Hampshire breed. *Meat Science* **13,** 49-63
MURRAY, A. C., ROBERTSON, W., NATTRESS, F. & FORTIN, A. (2001) Effect of pre-slaughter overnight feed withdrawal on pig carcass and muscle quality. *Canadian Journal of Animal Science* **81,** 89-97
NANNI COSTA, L., LO FIEGO, D. P., DALL'OLIO, S., DAVOLI, R. & RUSSO, V. (2002) Combined effects of pre-slaughter treatments and lairage time on carcass and meat quality in pigs of different halothane genotype. *Meat Science* **61,** 41-47
NATTRESS, F. M. & MURRAY, A. C. (2000) Effect of antemortem feeding regimes on bacterial numbers in the stomachs and ceca of pigs. *Journal of Food Protection* **63,** 1253-1257
SCHÜTTE, A., MERGENS, A., POTT, S. & VENTHIEN, S. (1996) Effect of different kinds of showering in lairage on physiological and meat quality parameters, taking climatic circumstances into account. *Landbauforschung Völkenrode Sonderheft* **166,** 181-201
SMULDERS, F. J. M., ROMME, A. M. C. S., WOOLTHUIS, C. H. J., DE KRUIJF, J. M., EIKELENBOOM, G. & CORSTIAENSEN, G. P. (1982) Pre-stunning treatment during lairage and pork quality. Proceedings of a CEC Seminar 'Stunning of Animals for Slaughter'. Zeist, The Netherlands, October 13 to 15, 1982. The Hague, Martinus Nijhoff. pp 90-95
SWANENBURG, M., URLINGS, H. A. P., KEUZENKAMP, D. A. & SNIJDERS, J. M. A. (2001a) Salmonella in the lairage of pig slaughterhouses. *Journal of Food Protection* **64,** 12-16
SWANENBURG, M., VAN DER WOLF, P. J., URLINGS, H. A. P., KEUZENKAMP, D. A., SNIJDERS, J. M. A. & VAN KNAPEN, F. (2001b) *Salmonella* in slaughter pigs: the effect of logistic slaughter procedures of pigs on the prevalence of *Salmonella* in pork. *International Journal of Food Microbiology* **70,** 231-242
VAN PUTTEN, G., CORSTIAENSEN, G. P., VAN LOGTESTIJN, J. G. & ZUIDHOF, S. (1983) Showering pigs intended for slaughter. *Tijdschrift voor Diergeneeskunde* **108,** 645-652
WARRISS, P. D. (1979) Adrenal ascorbic acid depletion as an index of preslaughter stress in pigs. *Meat Science* **3,** 281-285
WARRISS P. D. (1984) The incidence of carcass damage in slaughter pigs. Proceedings of the 30th European Meeting of Meat Research Workers. Bristol, UK, September 9 to 14, 1982. paper 1:8
WARRISS P. D. (1985) Marketing losses caused by fasting and transport during the preslaughter handling of pigs. *Pig News and Information* **6,** 155-157
WARRISS P. D. (1987) Evaluation and Control of Meat Quality in Pigs. Eds P. V. Tarrant, G. Eikelenboom, G. Monin. Dordrecht, Martinus Nijhoff. pp 245-264
WARRISS, P. D. (1994) Pig handling: guidelines for the handling of pigs ante mortem. *Meat Focus International* **4,** 491-494
WARRISS, P. D. (1996) The consequences of fighting between mixed groups of unfamiliar pigs before slaughter. *Meat Focus International* **5,** 89-92
WARRISS, P. D. (2000) Meat Science: An Introductory Text. Wallingford, CAB International. pp 131-155
WARRISS, P. D. & BEVIS E. A. (1986) Transport and lairage times in British slaughter pigs. *British Veterinary Journal* **142,** 124-130
WARRISS P. D., BEVIS, E. A. & EKINS, P. J. (1989) The relationships between glycogen stores and muscle ultimate pH in commercially-slaughtered pigs. *British Veterinary Journal* **145,** 378-383
WARRISS, P. D. & BROWN, S. N. (1985) The physiological responses to fighting in pigs and the consequences for meat quality. *Journal of the Science of Food and Agriculture* **36,** 89-92
WARRISS, P. D., BROWN, S. N., EDWARDS, J. E., ANIL, M. H. & FORDHAM, D. P. (1992a) Time in lairage needed by pigs to recover from the stress of transport. *Veterinary Record* **131,** 194-196
WARRISS, P. D., BROWN, S. N., EDWARDS, J. E. & KNOWLES, T. G. (1998) Effect of lairage time on levels of stress and meat quality in pigs. *Animal Science* **66,** 255-261
WARRISS, P. D., BROWN, S. N., FRANCOME, M. A. & HIGGINS, J. A. (1987) The effect of pre-slaughter fasting on the characteristics of pig livers. *International Journal of Food Science Technology* **22,** 255-263
WARRISS, P. D., BROWN, S. N., KNOWLES, T. G. & EDWARDS, J. E. (1992b) A note on the influence of width and the incorporation of bends on the time taken by pigs to move along races. *Veterinary Record* **130,** 202-206
WEEDING, C. M., GUISE, H. J. & PENNY R. H. C. (1993) Factors influencing the welfare and carcass and meat quality of pigs: the use of water sprays in lairage. *Animal Production* **56,** 393-397

Anaemia and mortality in calves infested with the long-nosed sucking louse (*Linognathus vituli*)

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Young calves which died on three dairy farms in England and Wales had generalised pallor and heavy infestations of the long-nosed sucking louse, *Linognathus vituli*. Surviving calves had packed-cell volumes, haemoglobin concentrations and red blood cell counts below the reference ranges, consistent with anaemia, and they were also heavily infested with lice. No other causes of anaemia were identified. It is proposed that heavy infestations with *L vituli* should be considered when investigating the cause of anaemia in calves.

LOUSE infestation or pediculosis is common in British cattle. Titchener (1983) identified louse-infested calves on 80 of 100 Ayrshire farms surveyed. *Linognathus vituli*, the long-nosed sucking louse, was the most frequently detected species and identified on 56 of the farms; the biting louse, *Bovicola bovis*, was identified on 48 of the farms, *Haematopinus eurysternus* was recorded on 11 and *Solenopotes capillatus* was recorded on seven of the farms. The chief effect of both sucking and biting lice is skin irritation (Soulsby 1982) and in recent years hide damage caused by lice has been increasingly recognised (Bugby and others 1990, Webster and Bugby 1990). Gibney and others (1985) reported an improvement in weight gain when heifers with heavy louse infestations were treated, but other workers have observed no improvement in comparison with untreated animals (Kettle 1974, Cummins and Tweedle 1977, Chalmers and Charleston 1980, Cummins and Graham 1982). In several studies, infestations with *L vituli* were not associated with anaemia (Cummins and Tweedle 1977, Callinan 1980, Chalmers and Charleston 1980, Oormazdi and Baker 1980, Cummins and Graham 1982, Bailey and others 1984, Burns and others 1992) but Ammeloux (1980) and Mehrotra and Singh (1986) reported anaemia without fatalities in calves infested with *L vituli*. This paper describes investigations into the deaths of young calves on three farms where heavy infestations with *L vituli* were associated with anaemia.

MATERIALS AND METHODS

Blood samples were taken into EDTA as anticoagulant and examined haematologically on a F800 cell counter (Sysmex); the reference ranges for the haematological parameters have been derived from Jain (1993). The louse populations were evaluated by a method similar to that described by Cummins and Tweedle (1977); when the total count of lice at 10 sites on a calf exceeded 60, a maximum score of 3 on a scale of 0 to 3 was given, and infestations with this score are described as 'heavy' in the following text.

CASE DESCRIPTIONS

Postmortem examinations and farm investigations

Farm 1 In June 1999, the carcases of two three-month-old Simmental cross calves from a closed 40-cow dairy herd were examined. They were from a group of eight similarly aged housed calves and had not previously been examined by a veterinary surgeon. Their diet had consisted of coarse mix and hay, both fed ad libitum, and water. Both calves were in poor body condition, had generalised pallor and extensive crusty thickening of the skin, particularly of the ears, neck and axillae, and a heavy louse infestation. The lice were most numerous around the eyes and on the muzzle, at the base of the ears and around the poll, neck and shoulders. No other abnormalities were observed. The lice were identified as a mixed population of *B bovis* and *L vituli*, present in a ratio of approximately five *B bovis* to one *L vituli*.

The remaining six calves in the group were in poor body condition and were heavily infested with lice, like the calves examined postmortem. Four of the calves (calves 1 to 4) (Table 1) were depressed, dehydrated, weak and spent most of their time lying down. They had extensive skin lesions similar to the calves examined postmortem (Fig 1), but pruritus was not observed. The other two calves (calves 5 and 6) occasionally rubbed and licked themselves. The packed-cell volumes (PCVs), haemoglobin concentrations and red blood cell (RBC) counts of calves 1 to 4 were below the reference ranges (Table 1). All six calves were treated with a 4 per cent permethrin pour-on product (Ryposect; C-Vet Veterinary Products), but calves 2, 3 and 4 died within the next three days. One month later, the surviving three calves were brighter and more active; no lice were identified on any of them and they were treated with the same permethrin product again.

In January 2001, the farmer reported the sudden death of two weaned calves among a group of housed calves, aged three to six months, which were in poor body condition. The remaining seven calves were pruritic with scurfy skin lesions, predominantly over the head, neck and shoulders, and had heavy louse infestations. Lice collected from three of the calves were all identified as *L vituli*. One very weak calf had pale mucous membranes (calf 1) (Table 2). No other diseases were evident in the calves and no worm eggs or coccidial oocysts were detected in faecal samples by the modified McMaster technique. The PCV and haemoglobin concentrations of the three calves were below the reference ranges and the RBC values were low in two of them (Table 2).

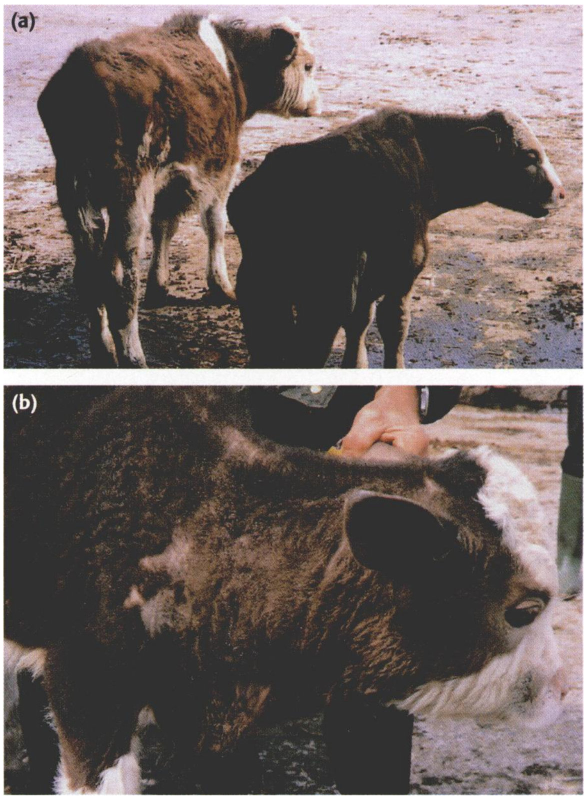

FIG 1: (a) Depressed calves in poor condition on farm 1. (b) Detail of hair loss and skin lesions which particularly affected the neck and muzzle

Farm 2 In January 2001, the carcase of a two-month-old Limousin cross calf and blood samples collected antemortem were examined. It was one of 30 similarly aged calves, housed in groups of five, on a 140-cow dairy farm. Their diet consisted of milk, water, starter pellets fed ad libitum, and straw. In the previous three weeks, 14 calves were reported to have died either suddenly or after exhibiting respiratory distress.

TABLE 1: Haematological results for the group of six calves on farm 1 in June 1999

Variable	Reference range (Jain 1993)	Calf 1	2	3	4	5	6
PCV (litre/litre)	0·32-0·40	0·23	0·20	0·20	0·24	0·42	0·48
Haemoglobin (g/dl)	9·7-12·7	7·7	6·9	5·8	8·1	12·6	15·4
RBC (x 10^{12}/litre)	8·5-10·5	5·4	5·2	5·9	5·8	11·6	14·1
MCV (fl)	34·6-41·0	42·6	39·1	33·9	42·1	36·0	33·9
MCH (pg)	10·2-13·4	14·2	13·2	9·9	14·1	10·9	10·9
MCHC (g/dl)	28·4-34·0	33·2	33·8	29·1	33·5	30·3	32·2
Platelets (x 10^9/litre)	100-800	479	575	892	705	549	880

PCV Packed-cell volume, RBC Red blood cells, MCV Mean cell volume, MCH Mean cell haemoglobin, MCHC Mean cell haemoglobin concentration

TABLE 2: Haematological results for three calves on farm 1 in January 2001

Variable	Reference range (Jain 1993)	Calf 1	2	3
PCV (litre/litre)	0·32-0·40	0·13	0·24	0·31
Haemoglobin (g/dl)	9·7-12·7	4·1	7·5	9·4
RBC (x 10^{12}/litre)	8·5-10·5	3·5	6·9	9·0
MCV (fl)	34·6-41·0	36·8	34·8	34·4
MCH (pg)	10·2-13·4	11·9	10·9	10·4
MCHC (g/dl)	28·4-34·0	32·3	31·4	30·3
Platelets (x 10^9/litre)	100-800	533	906	889

PCV Packed-cell volume, RBC Red blood cells, MCV Mean cell volume, MCH Mean cell haemoglobin, MCHC Mean cell haemoglobin concentration

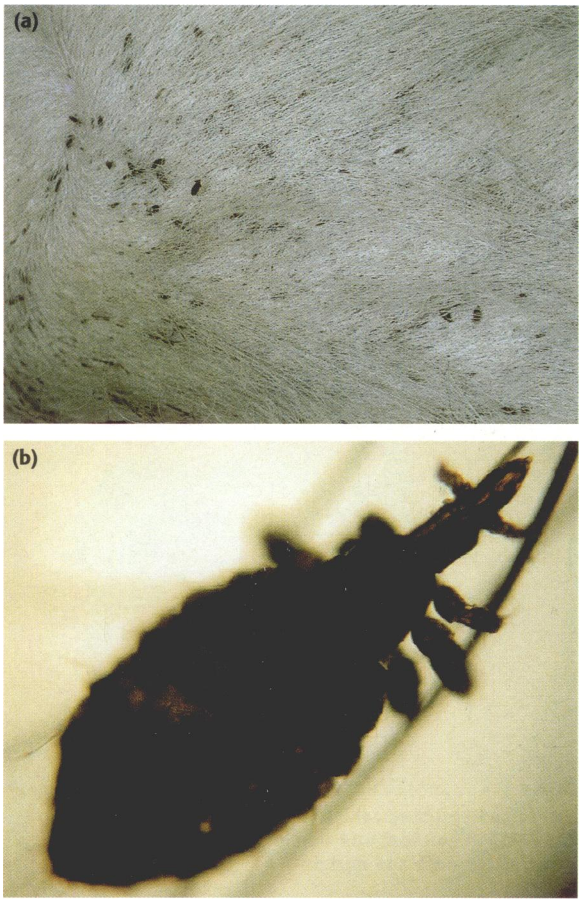

FIG 2: (a) Sucking lice on the skin of a dead calf from farm 2. (b) *Linognathus vituli* from the skin of the dead calf. x 200

The cause of the deaths had not been established and the calves had not responded to treatment with various antibiotics and multivitamin preparations. No gross skin lesions were identified although the calf was heavily infested with *L vituli* (Fig 2). Other findings included a pale carcase and abscesses in the cranial lobes of the lungs, which were also consolidated; no other abnormalities were observed. Blood samples were taken from five other calves in the group by the referring practitioner, when they were reported to have been heavily infested with lice. These calves and the calf which was examined postmortem had marginal or low PCV, haemoglobin and RBC values (Table 3). No further deaths were reported after the remaining calves were treated with a pour-on doramectin product (Dectomax Pour-on; Pfizer).

Farm 3 In February 2001, the carcase of a four-month-old Friesian heifer from a 60-cow dairy farm was examined. It was from a group of 10 similarly aged housed calves which were fed hay, rearing nuts and water, three of which had died during the previous three weeks, either suddenly or after a brief period of lethargy, with no other clinical signs. The cause of the deaths of these three calves was not investigated; they had received no medication. The calf examined had a heavy infestation with *L vituli*, but no other skin lesions. Its carcase was pale and it had left ventricular hypertrophy, subcutaneous and pulmonary oedema and mucoid intestinal contents, but no other gross abnormalities. Faeces examined by the modified McMaster technique contained 12,900 coccidial oocysts per gram but no helminth worm eggs. Blood samples were taken by the referring practitioner from the surviving calves in the group when they were reported to have been infested

TABLE 3: Haematological results for the dead calf and five calves in the same group on farm 2 in January 2001

Variable	Reference range (Jain 1993)	Dead calf	Calf 1	2	3	4	5
PCV (litre/litre)	0·32-0·40	0·11	0·30	0·32	0·24	0·28	0·30
Haemoglobin (g/dl)	9·7-12·7	3·1	8·8	9·5	6·5	8·2	8·9
RBC (x 10^{12}/litre)	8·5-10·5	3·1	8·1	8·5	7·4	7·5	8·0
MCV (fl)	34·6-41·0	34·5	37·3	38·0	31·9	36·9	38·1
MCH (pg)	10·2-13·4	9·9	10·8	11·2	8·8	11·0	11·2
MCHC (g/dl)	28·4-34·0	28·7	28·9	29·3	27·5	29·8	29·3
Platelets (x 10^9/litre)	100-800	700	706	670	1225	464	783

PCV Packed-cell volume, RBC Red blood cells, MCV Mean cell volume, MCH Mean cell haemoglobin, MCHC Mean cell haemoglobin concentration

TABLE 4: Haematological results for six calves of the same age on farm 3 in February 2001

Variable	Reference range (Jain 1993)	Calf 1	2	3	4	5	6
PCV (litre/litre)	0·32-0·40	0·36	0·25	0·26	0·35	0·34	0·43
Haemoglobin (g/dl)	9·7-12·7	10·2	7·5	8·2	9·9	9·8	12·1
RBC (x 10^{12}/litre)	8·5-10·5	9·9	7·3	7·8	9·8	9·3	12·8
MCV (fl)	34·6-41·0	36·7	34·9	33·6	35·4	36·5	33·9
MCH (pg)	10·2-13·4	10·3	10·3	10·6	10·1	10·5	9·4
MCHC (g/dl)	28·4-34·0	28·0	29·5	31·4	28·4	28·9	27·9
Platelets (x 10^9/litre)	100-800	527	867	559	508	592	659

PCV Packed-cell volume, RBC Red blood cells, MCV Mean cell volume, MCH Mean cell haemoglobin, MCHC Mean cell haemoglobin concentration

with lice, and in two of them the PCV, haemoglobin and RBC values were below the reference ranges (Table 4). No further deaths occurred after the calves were treated with a 1 per cent ivermectin injectable product (Panomec; Merial Animal Health).

DISCUSSION

All the calves examined postmortem had pale carcases and were heavily infested with *L vituli*. In addition, one of the calves examined postmortem had low PCV, haemoglobin and RBC values (dead calf) (Table 3) and other calves on each farm had low to marginal PCV, haemoglobin and RBC values. The haematological results are consistent with anaemia as defined by Jain (1993). There are many possible causes of anaemia in calves (Radostits and others 2000), but on the basis of their clinical histories, postmortem findings, haematological results and their response to treatment with ectoparasiticides, the heavy burdens of sucking lice were considered to be the most likely cause of the anaemia in the calves on the three farms.

Infestations with *L vituli* are more common in calves than in mature animals (Townsend and Scharko 1999), a finding which is consistent with the age distribution of the affected calves. The infestations are generally more severe in undernourished calves (Cummins and Tweedle 1977, Callinan 1980, Cummins and Graham 1982), but these calves were considered to have been adequately nourished. On farms 2 and 3 it is possible that pneumonia and coccidiosis, respectively, which by themselves were unlikely to have caused anaemia, may have predisposed the calves to heavier louse infestations; however, on farm 1 no other diseases were identified.

On farms 2 and 3 the finding of calves infested with lice during the winter housing period is consistent with previous reports (Matthysse 1946, Geden and others 1990). The increased severity of louse infestations during the winter months is believed to be due to various factors; the thicker coat provides an ideal habitat for the multiplication of lice, whereas the shedding of the winter coat and exposure to the warmer temperatures of the summer months is believed to be detrimental to their survival (Matthysse 1946). Furthermore, winter-housed animals are in closer contact with one another, facilitating the transmission of the lice (Soulsby 1982). The outbreak on farm 1 occurred in June 1999, an unusual time of year for pediculosis in countries in the northern hemisphere. The failure of the stockman to recognise a re-infestation undoubtedly contributed to the recurrence of heavy *L vituli* infestations in 2001. The absence of *B bovis* at that time suggests that the pyrethrin pour-on used in 1999 may have been fully effective against *B bovis* but not against *L vituli*.

Matthysse (1946) reported that infestations of *L vituli* cause less severe hair loss than infestations of *B bovis*. In agreement with this, the skin lesions on the calves on farm 1 were more severe than those on the calves on farms 2 and 3, probably in association with the large numbers of *B bovis* on farm 1 in 1999, whereas only *L vituli* was detected on farms 2 and 3. The less pronounced skin irritation caused by *L vituli* may be a factor which leads to infestations of *L vituli* being overlooked.

The observations on these three farms differ from previous reports that infestations with *L vituli* are of little clinical significance other than as a cause of skin irritation (Oormazdi and Baker 1980, Weeks and others 1995). The lack of reports of significant disease in infested calves may be explained by the lower parasite burdens and the older animals studied (Cummins and Tweedle 1977, Chalmers and Charleston 1980, Oormazdi and Baker 1980, Weeks and others 1995), in contrast with the heavy infestations found on these young calves. In contrast with the few reports of significant clinical disease caused by *L vituli*, heavy infestations of *H eurysternus*, the short-nosed sucking louse, have been reported to cause anaemia (Peterson and others 1953, Shemanchuk and others 1960, Scharff 1962, Collins and Dewhirst 1965, Nelson and others 1970).

The results described indicate that *L vituli* may be of more pathogenic significance than previously considered, especially when it is present in large numbers on young calves. Other unrecognised causes of anaemia may have been responsible for these outbreaks, but investigations failed to identify any. The authors suggest that infestations with this parasite should be included in the differential diagnosis of calf anaemia. Infestations can be overlooked by stockmen (Milnes and Green 1999) and if untreated may cause fatalities. The treatment of cattle in early winter before heavy infestations become established should be most effective in eradicating the lice.

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References

AMMELOUNX, B. (1980) Severe anaemia in a calf as a result of heavy louse infestation (*Linognathus vituli*). *Tierärztliche Umschau* **35,** 692-696

BAILEY, P. J., CARROLL, W. A. D. & KNEE, B. (1984) Effects of lice infestation on the growth of beef heifers in Victoria. *Australian Journal of Experimental Agriculture and Animal Husbandry* **24,** 140-143

BUGBY, A., WEBSTER, R. M. & TITCHENER, R. N. (1990) Light Spot and Fleck. Part 2; Animal Infestation Studies. Laboratory Report 186. Northampton, British Leather Confederation

BURNS, L. M., TITCHENER, R. N. & HOLMES, P. H. (1992) Blood parameters and turnover data in calves infested with lice. *Research in Veterinary Science* **52,** 62-66

CALLINAN, A. P. L. (1980) Effects of artificially induced infestations of the cattle louse, *Linognathus vituli*. *Australian Veterinary Journal* **56,** 484-486

CHALMERS, K. & CHARLESTON, W. A. G. (1980) Cattle lice in New Zealand: effects on host liveweight gain and haematocrit levels. *New Zealand Veterinary Journal* **28,** 235-237

COLLINS, R. C. & DEWHIRST, L. W. (1965) Some effects of the sucking louse, *Haematopinus eurysternus*, on cattle on unsupplemented range. *Journal of the American Veterinary Medical Association* **146,** 129-132

CUMMINS, L. J. & GRAHAM, J. F. (1982) The effect of lice infestation on the growth of Hereford calves. *Australian Veterinary Journal* **58,** 194-196

CUMMINS, L. J. & TWEEDLE, N. E. (1977) The influence of light infestations of *Linognathus vituli* on the growth of young cattle. *Australian Veterinary Journal* **53,** 591-592

GEDEN, C. J., RUTZ, D. A. & BISHOP, D. R. (1990) Cattle lice (Anoplura, Mallophaga) in New York: seasonal population changes, effects of housing type on infestations of calves, and sampling efficiency. *Journal of Economic Entomology* **83,** 1435-1438

GIBNEY, V. J., CAMPBELL, J. B., BOXLER, D. J., CLANTON, D. C. & DEUTSCHER, G. H. (1985) Effects of various infestation levels of cattle lice (Mallophaga: Trichodectidae and Anoplura: Haematopinidae) on feed efficiency and weight gains of beef heifers. *Journal of Economic Entomology* **78,** 1304-1307

JAIN, N. C. (1993) Schalm's Veterinary Hematology. Philadelphia, Lea & Febiger. pp 26, 124, 159

KETTLE, P. R. (1974) The influence of cattle lice (*Damalinia bovis* and *Linognathus vituli*) on weight gain in beef animals. *New Zealand Veterinary Journal* **22,** 10-11

MATTHYSSE, J. G. (1946) Cattle lice, their biology and control. *Cornell University Agricultural Experimental Station Bulletin* **832,** 3-67

MEHROTRA, P. & SINGH, T. (1986) Studies on some blood constituents of calves infested with *Linognathus vituli* (Linn). *Indian Journal of Animal Health* **25,** 29-32

MILNES, A. S. & GREEN, L. E. (1999) Prevalence of lice on dairy cattle in England and the bordering counties of Wales. *Veterinary Record* **145,** 357-362

NELSON, W. A., SHEMANCHUK, J. A. & HAUFE, W. O. (1970) *Haematopinus eurysternus*: blood of cattle infested with the short-nosed cattle louse. *Experimental Parasitology* **28,** 263-271

OORMAZDI, H. & BAKER, K. P. (1980) Studies on the effects of lice on cattle. *British Veterinary Journal* **136,** 146-153

PETERSON, H. O., ROBERTS, I. H., BECKLUND, W. W. & KEMPER, H. E. (1953) Anemia in cattle caused by heavy infestations of the blood-sucking louse, *Haematopinus eurysternus*. *Journal of the American Veterinary Medical Association* **122,** 373-376

RADOSTITS, O. M., GAY, C. C., DOUGLAS, C. B. & HINCHCLIFF, K. W. (2000) Veterinary Medicine. A Textbook of the Diseases of Cattle, Sheep, Pigs, Goats and Horses. 9th edn. Philadelphia, W. B. Saunders. pp 414-417

SHEMANCHUK, J. A., HAUFE, W. O. & THOMPSON, C. O. M. (1960) Anemia in range cattle heavily infested with the short-nosed sucking louse, *Haematopinus eurysternus* (Nitz) (Anoplura: Haematopinidae). *Canadian Journal of Comparative Medicine and Veterinary Science* **24,** 158-161

SCHARFF, D. K. (1962) An investigation of the cattle louse problem. *Journal of Economic Entomology* **55,** 684-688

SOULSBY, E. J. L. (1982) Helminths, Arthropods and Protozoa of Domesticated Animals. 7th edn. London, Baillière Tindall. p 374

TITCHENER, R. N. (1983) Prevalence of cattle lice on calves. *Veterinary Record* **112,** 460

TOWNSEND, L. & SCHARKO, P. (1999) Lice infestation in beef cattle. *Compendium on Continuing Education for the Practicing Veterinarian* **21** (Suppl), 119-123

WEBSTER, R. M. & BUGBY, A. (1990) Light Spot and Fleck Grain Defects of Economic Importance to the UK Leather Industry. Part 1; Identification of the Causal Agent. Laboratory Report 184. Northampton, British Leather Confederation

WEEKS, C. A., NICOL, C. J. & TITCHENER, R. N. (1995) Effects of the sucking louse (*Linognathus vituli*) on the grooming behaviour of housed calves. *Veterinary Record* **137,** 33-35

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