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BOVINE OSTERTAGIOSIS, A REVIEW. ANALYSIS OF TYPES AND SYNDROMES FOUND IN FRANCE BY *POST MORTEM* EXAMINATIONS AND TOTAL WORM COUNTS

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SUMMARY

We have completed an analysis of the total worm counts (including digests) performed on 74 weaned cattle of various ages and sacrificed in our laboratory. We identified 21 cases of animals *suffering from Ostertagiosis* (harbouring over 40,000 adults + immatures in the lumen and the mucosa) or moribund animals showing *symptoms* and *lesions* of Ostertagiosis. The results are presented with the *Parasite profiles* (percentage of G.I. genera) and *Parasite levels* (« Very low, Low and Average » for carrier animals and « High » and « Very High » for animals suffering from parasitism).

We have observed typical cases of *Type I* on weaned calves but not on calves grazing when suckling their own dams (*Charollais, Limousin* type), *Pretype II* and typical *Type II* on 2 year old or older animals. Variants of *Type II* were found : *Fasciolosis/Ostertagiosis* complex and *Parturient Ostertagiosis* which seems to be well-known by practitioners. Complexes of a *clinical Type II + stage of Pretype II* with 1 to 2 million hypobiotic L 4 larvae could explain the difficulty to control very severe diseases. *Oedematous ostertagiosis* is also described as an original type or syndrome in 2 to 3 year old cattle : the typical lesion is a dramatic oedema of the abomasum which is found enlarged up to × 2 or × 3 times its normal size/weight. The abomasal folds and the edges are filled with a watery oedema and have an appearance of « foetal membranes ». As only few parasites are present the disease is considered to be an *allergic over reaction* in adult animals.

It is recommended that the peptic digestion of the abomasal mucosa and differential counts of the various developmental stages of the parasites be added to the routine technique used in diagnosis laboratories.

I. — INTRODUCTION

« *Bovine Ostertagiosis* is a parasitic condition, primarily of young cattle, and caused by the abomasal nematode *Ostertagia ostertagi*. It is of economic importance for several reasons ; firstly in heavy infections deaths may occur, and secondly in

lighter infections there is a loss of weight and reduced weight gains which result in the development potential of the farm being limited. Also the treatment and prophylaxis of the disease can prove costly both in terms of drug and labour cost. » This presentation by scientists of the Glasgow university (ARMOUR *et al.*, 1973) summarizes well the present situation in the UK after 20 years of intensive, precise and large scale experiments and observations since MARTIN *et al.*, 1957 ; ANDERSON *et al.*, 1965, were the first to describe the three major types of the infection with *O. ostertagi*. They also brought to light the sequential development of these types, the epidemiological factors and their relative importance in cattle pathology and economics. These findings were subsequently confirmed in Australia (HOTSON, 1967; SMEAL, 1973) and in New Zealand (BRUNSDON, 1969 ; WEDDERBURN, 1970).

The *Ostertagiosis* syndromes are identified and known in Continental Europe as described in « Helminths diseases of cattle, sheep and horses in Europe » 1973. It is easy to see that the size and quality of the epidemiological and experimental work is less impressive, even though the importance of the disease is well understood, in various countries than in UK : JORGENSEN R. J. *et al.*, for Denmark, EUZEBY J. for France, SWIERSTRA D. for Netherlands, HELLE O. for Norway, NILSSON O. for Sweden, ECKERT J. for Switzerland and BURGER H. J. for Western Germany. *Ostertagiosis* was also identified, with egg counts and *post mortem* worm counts, in Belgium and is reported by POUPLARD L. and PECHEUR M. (1974).

In France there are few reports and publications. No detailed description of the disease was given before 1957 when PITRE and QUITTET published the results of a survey in slaughter-houses. They were the first in the country to emphasize the particular aspect of the disease encountered in old stocks and known as « *Oedematous gastritis* ». In 1964 PITRE extended his observations to a diagnosis laboratory and a slaughter-house survey in Normandy.

In 1968 one of us published experimental results obtained with Pyrantel tartrate in cattle (RAYNAUD, 1968 *b*). We found in Normandy :

a) *In the department of Seine-Maritime (76) in October*

A herd of 50 heifers 2 years old in average, the majority of which were affected with a severe loss of weight and alternances of diarrhoea. One was found dead with *Oedematous ostertagiosis.*

b) *In the department of Calvados (14) from January to April*

3 herds of 9, 10 and 15 animals of 12 to 18 months old. The animals were affected with a severe *Type II Ostertagiosis.* The diagnosis was confirmed by *post mortem* examination from one to 3 animals in each of the herds were mortality occurred.

In Amboise, we killed « tracer » calves which had been grazing for various time periods. The results of the experiments, conducted in the department of Côtes-du-Nord (Brittany), were published and concerned the efficacy of tactical treatments to control digestive strongyles parasitism (LAUDREN et RAYNAUD, 1973-1974). A survey of *post mortem* examinations and total worm counts for 29 « tracer » calves (RAYNAUD *et al.*, 1974) was also published. We were able to describe the two clinical types originally named *Type I* and *Type II* by ANDERSON *et al.*, 1965.

II. — SURVEY OF THE LITERATURE

The disease and therefore the parasite are not newly developed subjects, however different it might appear from the previous chapter. As a matter of fact references are found as early as 1900.

In U.S.A. : ACKERT and MULDOON, 1920, state « our attention was recently attracted to a herd of unthrifty yearling steers, many of which were suffering from a severe attack of strongylosis, which was so acute that several of them died. The autopsies revealed heavy infestations of the encysted stomach worm, *Ostertagia ostertagi* which apparently was responsible for the loss of the stock... These steers had been summered in Missouri, purchased in the Kansas City Stockyards and shipped to the vicinity of Manhatta, Kans., during the month of January 1920 all of them being in poor physical condition. Of the 84 steers purchased about one half became visibly affected... and 9 died ».

The same authors gave a summary from STILES (1900) : « *Ostertagia ostertagi* was found in every calf, steer and cow examined on post mortem during my second trip in Texas. Although the worm is small, I cannot escape the conclusion that it was the chief factor in the disease found among the cattle. »

In *Argentina* heavy infestations of *Ostertagia ostertagi* were reported by MORAS (1907) as the cause of a gastric enteritis of calves seen in 1898.

In various parts of England GARDENER, 1911 reported outbreaks of parasitic gastritis in young cattle due to *O. ostertagi* in 1907 and 1909.

Around the same time, GILRUTH, 1900, in *New Zealand* described parasitic gastritis in calves and estimated the presence of 40,000 *O. ostertagi* in a single calf. The main references found on the disease in these early years (just after the characterization of the parasite itself by R. Ostertag in Germany in 1890) are given in FITZSIMMONS (1969).

To summarize what is at present known and understood of the life cycle, the classification of the disease syndromes and of the pathogenesis, we can quote BRUNSDON, 1973 : « Following ingestion by the calf the 3rd larval stage exsheaths in the rumen, passes to the abomasum and enter the gastric glands of the mucosa and there moult to become the 4th larval stage. This takes 4 days. The parasite continues to grow in the gastric gland, moults again to become the 5th larval stage which emerges and matures on the surface as the adult stage. From the 3rd larval to the adult stage usually takes 18-22 days but this development can take up to *at least six months* when larvae become inhibited at the early 4th stage. »

When inhibition occurs, although up to several hundreds of thousands of L 4 larvae may accumulate in the abomasal mucosa *they do not cause the disease.* This phenomenon of inhibition was named Hypobiosis, a condition akin to that of Diapause in insects (ARMOUR *et al.*, 1969). While *normally developing,* the *early 4th stage O. ostertagi* are susceptible to anthelmintics but the *inhibited early 4th stage* in hypobiosis are not metabolising and they do not respond to anthelmintics.

This critical point explains the fact that the best anthelmintics when drenched or injected during the fall or in winter are unable to control the *Pretype II* phase *i.e.* are unable to suppress or prevent the *Type II* syndrome from occurring.

Classification of the disease syndromes

Type I

Calves in their first summer and autumn seasons on pasture show a loss of weight together with diarrhea. In U. K. the disease in calves in their first year on pasture is reported from *late July to October. Ostertagia* counts are usually of the order of *45,000* to *60,000,* of which never more than 20 p. 100 and usually *less than 10 p. 100* are early 4th stage parasites. To summarize the clinical findings, *Type I* syndrome has a *high morbidity* and a *low mortality.*

Pretype II

The parasites are usually above 100,000 of which an average of 70 p. 100 and sometimes up to 96 p. 100 (U. K. results) are inhibited 4th stage larvae within the abomasal mucosa. There are usually no obvious clinical signs but under some conditions, emerging larvae and adults, even when they represent only 20 p. 100 of the total, are in a sufficiently high number to give clinical

signs, mild diarrhoea and reduced growth rate. This stage is found when animals are sacrificed in autumn and winter : « a high proportion of the infective larvae ingested from October until March (approximately 25 weeks) become inhibited ». (ARMOUR *et al.*, 1973.)

Type II

This syndrome results from the subsequent maturation and emergence of large numbers of previously inhibited larvae which had been ingested *up to 6 months earlier*. Worm counts are frequently almost twice as high as those found in *Type I* disease and from 20 p. 100 to 80 p. 100 of them are in the early 4th stage.

The typical disease is characterized by a rapid onset, a severe weight loss and a profuse diarrhoea. The *morbidity is low* (a few animals within a herd only) but the *mortality is high.* It occurs from March to May after the first year on grass in usually housed or outwintered calves or in older stock. A submandibular oedema is sometime observed.

Fasciolosis/Ostertagiosis complex

It is a *Type II* disease with the following characteristics : 1) an earlier seasonal occurence, 2) consistent presence of a severe anemia, 3) usually intermittent soft faeces and only occasionally profuse diarrhoea.

Parturient ostertagiosis

Probably a special case of *Type II*, occurs in adult cows in the parturient period.

Clinical ostertagiosis in aged cows was reported in U.S.A. (SMITH and JONES, 1962 ; BECKLUND, 1962).

Ostertagia induced oedematous gastritis was described in France (PITRE et QUITTET, 1957) in old stock*.

Gross pathology

The main lesions and the associated biochemical changes occur in the period following the emergence of 5th stage from the gastric glands. As the larva grows the gastric gland dilates and forms a nodule, 1 to 4 mm in diameter, on the surface of the mucosa. It is a *primary nodule.* When a L5 emerges from the gastric glands the lesion produced is a raised circular nodule 2-3 mm in diameter with a visible central orifice which represents the opening of the parasitized gland. It is the *secondary nodule* and in heavy infections where coalescence of these nodules occurs, there is a thickened hyperplastic mucosa with a characteristic « *morocco leather* » or « crazy paving » appearance. The lesion which follows emergence from the gland is *necrosing* and if there is confluence of lesions the so-called « thumbprint » or superficial mucosal erosion is observed. Several epithelial cytolysis result in a *gross diphteritic appearance* of the abomasal mucosa. *Oedema of the abomasal folds may* occur as can severe *congestion.*

BRUNSDON, 1973, made the following important comment : the principal difference in gross pathology, between the two syndromes is that *oedema* is a relatively constant feature of the *Type II* disease whereas it may or may not be present in *Type I* infections.

Oedema disease in France

The oedema of the abomasal folds which is given as « relatively constant » of the *Type II* was found much more severely under particular conditions in France. As described by PITRE and QUITTET (1957), PITRE (1964) and EUZEBY (1963) (reference page 80) and summarized by RAYNAUD (1968 *a*), this syndrome was found in Normandy and in the Lyon area in 18 months to 3 year old animals. In some slaughter-houses in Normandy, the incidence was as high as 1 p. 100 of the « supposed-to-be-normal » animals. The oedematous abomasum is easily recognized with the naked eye. Some animals at the end of their second year on pasture present a sudden and rapid weight loss and a profuse diarrhoea. The aspect of the abomasum is characteristic : while a normal empty organ weighs 2.8 to 3 kg, the oedematous abomasum can reach 4.5 kg or more (2 to 3 times the normal weight).

(*) This inclusion of the oedematous gastritis as a variant of the Type II disease is proposed by BRUNSDON, 1973.

The abomasal folds are found to be oedematous so may be *the submucosa*; nodules are found on the surface of the mucosa. The walls of the organ are filled with a watery fluid and when sectioned this fluid, clear in colour, flows out.

EUZEBY pointed out the contrast between the importance of the lesions and the few parasites which are found in the lumen and interpreted the disease as an allergic over reaction to the irritation given, under some conditions, by the sensitization of previous intakes of parasites.

PRIOUZEAU (1954) found in Vendée (region of Poitou, in the western part of France) in 30 years of practice, 2 to 3 cases a year of *Oedematous gastritis* in 18 months to 3 years old cattle. The loss of weight was slow but constant with alternant periods of diarrheic and normal feces and at the same time appearance or disappearance of a submandibular oedema. Death in cachexia occured after 3 to 4 months of illness. At post mortem the size of the abomasum was quite normal but the oedema was so extreme that a large portion of the organ, when put in water floated. But this practitioner was not able to find any parasite in the lumen of the abomasum (no Fasciola was present on these animals and the liver was normal) so the origin of the disease remained unknown to him.

III. — PURPOSES AND OBJECTIVES OF THE EXPERIMENT — LIMITS OF THE SUBJECT

We had the occasion to examine in the laboratory either :

a) sacrificed animals used as « tracer calves » in field experiments to control the efficacy of anthelmintics,

b) or animals sent by practitioners and generally severely affected by a disease which was suspected to be due to helminths.

In this case our examination was conducted for a diagnosis purpose to help the practitioner.

We had the intention to complete worm counts in the lumen as well as *in the mucosa* for numbering *hypobiotic* L_4 or active L_5 stages. In France we yet need information on *Oedematous ostertagiosis* which does not seem to have been encountered in other countries. The facilities we had allowed us to perform *complete worm counts including digests.*

On 74 cattle sacrificed and examined, 21 were kept and we considered them as typical of *bovine ostertagiosis.* We had to define the parasite levels according to the number of parasites found (table I) is a subjective judgment of these numbers (RAYNAUD *et al.*, 1974).

a) *3 levels were distinguished for the carrier stage*

1. *Very small number of parasites.*

Ostertagia and *Trichostrongylidae* it is fixed below 250.

2. *Small number of parasites.*

Ostertagia : above 250 and below 7,500.

3. *Average number of parasites.*

Ostertagia : above 7,500 and below 40,000.

TABLE I

Parasites levels in sacrificed young cattle and total worm counts
(Adult + immature worms)
RAYNAUD, LAUDREN, JOLIVET, 1974

Animals		Parasite levels				
		parasite affected		parasite carriers		
Number of parasites		very large	large	average	small	very small
Clinical significance		pathology lethality	pathology	0	0	0
Organs or tract	Type of parasites					
Gastro-intestinal	*Nematodirus Trichuris-Capillaria*	> 40 000	> 10 000 ⩽ 40 000	> 3 000 ⩽ 10 000	> 100 ⩽ 3 000	⩽ 100
	Ostertagia-Cooperia or other *Trichostrongylidae*	> 80 000	> 40 000 ⩽ 80 000	> 7 500 ⩽ 40 000	> 250 ⩽ 7 500	⩽ 250
	Total GI Nematodes	> 100 000	> 50 000 ⩽ 100 000	> 10 000 ⩽ 50 000	> 500 ⩽ 10 000	⩽ 500
Pulmonary	*Dictyocaulus*	> 1 500	> 500 ⩽ 1 500	> 100 ⩽ 500	> 10 ⩽ 100	⩽ 10
Liver	*Fasciola hepatica*	> 500	> 250 ⩽ 500	> 50 ⩽ 250	> 20 ⩽ 50	⩽ 10

b) *In animals clinically affected by a parasitic disease, 2 levels*

In our particular case, they were found to harbour large numbers of *Ostertagia ostertagi* and were affected with *bovine ostertagiosis.*

1. « *Large number* » *of parasites.*

Range known or recognized as *pathological* for *Ostertagia* : above 40,000 and below 80,000 parasites.

2. « *Very large number* » *of parasites.*

Level recognized as either *lethal* or giving risk to a *very severe disease*; for *Ostertagia* : above 80,000 parasites.

Among the 74 individual results, we have considered as being affected with *Ostertagiosis* :

— *normal animals* (tracers) carrying more than 40,000 parasites (close to the level of 45,000 given by BRUNSDON (1973) as the counts usually found in *Type I Ostertagiosis* — 45,000 to 60,000 — and the level of 40,000 adults, 2 to 20 p. 100

early 4th larval stage, given by ARMOUR (1970) — « if the adult *O. ostertagi* burden exceed a threshold for disease, *i.e.* about 40,000 adults, *Type I* disease occurs »).

The levels we give in table I are indicative and only valuable for young animals of less than one year of age.

The values in older and adult animals are probably different.

— Diseased animals with lesions of *Ostertagiosis*.

Those are our 21 cases of bovine *Ostertagiosis* considered in this study.

IV. — MATERIAL AND METHODS

1. — *Animals*

All were weaned animals grazing on pasture.

a) *Either for a limited time.*

Several months for the so-called « tracer » calves.

b) *Or for a long time.*

Permanent pasture, the animals being being housed for the winter time only.

We have carried out 74 post mortem examinations since 1967. The animals were sacrificed at the occasion of experiments carried out in Brittany (LAUDREN and RAYNAUD, 1973-1974) or in Normandy (RAYNAUD, 1968 *b*) or following veterinary practitioners' call ups to solve diagnosis problems they had.

Therefore the geographical distribution of the animals examined does not mean that bovine *ostertagiosis* is only important in those departments. All the animals came from the western or central parts of the country mainly, Brittany, Normandy and the *Charollais* areas.

2. — *Bovine Ostertagiosis*

As explained in the above chapter « Limits of the subject » the 21 cases considered here are :

— either sacrificed animals having a worm burden of more than 40 000 *Ostertagia ostertagi* (adults + immatures in the lumen and the mucosa counts),

— or moribund animals showing symptoms and lesions of *Ostertagiosis*.

3. — *Laboratory techniques*

The laboratory techniques used for post mortem examinations and worm counts were as described by RAYNAUD, 1968 *a*, 1969 and 1970. They are presented and up-to-dated in RAYNAUD *et al.*, 1974.

In brief, we noted the following individual data (see annex 1 and 2) :

— Age and type of animal,
— Date of sacrifice or death,
— Time kept on pasture,
— Clinical status,
— Type of *Ostertagiosis*,
— E.P.G. egg counts using the technique described by RAYNAUD, 1970 (modified from Mac Master — Sensitivity limit 15/g and between 0 and 15/g),
— Lesions in *lungs* (broncho-pneumonia : BP from + to +++), *liver*.

In the *abomasum* : *congestion* : C + to +++, *Oedema* : Oe + to +++. Oedema +++ is given when the abomasum is × 2 or × 3 its normal weight, walls filled with oedema fluid as described by PITRE and QUITTET, 1957, 1964, PRIOUZEAU, 1954, and summarized by EUZEBY, 1963

and RAYNAUD, 1968, *Nodules* (N + to + + + +). Nodules + + + + is given for hyperplastic mucosa with *morocco leather* or *diphteric appearance*. In the *small intestine*, enteritis is + to + + + and in the coecum or colon, nodular lesions are noted from + to + + + +.

— Worm counts, in lungs, liver and gastro-intestinal tract. For each parasite we give the number of immatures, adults and the total.

But for *Ostertagia* we counted :

a) the *adult* worms in the abomasal lumen,
b) the *L 5* stages in the abomasal lumen or L 5 + developing L 4 in the mucosa digests,
c) the *L 4* stages in the mucosa digests (inhibited L 4 larvae).

4. — *Results*

To give an objective and relative figure we expressed the number of parasites in (RAYNAUD *et al.*, 1974) :

a) *Parasite profiles* modified from LEVINE, 1963.

We give in percent the total worms (adults + immatures) for the genera found : *Haemonchus, Ostertagia, Trichostrongylus axei, Cooperia, Nematodirus, Trichostrongylus* spp. (for the species found in the small intestine), *Oesophagostomum, Capillaria* and *Trichuris*. On the grapps immatures are in natching and adults in stippling.

b) *Parasite levels.*

Following table 1 and the explanations given in the former chapter « Purposes and objectives of the experiment, limits of the subject » the number of parasites are estimated for all those genera (adults + immatures) plus for *Dictyolaucus* and *Fasciola* or *Dicrocoelium*.

Also, the level of the total gastro-intestinal parasites is estimated and the actual number is given.

V. — RESULTS

The individual results are given in Annexes 1 and 2. The following information is presented in table 2 : information on the animals, type, age, time kept on pasture, *Ostertagia* counts and lesions of the abomasum.

The 21 cases were assigned to the various types or syndromes described. Some are typical of :

— *Type I.*

— *Pretype II.*

— *Type II* with the two variants.

Parturient Ostertagiosis and *Fasciolosis/Ostertagiosis complex*. In certain instances, there are complexes of more than one type or syndrome.

— The *Oedematous ostertagiosis* described in 4 cases :

1. the oedema alone can explain the death (and not the number of parasites found which are few) ;

2. the oedema was impressive but the amount of parasites was low for adults and L_5 stages but large for L_4 stages in the mucosa. They were described as *Oedematous + Pretype II* (2 cases) ;

3. a *Type II Ostertagiosis* with quite a large number of adults and L_5 stages : 240,000 parasites. In this case the oedema can be considered as a superimposed lesion which aggravates the symptoms and the severity of the disease.

Among the 21 cases and the typical types or syndromes described, we have selected 8 characteristic animals which are examined in more detail in figures 1 to 8.

1. — *Figure 1 : Ostertagiosis Type I*

Tracer calf sacrificed in mid July (Reference n° 19/70 (22)).

The number of parasites found was not great : 41,700 *Ostertagia* after 4 months on pasture. This young weaned calf (8 months old) grazed with normal heifers which were not affected with parasitic diseases. So the tracer calf grazed a pasture with « cryptoparasitism » *i.e.* with a level of parasites insufficient to provoke the disease. The tracer calf was in good health when sacrificed. Even at this low level of contamination the young weaned calf accumulated a large amount of parasites, close to the disease level (« High » level of *Ostertagia* and « Average » level of *Cooperia*). This example justifies the *mid July treatment* which is recommended and is now popular in UK. In this country, *Type I Ostertagiosis* is a disease observed from the end of July to October. It should also be noted that there is a small amount of immatures : L_4 stages in mucosa representing only 2 p. 100 of the total number of *Ostertagia*.

FIGURE 1 **REFERENCE N° 19/70 (22)**

OSTERTAGIOSIS : TYPE I

CATTLE : "TRACER" CALF

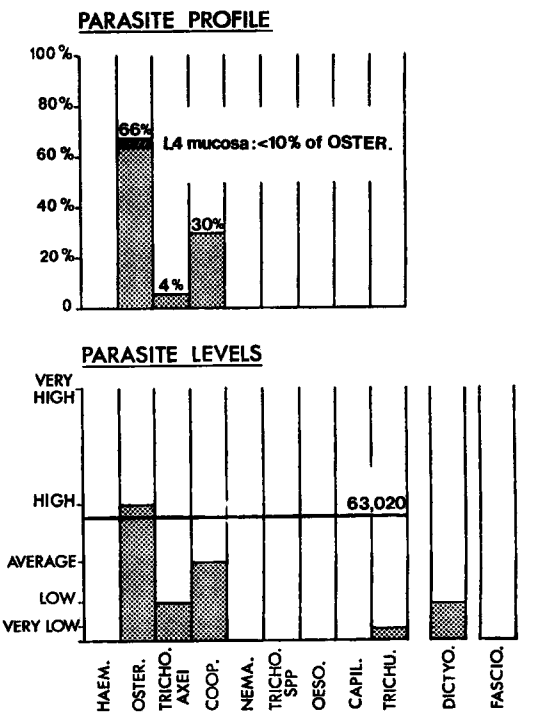
SACRIFICED / DEAD : S. JULY 20
AGE : 8 MONTHS
TIME ON PASTURE : 4 MONTHS
CLINICAL STATUS : 0

ABOMASUM :

LESIONS : NODULES ++

PARASITE COUNTS

OSTERTAGIA	TOTAL	: 41,700
O. OSTERTAGI	ADULTS	: 30,800
	L5	: 10,000
	L4 MUCOSA	: 900
	% L4 MUCOSA	: < 10 %
TRICHOSTRONGYLUS	TOTAL	: 2,400
T. AXEI	ADULTS	: 2,400
	IMMATURES	: 0



TA

21 cases

Salient results on lesions

Ostertagiosis Type or syndrome	Figure no.	Reference no. No./Year/ Department no.	Animals		
			Type and Age (months-years)	Real time on pasture	Sacrificed (S) Dead (D)/month
	1	19/70 (22)	calf 8 m.	4 months	S. 1/2 July
Type I	—	39/71 (22)	calf 7 m.	2 months	S. 1/2 Sept.
	2	29/70 (22)	calf 10 m.	5 months	S. 1/2 Oct.
	—	28/70 (22)	calf 10 m.	5 months	S. 1/2 Oct.
	—	25/70 (22)	calf 10 m.	5 months	S. 1/2 Oct.
	—	27/70 (22)	calf 10 m.	5 months	S. end Oct.
	—	30/70 (22)	calf 8 m.	4 months	S. end Oct.
Pretype II	3	26/70 (22)	calf 10 m.	5 months	S. 1/2 Oct.
	—	11/67 (61)	calf 9 m.	5 months	S. end Dec.
	—	5/67 (37)	calf 12 m.	7 months	S. end Feb.
Oedematous + Pretype II	—	56/74 (29)	bullock 2 y.	≅ 2 years	2. end Oct.
	—	71/75 (58)	cow-heifer 3 y.	≅ 3 years	D. 1/2 April
Oedematous	4	67/75 (53)	steer 2 y.	≅ 2 years	D. end Jan.
Oedematous + Type II	5	73/75 (58)	steer 16 m.	> 1 year	D. end May
Type II	—	54/74 (29)	calf (2) 12 m.	4 + 4 m.	S. end June
	—	53/73 (71)	calf 12 m.	4 + 2 m.	S. end June
	6	74/76 (76)	heifer 2 y.	1 year	D. early April
	7	69/75 (53)	heifer 2 y.	≅ 2 years	D. 1/2 March
	—	70/75 (72)	bullock 2 y.	≅ 2 years	D. early April
	—	72/75 (58)	cow aged	several y.	D. end May
Parturient	8	55/74 (29)	cow aged	several y.	S. end June

(1) EPG = 1) 555, 600, 850... numbers due to Ostertagia alone.
2) < or ≤ when other Trichostrongylidae, adults worms, participate with Ostertagia to the EPG.
3) — when « other Trichostrongylidae » are more numerous than Ostertagia.

(2) Fasciolosis + Ostertagiosis.

BLE 2

of Ostertagiosis
and worm counts

Ostertagia counts					Lesions abomasum			Ostertagia	
Total	Adults	L_5	L_4	P. 100 L_4	Cong.	Oed.	Nodules	P. 100 Total GI worms	EPG/g (1)
41 700	30 800	10 000	900	< 10	O	O	N++	66.2	< 850
84 840	78 480	3 720	2 640	< 10	O	O	N+++	93.2	?
191 700	149 800	39 200	2 700	< 10	O	O	N+++	97.9	555
68 250	53 400	14 000	750	< 10	O	O	N+	89.8	⩽ 200
71 650	53 400	17 000	1 250	< 10	O	O	N+	89.8	⩽ 75
120 750	102 200	2 800	15 750	15	O	O	N+	98.7	600
103 975	96 400	1 800	5 775	< 10	O	O	N++	95.8	850
108 450	28 900	11 600	67 950	63	O	O	N+	99.3	200
111 750	10 500	20 450	80 800	72	O	O	N++	?	?
59 180	8 280	8 400	42 500	72	O	O	N+	93.0	—
90 700	3 800	900	86 000	95	O	O+++	N++	86.6	—
?	?	?	120 000	?	O	O+++	N++++	?	—
32 700	8 400	5 800	18 500	57	O	O+++	N+++	93.7	⩽ 200
283 500	212 800	28 300	42 400	15	O	O+++	N+++	87.4	< 1 800
48 900	34 900	8 100	5 900	12	O	O	N++	99.7	250
201 400	153 000	35 000	13 400	10	O	O	N+++	63.0	—
2 814 980	40 300	135 780	2 638 900	94	O	O	N++++	97.7	⩽ 120
1 279 000	244 800	93 200	941 100	74	C+	O	N++++	98.4	< 5 700
1 671 000	285 000	669 000	717 000	43	C+	O	N++++	99.9	800
107 750	97 000	9 000	1 750	< 10	C+++	O	N+++	?	?
104 350	8 500	850	95 000	91	O	O	N+++	99.4	15

2. — *Figure 2 : Ostertagiosis Type I* (Reference n° 29/70 (22))

A 10 month old calf, at pasture from the month of June and sacrificed in mid October.

Clinical status was poor with severe diarrhea and approximately one month of weight loss. The *nodular* lesions in the abomasum were numerous and presented a thickened hyperplastic mucosa. The animal harboured a *very high level* of *Ostertagia* : 191 700 and in fact no other parasite. The large majority of the *Ostertagia* were adults and L_5 larval stages were numerous. There were only 555 eggs per gram. The nodular lesions were found very important with a *morocco leather* appearance. As the inhibited L_4 larval stages are of little importance (1.4 p. 100 of the total) this case is a *typical Type I Ostertagiosis* as described in the literature.

FIGURE 2 **REFERENCE N° 29/70 (22)**

OSTERTAGIOSIS : TYPE I

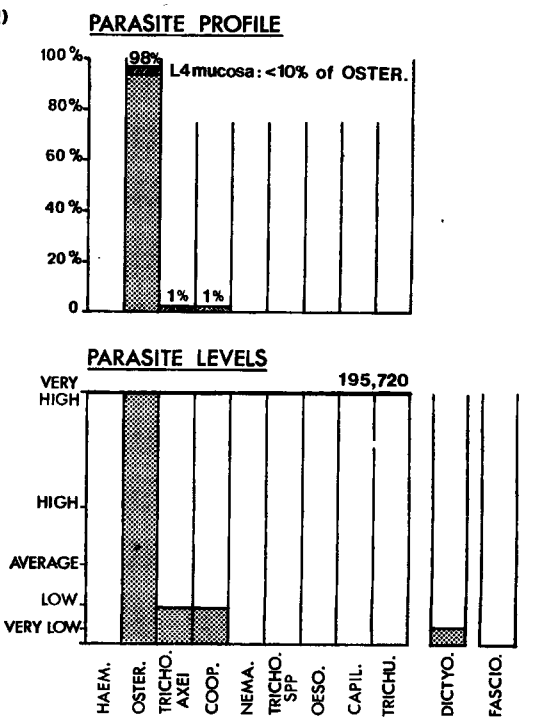
CATTLE : CALF

SACRIFICED / DEAD : S. OCTOBER 15
AGE : 10 MONTHS
TIME ON PASTURE : 5 MONTHS
CLINICAL STATUS : SEVERE DIARRHŒA
WEIGHT LOSS FOR 1 MONTH

ABOMASUM :

LESIONS : NODULES +++

PARASITE COUNTS		
OSTERTAGIA	TOTAL	: 191,700
O. OSTERTAGI	ADULTS	: 149,800
	L5	: 39,200
	L4 MUCOSA	: 2,700
	% L4 MUCOSA	: <10%
TRICHOSTRONGYLUS	TOTAL	: 2,000
T. AXEI	ADULTS	: 2,000
	IMMATURES	: 0



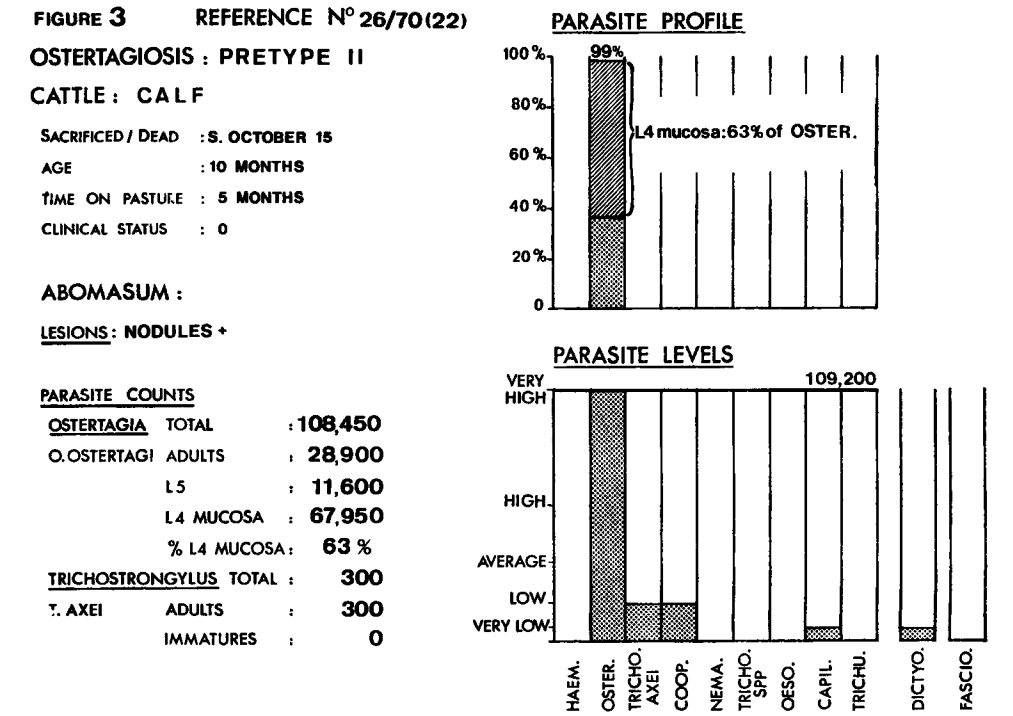
3. — *Figure 3 : Ostertagiosis Pretype II* (Reference n° 26/70 (22))

A 10 month old calf, having been on pasture for 5 months.

Its appearance was good and no symptom was found when sacrificed in mid-October. The egg counts averaged a level of 200 eggs/g. Lesions in the abomasum were slight : nodules are quoted +.

The number of *Ostertagia* found represented 99 p. 100 of the total worm count. Of 108 450 *Ostertagia*, 63 p. 100 were inhibited 4th stage larvae. This example is

also typical of a *Pretype II* calf as described in the literature, despite the fact that mid-October is an early period for such a large number and percent of inhibited 4th stage larvae to be found. Later in the season, the number is likely to be even more important.



4. — *Figure 4 : Oedematous ostertagiosis* (n° 67/75 (53))

This case is quite interesting and typical of what could be described as an original type found in France. *This steer, 2 years old, at the end of its second grazing season* suffered from a severe watery diarrhea for one month and an intense loss of weight. It was moribund in cachexia when sacrificed. We counted 200 eggs per gram, almost exclusively *Ostertagia*. The lesions were very impressive as the volume of the abomasum had almost tripled its weight. The edges were full of a watery oedema, the abomasal folds being also enlarged with oedema.

The opened abomasum gave the appearance of « foetal membranes » (see plate n° 3, 4 and 5). A large amount of nodules (N + + +) were observed but the oedema of the mucosa could hardly be seen due to the oedema. Despite those outstanding lesions the number of *Ostertagia* found was low : 32 700 total with 57 p. 100 immatures at the 4th stage. Except for a low number of *Trichostrongylus axei* no other parasite was found. Apart from this oedema of the abomasum no other lesion can explain the disease and the death. This is the reason why EUZEBY, 1963, interpreted the

disease as an *allergic over reaction* to the irritation provoked by the repeated absorption of small amounts of parasites. In this case the *Oedematosis* is not a lesion in the *Type II syndrome* but is an *original type* the pathogenesis of which has yet to be confirmed.

FIGURE 4 REFERENCE N° 67/75 (53)

OSTERTAGIOSIS : OEDEMATOUS

CATTLE : STEER

SACRIFICED / DEAD : D. JANUARY 31

AGE : 2 YEARS

TIME ON PASTURE : ∝ 2 YEARS

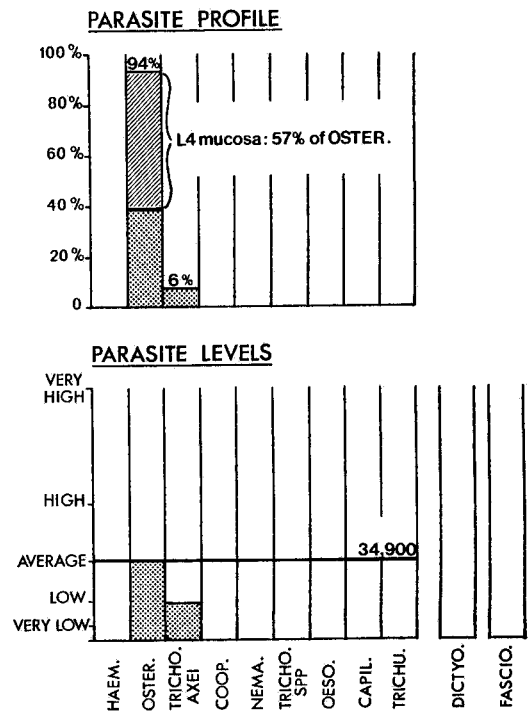
CLINICAL STATUS : 1 MONTH WITH DIARRHŒA
WEIGHT LOSS

ABOMASUM :

LESIONS : OEDEMA +++
NODULES +++

PARASITE COUNTS

OSTERTAGIA	TOTAL	:	32,700
O. OSTERTAGI	ADULTS	:	8,400
	L5	:	5,800
	L4 MUCOSA	:	18,500
	% L4 MUCOSA	:	57%
TRICHOSTRONGYLUS	TOTAL	:	2,200
T. AXEI	ADULTS	:	1,700
	IMMATURES	:	500



5. — *Figure 5 : Oedematous/Type II Ostertagiosis* (Reference n° 73/75 (58))

Two *Charollais* steers, 16 months old, at the start of their second grazing season (in May) suffered from a very sudden and severe diarrhea and in a very short time, 8 days only, dramatically lost weight. One of them, near death, was sent to the laboratory. At the same time his « brother » who was in a better condition was treated 4 times with anthelmintics every 3 to 5 days and recovered.

The animal (n° 73/75 (58)) was in a very poor condition when sacrificed and voided 1 800 eggs/g (not only *Ostertagia* eggs but also *Trichostrongylus* and *Cooperia*). The lesions were of the same type as in the former case : the abomasum weighed twice its normal weight, the oedema was of an outstanding size but the nodules (+++) were very numerous. 87 p. 100 of the parasites found (total « *very High* » : 324, 450) were *Ostertagia* at a *very high level. Trichostrongylus axei* was also found in the abomasum at an *average* level. The number of *Ostertagia* was very high, 283 500, with only 15 p. 100 4th stage larvae. 241 100 adults + L_5 explain the severe nodular lesions found. In this case, the *Oedematous ostertagiosis* was probably *aggravated by a Type II syndrome.* As already mentioned, the other animal of a similar condition, was cured with numerous and frequent anthelmintic treatments.

FIGURE 5 REFERENCE N° 73/75 (58)
OSTERTAGIOSIS : TYPE II + OEDEMATOUS
CATTLE : "CHAROLAIS" STEER

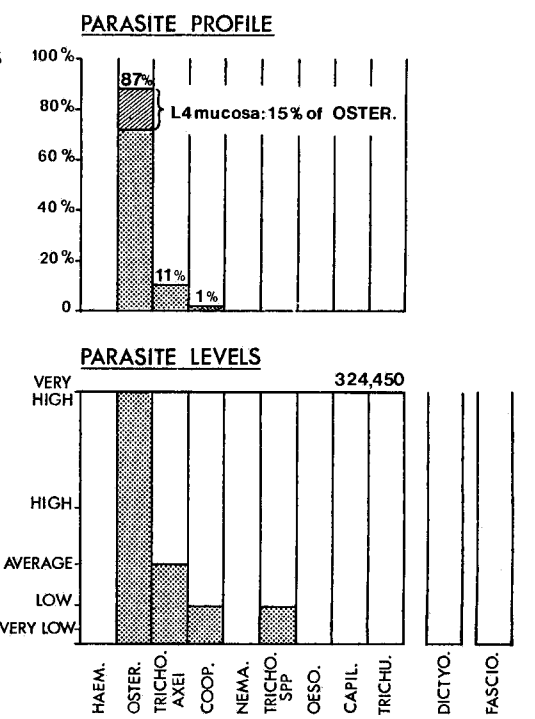
SACRIFICED / DEAD : D. MAY 29
AGE : 16 MONTHS
TIME ON PASTURE : >1 YEAR
CLINICAL STATUS : SEVERE LOSS OF WEIGHT
ACUTE DIARRHŒA · DEAD

ABOMASUM :

LESIONS : OEDEMA +++
NODULES +++

PARASITE COUNTS

OSTERTAGIA	TOTAL	:283,500
O. OSTERTAGI	ADULTS	:212,800
	L5	: 28,300
	L4 MUCOSA	: 42,400
	% L4 MUCOSA	: 15%
TRICHOSTRONGYLUS	TOTAL	: 37,000
T. AXEI	ADULTS	: 31,000
	IMMATURES	: 6,000



6. — *Figure 6 : Type II* (and Pretype II?) *Ostertagiosis* (Reference n° 74/76 (76))

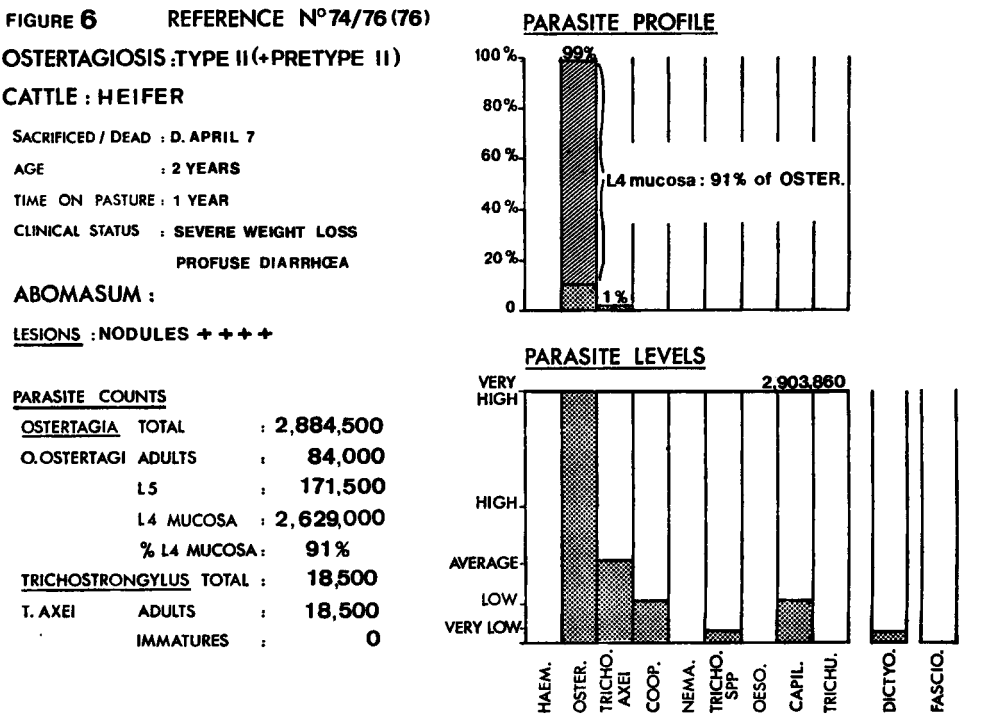
With 15 others, this heifer was raised in Normandy. For its first year it was put indoors to avoid the problem, so common in that area, of lungworms (and digestive strongyles). It was put on permanent pasture when one year old and it grazed without any special problem.

When housed for wintering, no systematic anthelmintic treatment was practiced. During winter, in February, all the animals suffered from a severe weight loss and a profuse diarrhea. All were treated with Tetramisole and Diethyl-carbamazine and the symptoms disappeared in 10 animals but were persistent in 5. Treated again without any spectacular success, 4 animals were sent to the abattoir. The most severely affected animal was kept indoors after a third treatment but it kept losing weight and was sacrificed in April. The nodular lesions with a « morocco leather » appearance were scored at ++++. The only significant parasites found were *Ostertagia ostertagi* (« very high level » : 2 884 500 parasites) and *Trichostrongylus axei* (« High level » : 66 000 parasites).

The lesions and disease were caused by the number of parasites found on the mucosa or emerging from the nodules : 4 300 adults and 5th stage larvae, 135 780. The disease is a *Type II Ostertagiosis*. But the number of 4th larval stage was so large : 2 629 000 that we consider that the *Pretype II phase* was also present in this

animal. We consider that the worm counts and lesions found showed the complex *Type II + Pretype II.*

Such a large amount of parasites found could be explained by the fact that it was a 2 year old susceptible animal at the end of its first year on pasture only which had ingested a considerable quantity of grass contaminated by larvae.



7. — *Figure 7 : Type II Ostertagiosis* (Reference n° 69/75 (53))

This 2 year old heifer on pasture for 2 grazing seasons was diarrheic in early February. In one month the weight loss was severe. It was sacrificed in a poor condition, moribund with watery diarrhea, on mid March.

The lesions found in the abomasum were : haemorrhagic mucosa (see photo n° 2) and such a large number of nodules (+ + + +) that it had a « crazy paving » appearance. The only significant parasites were found in the abomasum : *Ostertagia ostertagi* (« very high ») and *Trichostrongylus axei* (« average »). The number of adults and 5th larval stage on the mucosa or emerging from the nodules, was very large and explained the severity of the disease : 244 800 adults and 93 200 immatures 5th larval stage were counted. 4th stage larvae were very numerous, 941 100 and represented 74 p. 100 of the total *Ostertagia.* In other words the stock of inhibited 4th stage larvae was large enough to be considered as a case of *Pretype II ostertagiosis* but the disease is of *Type II.* This differs from the description given by BRUNSDON, 1973 : « In *Type II* disease the percentage of early 4th stage larvae is directly propor-

FIGURE 7 REFERENCE N° 69/75(53)

OSTERTAGIOSIS: TYPE II

CATTLE: HEIFER

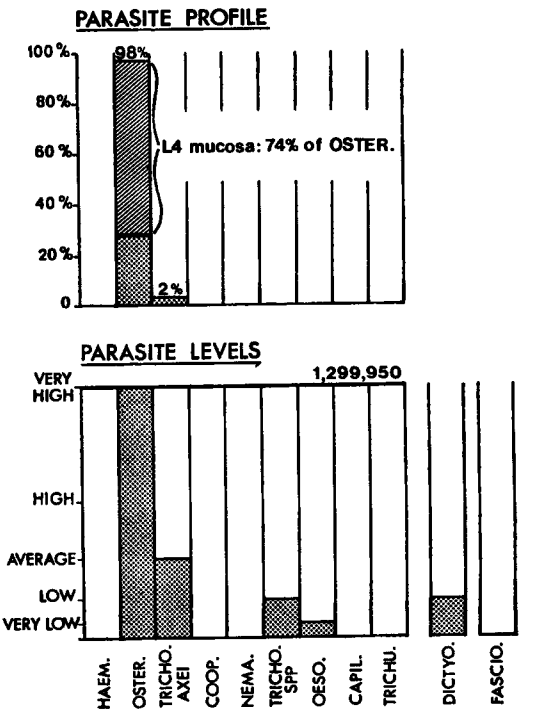
SACRIFICED / DEAD : D. MARCH 18
AGE : 2 YEARS
TIME ON PASTURE : ± 2 YEARS
CLINICAL STATUS : WEIGHT LOSS
SEVERE DIARRHŒA

ABOMASUM:

LESIONS: CONGESTION +
NODULES ++++

PARASITE COUNTS

OSTERTAGIA	TOTAL	1 279,100
O. OSTERTAGI	ADULTS	244,800
	L5	93,200
	L4 MUCOSA	941,100
	% L4 MUCOSA	74%
TRICHOSTRONGYLUS	TOTAL	20,000
T. AXEI	ADULTS	20,000
	IMMATURES	0



tional to the period of clinical illness, *i. e.* the longer the duration of diarrhoea, the fewer the inhibited forms in the mucosa. » This case is to be compared to the former (reference n° 74/76 (76)), both examples being of *Type II* disease and in fact of *Pretype II* and *Type II*.

These *244 800 Ostertagia adults* and *20 000 Trichostrongylus adults* explain the *exceptionally high egg counts : 5 700 eggs/g.*

Reference n°	74/76 (76)	69/75 (53)
Age	2 years	2 years
N° of grazing seasons	1	2
Ostertagia adults	4 300	244 800
— L_5	135 780	93 200
— L_4 mucosa	2 638 900 (94 %)	941 100 (74 %)

8. — *Figure 8 : Type II : Parturient Ostertagiosis*
(Reference n° 55/74 (29))

This aged cow is a typical case, similar to those recorded in Australia by HOTSON, 1967 and in New Zealand by WEDDERBURN 1970. It was raised in the *Charollais* area and had presented since calving intermittent soft faeces and only occasionally profuse diarrhoea with low egg counts : 15/g. The nodular lesions of the abomasum

were important (+++). The burden of 4th stage larvae was quite high (95 000) but the number of adults (8 500) and L_5 on/in mucosa, was low.

We do not know if such a number is sufficient to explain the disease *i. e.* if 9 350 adults + L_5 are enough and pathogenic in adult cows.

FIGURE 8 REFERENCE N° 55/74(29)

OSTERTAGIOSIS: PARTURIENT (TYPE II)

CATTLE: COW

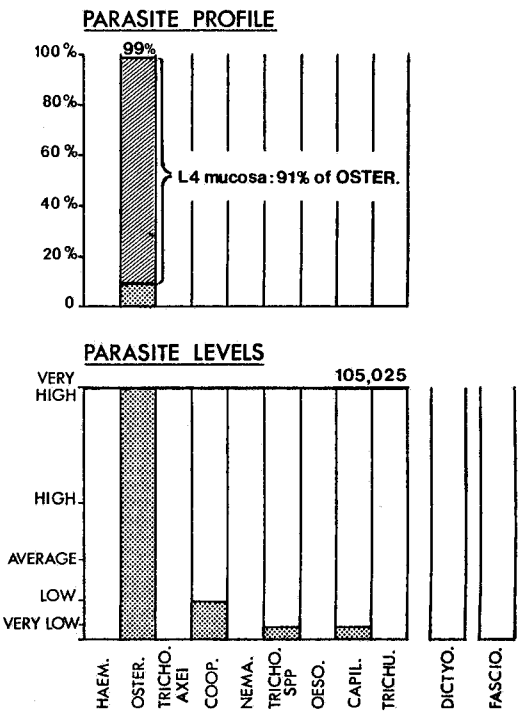
SACRIFICED / DEAD : S. JUNE 6
AGE : AGED COW
TIME ON PASTURE : SEVERAL YEARS
CLINICAL STATUS : DIARRHŒA SINCE CALVING

ABOMASUM:

LESIONS: NODULES +++

PARASITE COUNTS

OSTERTAGIA	TOTAL	: 104,350
O. OSTERTAGI	ADULTS	: 8,500
	L5	: 850
	L4 MUCOSA	: 95,000
	% L4 MUCOSA	: 91%
TRICHOSTRONGYLUS	TOTAL	: 0
T. AXEI	ADULTS	: 0
	IMMATURES	: 0



In case n° 54/74 (29) (see annex 1 and table 2) a one year old calf on its 2nd year on pasture, sacrificed in June, harboured 48 900 *Ostertagia* associated with 16 *Fasciola hepatica*. The clinical status being poor (anemia and diarrhoea) it could be used as an example of the *Fasciolosis/Ostertagiosis* complex (REID *et al.*, 1967).

VI. — DISCUSSION

With 21 results, out of 74 cattle sacrificed in our laboratory, we have covered a large number of the typical cases of *bovine ostertagiosis* found in France. Taking all the reports where *Ostertagiosis* was controlled by post mortem examination and our results, associated with worm counts (including digests) there is some evidence that the disease exists in the western, north-western and central parts of the country.

These areas are the most important for cattle raising (meat, milk) in the country. The western and north-western areas include departments with over 500 000 heads

each. The central area includes departments with between 275 000 and 500 000 heads each.

We have demonstrated the existence of the main types and syndromes already described.

TABLE 3

Bovine Ostertagiosis *in France*
Sites where the disease was identified as an implement to the survey

Part of the country Climatic area	Regions Provinces	Departments	Other references
West	Brittany Maine Touraine Poitou	Côtes-du-Nord Finistère Mayenne Sarthe Indre-et-Loire Vendée	PRIOUZEAU
Notrh-West	Normandy	Calvados Orne Seine-Maritime	PITRE, RAYNAUD, 1968 RAYNAUD, 1968
Center	Nivernais Burgundy Lyonnais	Nièvre Saône-et-Loire Rhône	EUZEBY

1. *Type I Ostertagiosis.*

Was found in weaned animals during the first year at pasture. It does not exist or was not found in young animals grazing and suckling their own dams for the first year. Grazing calves are sometimes only separated from the cows for wintering. This is done as a rule in *Charollais* or *Limousin*, the two main french beef cattle raising areas. (center of France). For these calves the intake of grass is slower and of a smaller quantity as they suckle their dam until June or July, than for weaned animals put on grass very early. In *Charollais* or *Limousin* areas in calves on pasture with their dams for the first year, *Type I Ostertagiosis* is barely or not seen. On weaned grazing animals, *Type I Ostertagiosis* is recorded from mid-July.

2. *Pretype II Ostertagiosis.*

The animals harbour very few adults and 5th stage larvae but a large or very large number of hypobiotic larvae of the 4th stage. The animals are in good health. This *Pretype II* was observed in 3 cases. 3 calves were sacrificed in mid-October, at the end of December and the end of February.

The heterogeneity of the individual results can be shown in 3 calves (n° 25/70 (22), 26/70 (22) and 27/70 (22)) (RAYNAUD *et al.*, 1974). They were put in the same herd on May 15. They were of the same age (5 months old) and of the same origin. When 10 months old, on October 15 they were sacrificed and the following results were recorded at *post mortem :*

No	Total Ostertagia	% of inhibited L_4 larvae	Ostertagiosis Type
25/70	71 650	2	I
26/70	108 450	63	II
27/70	120 750	15	I

With the same amount of total parasites, two calves were found with a *type I Ostertagiosis* and the other with a *Pretype II Ostertagiosis.*

3. *Type II Ostertagiosis.*

Is typical and was observed in 7 animals about 2 years of age and older. Some variants already described have been encountered :

— *Fasciolosis* + *Ostertagiosis* syndrome with slightly different symptoms, mainly anemia superimposed.

— *Parturient Ostertagiosis* was reported by practitioners as frequent in the *Charollais* area. After calving the cow, which may be old, shows symptoms of intermittent diarrhea and poor health.

The severity of the *Type II* disease is related to the burden of *adults and 5th stage larvae Ostertagia* found. But cases of *Type II Ostertagiosis* are reported *associated with a Pretype II stage.* Larvae from the mucosa emerge in successive waves from a stock of inhibited 4th stage larvae. When this stock is very large (1 000 000 to 2 000 000 L_4) the disease is very complex and cannot be easily controlled by anthelmintics except when treated several times at short intervals. It is probably the reason why some *Ostertagiosis* of *Type II* diseases, are reported as difficult or impossible to cure.

4. *Oedematous ostertagiosis.*

Is an original type and is more than a constant or frequent lesion in a *Type II* disease. The very severe lesions are unequivocal. The expanded abomasum (sometimes twice or three times its normal weight) with edges full of a watery oedema, the enlarged abomasal folds (« *foetal membranes* » appearance) are typical features of this severe disease found in 2 to 3 year old animals.

Under some conditions, the number of parasites found in the lumen or in the mucosa is so small that the only explanation for the disease can be an *allergic* over reaction to the parasite.

Sometimes this « simple oedematous type » is aggravated by a *Pretype II* or with a *Type II Ostertagiosis* and the well-known pathogenicity of the parasite can interfere with the allergic over reaction. Such *Type II* + *Oedematous* complexes were found to be very severe and quickly followed by the death of the animal.

In conclusion, *Ostertagiosis* is a well-known disease in France. To identify with precision the various types found, explain the symptoms observed and understand

the evolution of the disease, a complete *post mortem* examination of affected animals is recommended. Worm counts in the lumen and in the mucosal digests are useful and necessary.

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RÉSUMÉ

REVUE DE SYNTHÈSE SUR L'*OSTERTAGIOSE BOVINE* — BILAN DES TYPES ET SYNDROMES RENCONTRÉS EN FRANCE PAR AUTOPSIES ET INVENTAIRES PARASITAIRES COMPLETS

Soixante-quatorze bovins sevrés de tous âges ont été sacrifiés au laboratoire et nous avons réalisé des inventaires parasitaires complets à partir de lavages des organes et digestion des muqueuses. Vingt et un cas ont été considérés comme ceux d'animaux atteints d'*Ostertagiose*, animaux sacrifiés : *a*) et portant plus de 40 000 *Ostertagia ostertagi* adultes et immatures en lavages de caillette et digestion de muqueuse ; *b*) et moribonds présentant des symptômes et des lésions d'*Ostertagiose*. Les résultats ont été présentés en notant : 1) les symptômes cliniques ; 2) les lésions ; 3) les nombres de parasites trouvés ; 4) le *profil parasitaire*, ventilation en pourcentage des genres de nématodes gastro-intestinaux ; 5) les *niveaux parasitaires* : les nombres de parasites, par genre, sont jugés suivant des niveaux d'estimation *a*) de *porteurs de parasites* : niveaux Très Faible, Faible et Moyen, b) *des animaux affectés* à un *niveau élevé* : seuil de pathologie moyenne ou à un niveau *très élevé*, seuil de pathologie certaine ou de léthalité. Les résultats obtenus ainsi que ceux déjà publiés montrent une localisation de la maladie dans l'Ouest, le Nord-Ouest et le Centre de la France qui sont les régions de forte densité du bétail.

Nous avons démontré l'existence de l'*Ostertagiose de Type I* en première saison de pâture sur des animaux sevrés. Par contre elle n'est pas rencontrée sur les veaux d'élevage allaités au pâturage par leur mère (type *Charollais* ou *Limousin*). Le *Prétype II* est caractérisé par un faible nombre d'adultes et de larves L 5 et un nombre élevé de larves en hypobiose au stade 4, il a été démontré sur des animaux sacrifiés à la mi-octobre, fin décembre ou fin février.

L'*Ostertagiose de Type II* était rencontrée sur 7 animaux de 2 ans ou plus âgés. Quelques variantes du *type II* ont été notées : le complexe *Fasciolose-Ostertagiose* et l'*Ostertagiose du vêlage* qui semble reconnue par les praticiens français. La sévérité de la maladie est en relation avec le nombre d'adultes et des *Ostertagia* au stade 5. On a rencontré aussi des cas mixtes où la maladie de *Type II s'accompagne d'un état de prétype II*, c'est-à-dire une réserve considérable de larves en hypobiose au stade 4 (1 à 2 millions de L 4 par animal). Ces cas illustrent la difficulté du contrôle de ces affections par les anthelminthiques. L'*Ostertagiose œdémateuse* est pour nous un type ou syndrome particulier chez les animaux de 2 ou 3 ans. Le nombre total de parasites immatures et adultes en lumière et en muqueuse pouvant être *très faible* les lésions sont spectaculaires avec une caillette pouvant atteindre 2 à 3 fois son poids normal. L'œdème des parois et des plis est considérable et la caillette ouverte ressemble à un « délivre ». Parfois l'*œdème* tel que décrit se trouve associé à des parasites nombreux en *prétype II* ou en *Type II*. L'*Ostertagiose œdémateuse* a été interprétée comme un *processus allergique* chez des animaux sensibilisés par des infestations antérieures.

Pour approfondir nos connaissances en *Ostertagiose bovine*, et mieux analyser cette affection il est conseillé de réaliser en routine la digestion pepsique de la muqueuse de la caillette et la numération complète des helminthes et de leurs différents stades.

Laboratory results : clinical status, egg counts lesions and worm counts 12 results, ca

Bovine ostertagiosis					
Figure n°	1	—	2	—	—
Ref. n°/year/Department n°	19/70 (22)	39/71 (22)	29/70 (22)	28/70 (22)	25/70 (22)
Sacrificed (S) /day/month or Dead (D)	S 20/7	S 15/9	S 15/10	S 15/10	S 15/10
Sex	M	M	M	M	M
Age	8 months	7 months	10 months	10 months	10 months
Time on pasture	4 months	2 months	5 months	5 months	5 months
Clinical status	0	±	diarrhea weight loss	±	±
Ostertagiosis Type or syndrome	type I	type I	type I	type I	type I
Egg counts/g		?			
Digestive Strongyles	850		555	200	75
Nematodirus	0		0	0	0
Others	0		0	TRI (1) = 15	C+ (2)
Dictyocaulus	1/g		0	0	0
Lesions					
Lung	0	0	0	BP+	0
Liver	0	0	0	0	0
Abomasum	N++	N+++	N+++	N+	N+
Small Intestine	0	EH	0	0	0
Coecum colon	0	0	0	0	
Worm counts					
Liver : Fasciola adults	0	0	0	0	0
Lungs : Dictyocaulus Ad.	34	0	6	27	3
Immat.	0	0	0	0	0
Abomasum					
Ostertagia Total	41 700	84 840	191 700	68 250	71 650
Adults	30 800	78 480	149 800	53 400	53 400
L_5	10 000	3 720	39 200	14 000	17 000
L_4 lumen	900	2 640	2 700	750	1 250
PercentageL_4	< 10	< 10	< 10	< 10	< 10
Tricho. axei Adults	2 400	0	2 000	2 000	2 200
Immatures	0	0	0	0	0
Small intestine					
Cooperia Adults	17 200	5 600	1 820	4 400	5 400
Immatures	1 700	0	200	800	0
Nematodirus Adults	0	140	0	0	0
Immatures	0	0	0	0	0
Bunostomum	0	0	0	0	0
Trichostrongylus	0	420	0	0	0
Capillaria	0	0	0	500	400
Coecum colon					
Trichuris Adults	20	0	0	160	100
Immatures	0	0	0	0	0
Oesophagostomum Adults	0	0	0	0	0
Immat.	0	0	0	0	0
Moniezia	0	0	0	0	0
Total digestive worms	63 020	91 000	195 720	76 010	79 750
Adults	50 420	87 280	153 620	60 460	61 500
Immatures	12 600	3 720	42 100	15 550	18 250
Percentage Ostertagia vs. total	66.2	93.2	97.9	89.8	89.8

(1) TRI = Trichuris ; (2) C+ = Coccidia ; (3) CAP = Capillaria ;

tagiosis

heir first year on pasture or less than a year old

3	—	—	—	—	—	—
6/70 (22)	27/70 (22)	30/70 (22)	11/67 (61)	5/67 (37)	54/74 (29)	53/73 (71)
S 15/10	S 26/10	S 26/10	S 31/12	S 23/2	S 19/6	S 19/6
M	M	M	M	M	M	M
0 months	10 months	8 months	9 months	12 months	12 months	12 months
5 months	5 months	4 months	5 months	7 months	4 + 4 months	4 + 2 months
0	±	±	mediocre	0	mediocre	diarrhea weight loss
retype II	type I	type I	pretype II	pretype II	type II (+ fasciola)	type II (+ cooperia)
			?			
200	600	850		2 250	250	3 100
0	0	0				0
+ CAP (3)	C+	C+		TRI = 950	FAS (4) = 300	0
= 50				CAP = 600	C+	
0	0	0				0
0	BP+	BP+	0	0	0	0
0	0	0	0	0	CH++	0
N+	N+	N++	N++	N+	N+	N+++
0	0	0	0	0	0	E++
0	0			0	0	0
0	0	0	0	0	16	0
6	164	80	10	25	0	0
0	10	8	0	0	0	0
				HAE* 2 270		
108 450	120 750	103 975	111 750	59 180	48 900	201 400
28 900	102 200	96 400	10 500	8 280	34 900	153 000
11 600	2 800	1 800	20 450	8 400	8 100	35 000
67 950	15 750	5 775	80 800	42 500	5 900	13 400
62.7	15	< 10	72	72	12	10
300	0	2 800	500	1 760	0	0
0	0	0	40	0	0	0
			?			
350	1 600	1 800		0	150	76 000
0	0	0		0	0	42 800
0	0	0		0	0	0
0	0	0		0	0	0
0	0	0		0	0	0
0	0	0		80	0	0
100	0	0		80	0	0
			?			
0	0	10		254	0	0
0	30	0		0	0	0
0	0	0		0	0	0
0	0	0		0	0	0
0	0	0		0	0	0
109 200	122 380	108 585		63 624	49 050	320 200
29 650	103 800	101 010		12 584	35 050	229 000
79 550	18 580	7 575		51 040	14 000	91 200
99.3	98.7	95.8	?	93.0	99.7	63.0

[4]) FAS = Fasciola; * HAE = Haemonchus.

Laboratory results : clinical status, egg counts, lesions and worm co

Bovine ostertagiosis			
Figure n°	5	4	7
Ref. n°/year/Department n°	73/75 (58)	67/75 (53)	69/75 (53)
Sacrificed (S) day/month	D 29/5	D 31/1	18/3
or Dead (D)			
Sex			F
Age	16 months	2 years	2 years
Time on pasture			
Clinical status	diarrhea weight loss	diarrhea weight loss	diarrhea weight loss
Ostertagiosis / Type or syndrome	type II + oedematous	oedematous	type II
Egg counts/g			
Digestive Strongyles	1 800	200	5 700
Nematodirus	0	0	0
Others	0	C+	C++
Dictyocaulus	0	0	7
Lesions			
Lung	0	0	0
Liver	0	0	0
Abomasum	Oed.+++ N+++	Oed.+++ N+++	cong.+ N++++
Small intestine	N++	0	N+
Caecum colon	N+	0	N++
Worm counts			
Liver : Fasciola Adults	0	0	0
Dicrocoelium	295		
Lungs : Dictyocaulus Ad.	0	0	24
Immat.	0	0	0
Abomasum			
Ostertagia Total	283 500	32 700	1 279 100
Adults	212 800	8 400	244 800
L_5	28 300	5 800	93 200
L_4 lumen	42 400	18 500	941 100
Percentage L_4	15.0	57	74
Tricho. axei Adults	31 000	1 700	20 000
Immatures	6 000	500	0
Small intestine			
Cooperia Adults	3 250	0	0
Immatures	0	0	0
Nematodirus Adults	0	0	0
Immatures	0	0	0
Bunostomum	0	0	0
Trichostrongylus	700	0	600
Capillaria	0	0	0
Caecum colon			
Trichuris Adults	0	0	
Immatures	0	0	
Oesophagostomum Adults	0	0	100
Immat.	0	0	150
Moniezia	0	0	
Total digestive worms	324 450	34 900	1 299 950
Adults	247 750	10 100	265 390
Immatures	76 700	24 800	1 034 560
Percentage Ostertagia vs. total	87.4	93.7	98.4

rtagiosis

sults, older calves or adults.

—	—	—	—	8	6
70/75 (72)	56/74 (29)	71/75 (58)	72/75 (58)	55/74 (29)	74/76 (76)
D 3/4	S 31/10	D 15/4	D 27/5	S 19/6	D 7/04
M 2 years	M 2 years	F 3 years	F adult	F old	F 2 years 1 year
diarrhea weight loss type II	diarrhea weight loss pretype II + oedema	diarrhea weight loss pretype II + oedema	diarrhea weight loss type II	diarrhea since calv. parturient (type II)	diarrhea weight loss type II + pretype II
			?		
800	200	0		15	120
0	0	0		0	0
0	C+	0		0	0
0	0	0		0	0
0	BP+	0	0	0	0
0	0	0	0	0	0
ng. N++++	Oed.+++ N++	Oed.+++ N+++	H.+++ N+++	N+++	N++++
0	EH+	0	0	0	0
N+	0	0	0	0	0
		?			
0	0		0	0	0
					0
0	0		0	0	3
0	0		0	0	2
1 671 000	90 700	?	107 750	104 350	2 814 980
285 000	3 800		97 000	8 500	40 300
669 000	900		9 000	850	135 780
717 000	86 000	120 000	1 750	95 000	2 638 900
43	95	?	< 10	91	94
0	900	?	0	0	18 500
0	0		0	0	47 500
1 500	8 000	?	?	450	480
200	4 400			50	0
0	500			0	0
0	200			0	0
0	0			0	0
0	0			150	120
0	0			25	260
0	0	?	?	0	0
0	0			0	0
0	0			0	0
460	0			0	0
0	0			0	0
1 673 160	104 700	?	?	105 025	2 881 840
286 500	13 200			9 125	59 660
1 386 660	91 500			95 900	2 822 180
99.9	86.6	?	?	99.4	97.7

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PLATE

PLATE I

Gross pathological lesions of the abomasal mucosa Bovine ostertagiosis

N° 1 : primary nodules.

N° 2 : haemorrhagic mucosa.

N° 3 : two opened abomasa.
Front : oedematous *ostertagiosis.*
Back : type II *ostertagiosis* with congestion and oedema.

N° 4 : oedematous *ostertagiosis.*
The abomasal folds are extremely filled with a watery fluid.
Appearance of « foetal membranes ».

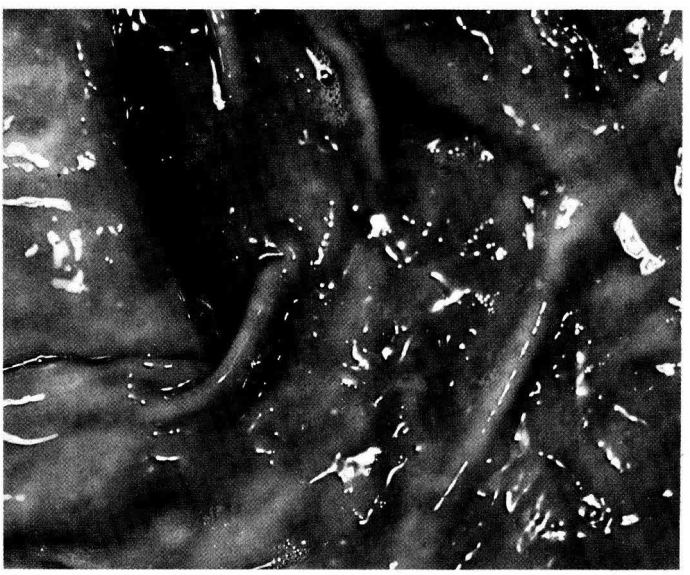
N° 5 : oedematous *ostertagiosis.*
Fundic folds filled with oedema are insulated.

BOVINE OSTERTAGIOSIS
OSTERTAGIOSE BOVINE

J.-P. RAYNAUD, A. BOUCHET 1976

N° 1

N° 2



n° 3

n° 4

n° 5