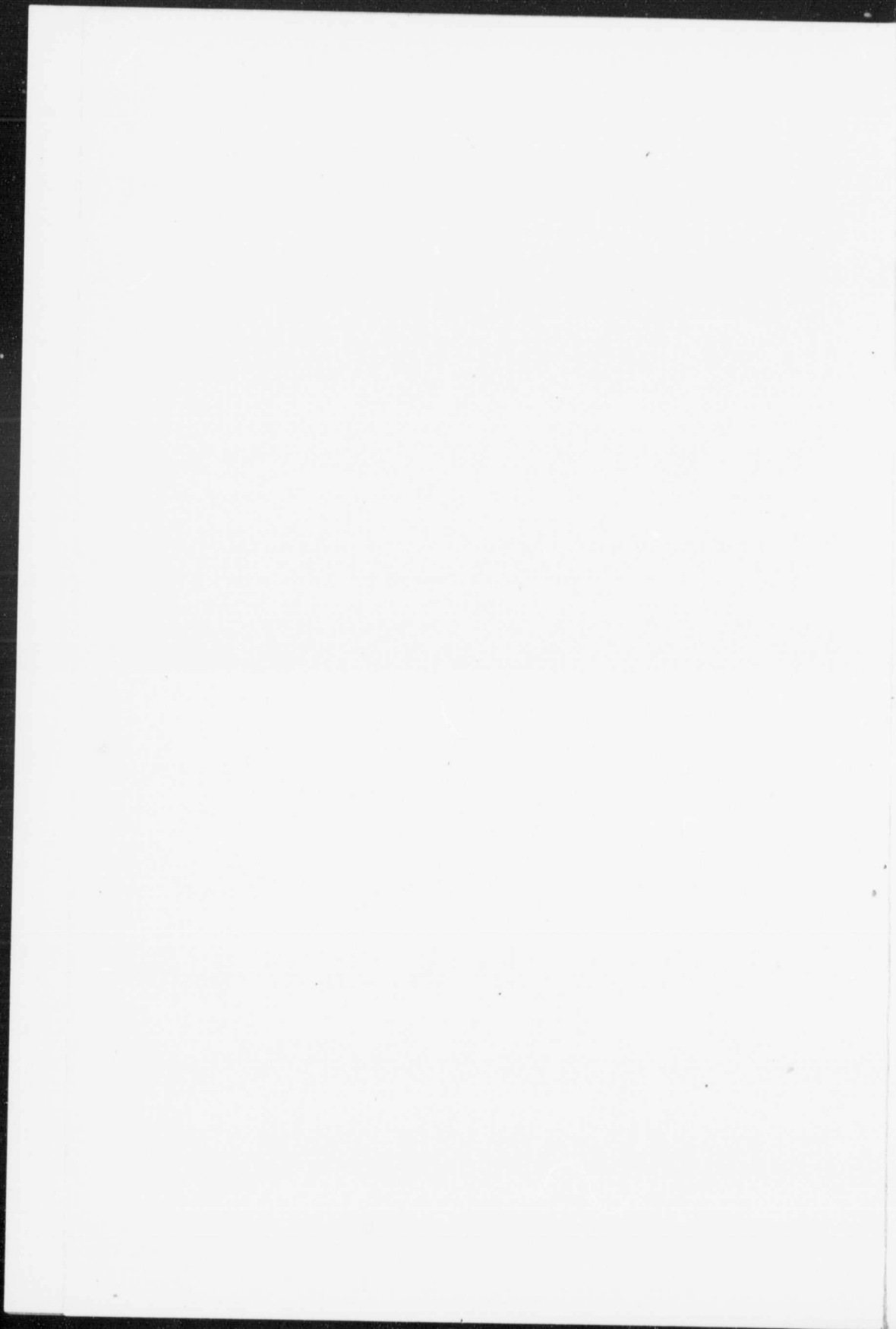
Where it is desired to determine the nature of any condition causing losses among fowl, an examination will be undertaken at the Biological Laboratory, Experimental Farm, Ottawa, Ont., providing suitable material is supplied. If possible, two live but affected birds should be forwarded by express in order that a thorough autopsy may be made. It is not necessary to prepay the express. When autopsies are made by the owner, the diseased tissues may be sent by mail if properly packed and preserved. Tissues may be preserved in pure alcohol or a solution of one part of formaldehyde to nine parts of water. After an examination has been made, suggestions will be forwarded for the prevention of further losses.

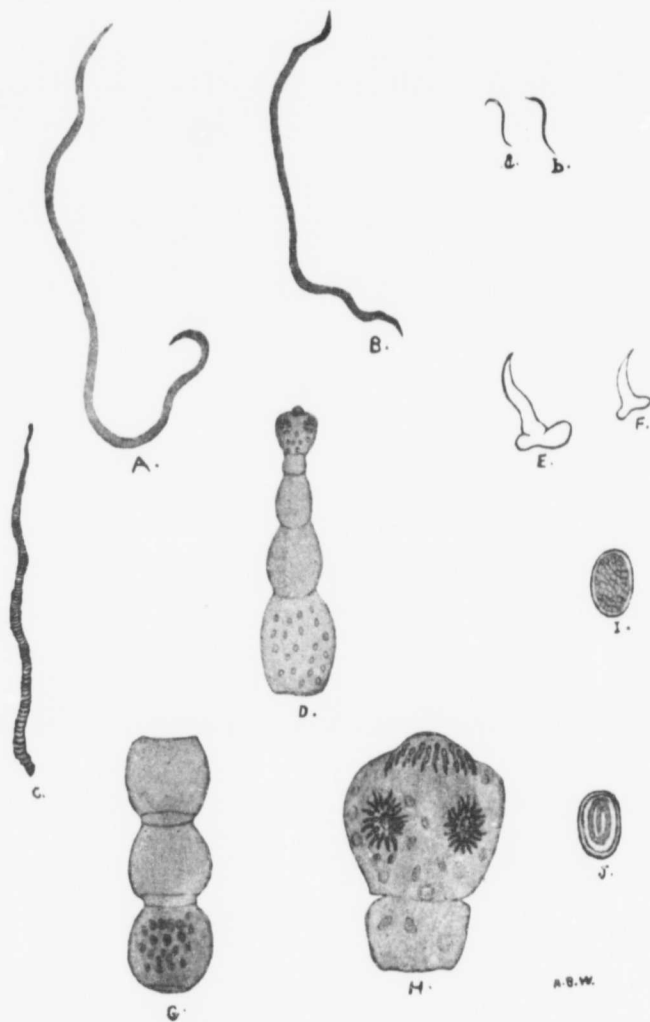
Information concerning the losses which have been experienced should be sent with the material in order that it may be properly identified, together with details of symptoms, etc. The name and address of the sender should be written plainly so that the reports of the examination may be forwarded with the least possible delay.

Specimens sent by express or mail should be addressed to the

BIOLOGICAL LABORATORY,

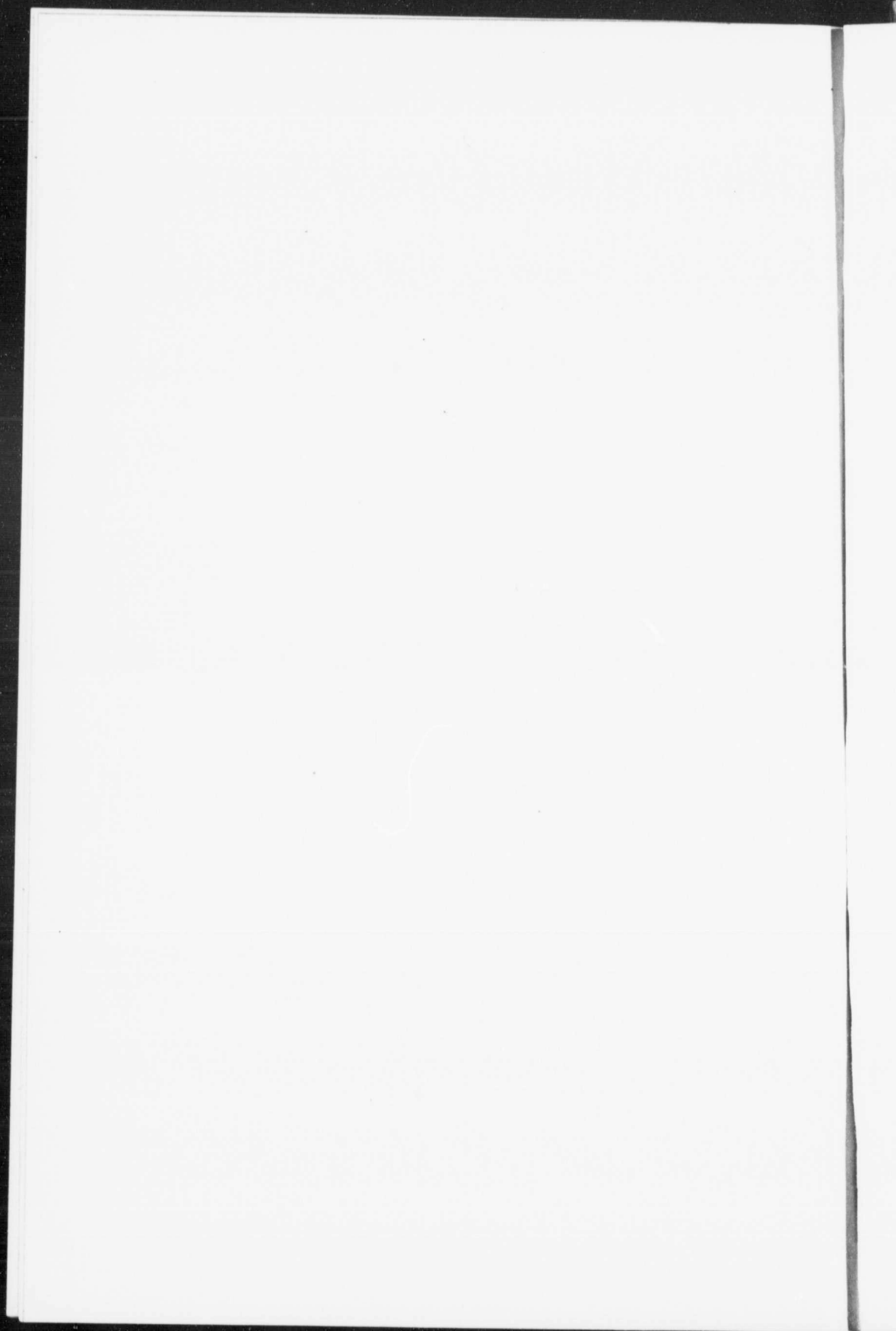
Experimental Farm, Ottawa, Ont.





Figs.:

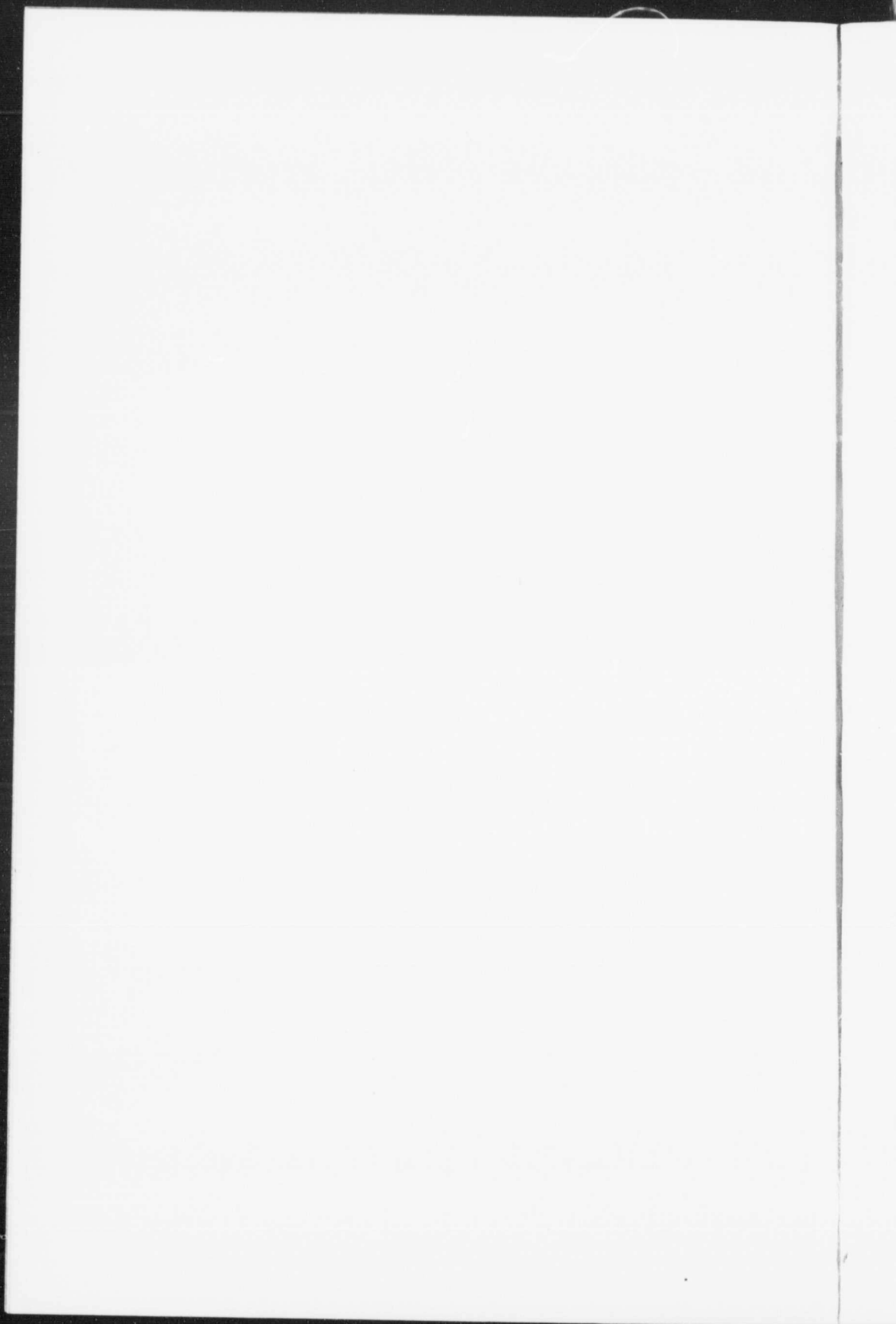
- A - B. Round Worms (*Heterakis perspicillum*) from small intestines. Male and Female. Natural size.
- a - b. Round Worms (*Heterakis papillosa*) from caeca or blind gut. Male and Female. Natural size.
- C. Tapeworm (*Drepanidotaenia infundibuliformis*) from small intestine. Natural size.
- D. Tapeworm (*Davainea proglottina*) from first portion of the small intestine. Microscopic in size but magnified 200 diameters.
- E - F. Hooks from heads of tapeworms. Magnified 200 diameters.
- G. Segments from tapeworm C. Magnified 90 diameters showing posterior segment filled with eggs.
- H. Head of microscopic tapeworm D. Magnified to show hooks and spines on suckers.
- I. Egg of tapeworm. Magnified 200 diameters.
- J. Egg of Round Worm. Magnified 200 diameters. (Original).

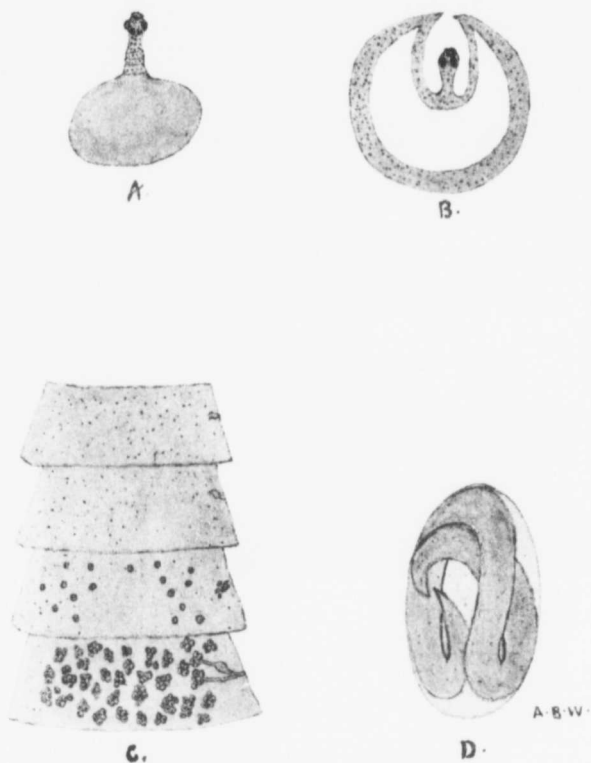




A. S. W.

Showing tapeworms (*Drepanidotaenia infundibuliformis*) adhering to bowel when slit open. (Original).





Figs.:

- A. Young or embryo form (Cysticercoid) of tapeworm. Magnified 20 diameters.
- B. Diagrammatic section of Fig. A showing head invaginated in small bladder-like cyst.
- C. Enlarged segments of tapeworm showing posterior segment filled with ripe eggs.
- D. Young or embryo form of Round Worm ready to hatch from egg. (Original).