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THE IMPACT OF A DIFFERENT CATTLE MANAGEMENT ON THE INCIDENCE OF HELMINTHS IN VARIOUS AGE GROUPS

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Abstract. Under conditions of two types of cattle management (traditional and modern), we identified these helminth genera in the individual age groups of cattle: *Strongyloides*, *Bunostomum*, *Cooperia*, *Nematodirus*, *Oesophagostomum*, *Ostertagia*, *Trichostrongylus*, *Trichuris*, *Dictyocaulus*, *Dicrocoelium*, *Fasciola* and *Moniezia*. The incidence of helminths in calves escalates with the age of the host in dependence on the season and the composition of feeding doses. In older animals, helminthic infection is influenced by the type of pasture, the number of animals on one ha, and the treatment before turn out and after turn in. Although an acute form of gastrointestinal helminthiases has sofar not been reported in Czechoslovakia, this situation might arise in modern, intensive husbandry establishments. Therefore, measures should be taken as regards the housing and grazing of cattle which might reduce parasitic infections to a minimum.

In recent years, cattle husbandry, one of the fundamental branches of animal production, has undergone considerable changes associated with the concentration of animals and specialisations. A new technology introduced to the raising, housing and grazing of cattle of various age categories has influenced also the incidence of parasites. The present study has been designed to determine the helminth fauna of calves, heifers and milking cows in dependence on the age, the type of management and grazing techniques under new conditions of an intensive husbandry.

MATERIAL AND METHODS

In the years 1970—1977, we examined 2884 calves, 1650 heifers and 1800 milking cows from 6 intensive and 4 traditional husbandry establishments raising calves, 6 farms raising heifers and from 2 modern, large cow houses and 4 traditional ones using the quantitative and qualitative coprological method suggested by Breza (1959). The pastures examined covered an area of 2550 ha.

Calves from 1—6 months of age were housed either in modern, large stables holding 1000—2000 animals or in traditional stables for 50—200 animals. In modern establishments, calves were kept individually in boxes up to approximately 2 months of age. From 3 months onwards, they were transferred to stalls each holding 10—20 animals. Calves were not kept separately in traditionally managed establishments. All floors were made of cement and cleaned daily with a mechanical scraper. From about 1.5 months onwards, they were fed with Laktosan A, B, granules and high-quality hay. From the age of 3—6 months (from May to October), they were given mainly green fodder, during the winter months they were fed on silage and hay. Faecal samples were collected regularly in monthly intervals.

Heifers and milking cows were housed both in large, modern, stables and in traditional cow sheds (in mountainous and submountainous areas) with pastures in the vicinity. We examined heifers aged from 6—14 months both in stables and on pasture, either in open grounds for 300 to 350 animals on an area of 120—180 ha, or in enclosures with a driving-in route and a resting place holding 70—100 heifers on a grazing area of 30—37 ha. In some mountain areas, heifers remained on pasture day and night. Milking cows from mountain areas were examined once a month, those

from submountainous areas 4 times a year. Both the size of the pasture and the number of animals on it were different. Herds of milking cows managed in the traditional way, were kept in numbers from 400 to 500 on a grazing area covering from 200—350 ha, those from a modern, intensive, husbandry establishment grazed in enclosures holding 250—300 animals.

Herds remained on pasture from June to September (sometimes October). Summer was temperate in all areas, in winter snowfall was heavier in mountainous areas.

RESULTS

CALVES

The only helminth species recovered from modernly managed calves from the age of 1—2 months were eggs of *Strongyloides papillosus* at an incidence ranging from 5 to 9 %. From the third month onwards, a decrease in the incidence of infection with this nematode species was concomitant with a gradual increase in infection with other nematode species such as *Oesophagostomum* spp., *Cooperia* spp., *Trichostrongylus* spp. (incidence of infection from 4—12 %). Faecal samples contained from 5—100 eggs of these nematodes in 1 g of faeces. *Haemonchus contortus*, *Ostertagia* spp., *Nematodirus* spp. and *Trichuris* spp. were recovered from 5—6 month-old calves. Thereby, the curve showing the incidence of helminths was most characteristic. Its first peak (infection with *S. papillosus*) was attained in March, April, the second in September, October at which time calves fed mainly on fresh food, and started to acquire helminth species common to adult cattle. The infective source was mainly green fodder. An examination of the environment of the stables housing calves disclosed that it provided the most satisfactory microclimatic conditions for the development of both eggs and larvae of several nematode species which might have an impact on an outbreak of helminthiases in housed calves. Therefore, we examined samples of scrapings taken off the walls of the individual stalls and floors, and material from between the hooves of calves. In 54 % of samples, we found eggs of *Cooperia* spp., *Oesophagostomum* spp. and *Trichuris* spp., developed and infective larvae (3rd stage) of the nematodes *Chabertia ovina*, *H. contortus*, *S. papillosus* and *Oesophagostomum* spp.

As with 1—2 month-old calves from modern, intensive, husbandry establishments, those from traditionally managed farms were found to be infected at the age of 1—2 months with *S. papillosus* only (average incidence 42 %). At the age of 3 months, an incidence of *S. papillosus* was frequently accompanied by that of *Trichuris ovis*. In one of the localities examined, the incidence of infection with *T. ovis* in 3—6 month-old calves was as high as 88 % in August.

Again the incidence of infection with *S. papillosus* decreased as the calves grew older at a concomitant increase in the incidence of members of the genera *Trichostrongylus*, *Ostertagia*, *Cooperia*, *Haemonchus*. In 3—6 month-old calves, the incidence of infection with members of these genera ranged from 6.3—28 %. The number of eggs in the faeces was relatively low, i.e., from 5—40 eggs/l g faeces. Eggs of *Nematodirus* spp. appeared in 5—6 month-old calves, mostly in October (incidence from 7.4—11.1 %). *H. contortus* and *Oesophagostomum* spp. were present in 18—22 %. Also in the case of traditionally managed calves, helminthic infections were concentrated mainly in the autumn months and occurred mainly in 4—6 month-old calves.

HEIFERS

Heifers were turned out past the age of 6 months and kept on pasture from June to the beginning of September. The incidence of infection in this age group ranged from 20—60 %, the species causing infection were these: *Cooperia* spp., *Haemonchus*

contortus, *Oesophagostomum* spp., *Trichuris* spp., *Trichostrongylus* spp. and *Nematodirus* spp. The representation of helminth species was different at the individual farms; sometimes, *Haemonchus contortus* was the dominant species, sometimes, it was *Oesophagostomum* spp. or *Cooperia* spp. *Bunostomum* spp., *Chabertia ovina* and *Ostertagia* spp. were found occasionally only. Shortly after turn out, the incidence of infection was weak. The incidence of *S. papillosus* was lower in 6—7 month-old heifers than it was in calves. In 8—9 month-old animals, its incidence was reduced to a minimum of 0.2 %. The species was even absent in several farms. The cestode *Moniezia expansa* was found in 4 animals aged 6 months from one farm. The animals had been 4 days on pasture and therefore, must have acquired infection before turn out from green fodder at the farm. During the grazing period, both the incidence and intensity of infection increased in all heifers independent of the type of husbandry management, and this applied also to the representation of helminth species (the occurrence of *Ostertagia* spp., *Bunostomum phlebotomum*, *Trichostrongylus* spp. and *Capillaria bovis* was more frequent, and there was an increase in infection with *Strongyloides papillosus*). On the other hand, differences among the individual farms were considerable. E.g., 40 % of heifers from one farm were found to be infected shortly after turn out; towards the end of the grazing season, the percentage of infected animals went up to 90. In animals from another farm, the incidence of infection increased from 24—84 %. In animals from an experimental farm, the incidence of infection ranged from 8—10 % throughout the year and 1 g of faeces contained 2—8 eggs. However, the low incidence might have been a consequence of a modernization of grazing techniques employed for young cattle (a satisfactory organisation of enclosures, etc.). The grass inside the enclosure was cut regularly before turn in in the spring, after turn out in the autumn, and in between the seasons at a change from one enclosure to another, and all excrements were broken down. The enclosures could not be entered by game animals.

Our results provided ample evidence for the fact that the rate of infection in the individual farms was influenced by a number of factors. Of these, the most important factor was shown to be the system of grazing having either a favourable or unfavourable effect on the intensity and incidence of infection with helminths. Of similar importance was the concentration of animals on pasture and the area available for grazing. Results of an examination of pasture areas disclosed that the incidence of larvae of gastrointestinal nematodes was higher on intensively grazed pastures than on extensive mountain pastures with a lower number of grazing animals. There was a considerable difference in the number of parasitic larval nematodes in 56 samples of soil and grass taken from the two types of pastures, i.e., 29 samples from the first type of pasture were positive for nematode larvae in comparison with merely 3 positive samples from the second type of pasture, although the incidence of infection in heifers from the latter type of pasture ranged from 24—40 %.

Another factor influencing the rate of infestation of pastures with helminths, and increasing the intensity and incidence of infection in animals grazing in these areas, was the position of the pasture, i.e., in close vicinity to a locality with a higher concentration of game animals. There, the cattle might acquire other helminthiases as this occurred in heifers from a pasture in close proximity to a locality colonized by 150 moufflons; infection with eggs of the thrematode *Dicrocoelium dendriticum* was found in one heifer, two were infected with *Fasciola hepatica*, and 95 % of the animal had acquired infection with gastrointestinal nematodes. Towards the end of the grazing season, infection with *Moniezia* was found in the animals at an incidence of 2—4 %.

The treatment of pastures including the breaking down of excrements and the moving of grazing areas before turn out or after driving herds across pastures was shown to be another important factor. According to our observations, cattle excrements on pasture

provide perfect conditions for the development of nematode eggs, because the hard crust of dry faeces protects larvae against unfavourable climatic conditions. This applies mainly to winter and early spring during which even infective larvae of less resistant nematode species such as *Dictyocaulus viviparus* are capable of surviving on pasture under the cover of old faeces. While 3.8 % of larvae survived for 7 months (until May) on pasture under dry excrements, none of the soil samples taken in March from harrowed pastures where excrements had thoroughly been broken down contained helminth larvae. This way of pasture treatment affected also larvae of *Haemonchus contortus* which are known to be susceptible to desiccation in the spring.

Of similar importance in acquiring infection were amelioration measures which improved the growth of the grass cover and drained wet and muddy sites, a general source of infection with dictyocaulosis and fascioliasis. Independent of the management of heifers before turn out, not a single case of this helminthiasis was recorded for these animals either during the grazing period or after their turn in. The majority of heifers investigated grazed on dry pastures.

MILKING COWS

In general, both the incidence and the intensity of infection was lower in milking cows than in heifers owing both to a higher resistance in older animals and to techniques and the organisation of pasture. Milking cows managed with a new technology, grazed on pastures situated close to their stables. The incidence of infection was highest in June (68.5 %), the helminths concerned were mainly *Haemonchus contortus* (37.7 %) and *Oesophagostomum* spp. (42.8 %). A decrease occurred in infection with *Ostertagia* spp., *Trichostrongylus* spp., *Bunostomum phlebotomum* and *Strongyloides papillosus* (1.3 %). The seasonal curve of infection dropped in September to 53.4 % and again in March of the following year when it was lowest (39.8 %). *Oesophagostomum* spp. was recovered from 12 % of animals in autumn, *Haemonchus contortus* from 33.9 % of milking cows. The ratio was reversed in spring — the number of eggs of *Haemonchus contortus* was reduced to 4.3 %, that of *Oesophagostomum* spp. went up to 19 %. Neither trematodes nor cestodes were recovered from any of these animals.

In the mountainous area, milking cows grazed on pastures more remote from the stables, on considerably rough ground. The number of animals on one ha of pasture was lower than in the foregoing case. Four months after turn out, 29.8—38.8 % had acquired infection mostly with *Oesophagostomum* spp., *Haemonchus contortus*, *Cooperia* spp., *Nematodirus* spp. and *Ostertagia* spp. On another farm, the incidence of infection in milking cows was different towards the end of the grazing season (October), i.e., 46.6 to 56 %. In July, even fascioliasis was identified in 20 % of animals. In March of the following year, owing to the advanced age of the trematode and an increased oviposition, eggs were recovered from 25 % of milking cows. Also dictyocaulosis appeared in the herds. Its incidence was 5—10 % in August, in October 9.6 % in one herd, 20 % in the other.

The incidence of these parasites was associated with generally worse conditions as regards the ground, soil and climate on these pastures. Owing to the fact that pastures were at a considerable distance from the stables, the herds had to be driven over unreinforced paths which became muddy by daily turn outs and turn ins of herds. In wet summers, they changed into a bog with numerous puddles which started to be colonized by *Lymnaea truncatula* thus constituting a potential source of infection with fascioliasis and dictyocaulosis.

Monieziasis in milking cows (2—7 %) occurred in several farms only.

DISCUSSION

The results of our examination of cattle from the youngest age groups to milking cows indicated that the course of helminthiases was influenced by several factors: the age of the animal, husbandry management, pasture techniques and the biology of parasites.

The presence of eggs of *Strongyloides papillosus* in faeces of 14 day-old calves suggested either a prenatal or neonatal infection. Shults and Dikov (1964) recovered eggs of *S. papillosus* from excrements of 10—12 day-old calves. Nikitin (1974, 1975) maintained that the incidence of infection with *S. papillosus* ranged from 20.6—40 % in calves aged 1.5—3.5 months. Apart from members of other genera, Griffiths (1974) referred to prenatal and neonatal infections caused by *S. ransomi* and *S. westeri*. In our opinion, this might apply also to nematodes whose larvae migrate in the body of the host (e.g., *Oesophagostomum* spp. the most frequent parasite of young calves).

Increasing trends in the incidence of gastrointestinal helminthiases in calves have to be ascribed to a re-infection in the stable (we found that conditions in calf-houses were satisfactory for the development of both eggs and larvae), feeding techniques and the composition of feeding doses (see the finding of monieziasis in heifers). Another factor fostering an increase in the incidence of these helminthiases in young calves is an absolute lack of resistance to helminths in these animals (Gibson and Parfitt 1972, 1973, Chiejina and Sewell 1974).

The course of helminthiases in older age groups of cattle, independent of the management, depended mainly on grazing techniques including agrotechnical measures as this was evident from results of faecal examinations made for various herds. In heifers and milking cows grazing on pastures not treated either before turn out or after turn in, in enclosures set up at unfavourable sites, inconvenient drive-in paths, contact with game animals and a failure to break down excrements after the termination of the grazing period, the incidence of helminths was increased to 95 % at an optimum. As indicated by our results, the incidence of infection in milking cows on mountainous pasture, where less animals were concentrated on one ha, ranged from 29—38 %. Helle (1978) from Norway ascribed the incidence of a smaller number of helminths in mountain areas mainly to a shorter grazing period and a smaller number of grazing animals on one ha. Prolonged grazing during wet autumn months is responsible for ingesting a large number of larval stages on the wet pasture in autumn (Ollerenshow 1978, Reed 1978, Thomas 1978, etc.) and again in spring of the next year, because a majority of gastrointestinal nematodes hibernate and survive until the new grazing season (Bürger 1974, Eisenegger et Eckert 1975, Erhardová 1962, Goldberg 1968, Klosterman et al. 1974, Kotrlá and Koždoň 1978, Levine et al. 1974, Person 1974, William and Bilkovich 1971, Worley 1968, Zhidkov 1976). Gibbs (1978) maintained that larvae overwintering on pasture are more dangerous to calves than a pasture common both to young and old, infected, animals. Also in Poland where new, modern techniques had recently been introduced to cattle husbandry, these did not solve the problem of infection with gastrointestinal helminths. They were present in cattle independent of the type of management (Malczewski et al. 1978, Fudalewicz-Niemczyk et al. 1978). A problem which has to be solved is the use of manure for fertilization, and their dehelminthisation. E.g., in one grazing area fertilized with its faeces, larvae of *Ostertagia* spp., *Strongyloides papillosus* and *Nematodirus* spp. were present in 66.6 % of samples. On the other hand, all samples from another, similarly treated, pasture were negative.

ВСТРЕЧАЕМОСТЬ ГЕЛЬМИНТОВ У КРУПНОГО РОГАТОГО СКОТА РАЗНОГО ВОЗРАСТА ПРИ РАЗЛИЧНЫХ ТЕХНОЛОГИЯХ СКОТОВОДСТВА

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Резюме. При обследовании крупного рогатого скота разного возраста обнаружены гельминты, относящиеся к следующим родам: *Strongyloides, Bunostomum, Cooperia, Nematodirus, Oesophagostomum, Ostertagia, Trichostrongylus, Trichuris, Dictyocaulus, Dicrocoelium, Fasciola Moniezia.* Изучены животные, разводенные в различных условиях скотоводства. Встречаемость гельминтов повышалась с возрастом телят в зависимости от сезона и состава кормового рациона. У старших животных на встречаемость гельминтов оказали влияние тип пастбищ, концентрация животных на гектаре и способ ухаживания перед пастьбой и после нее. Хотя в условиях ЧССР гастро-интестинальные гельминтозы не проходят в острой форме, на них нужно рассчитывать даже и в условиях разведения в большом масштабе. С точки зрения профилактики нужно образовать такие условия разведения и применять такую технику пастьбы, чтобы гельминтозы не встречались в развивающемся хозяйстве ни в будущем.

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FIRST RECORD OF THE NEMATODE CAPILLARIA SALVELINI POLYANSKY, 1952 FROM CZECHOSLOVAKIA

While studying the helminth parasites of fishes of the river Kamenice near Hřensko (a tributary of the Elbe, northern Bohemia), 10 specimens of brown trout (*Salmo trutta* m. *fario* L.) were examined in November 1978 and July 1979; in two of them (body lengths 20 and 22 cm), nematodes *Capillaria salvelini* Polyansky, 1952 were found in the posterior section of their intestines. This parasite species was not previously reported from Czechoslovakia and this finding is the first record of *C. salvelini* both from the R. Elbe basin and central Europe.

A total of two specimens of this nematode were obtained — a male and a young female. The male body (Figs. 1A, B) is 6.17 mm long with a maximum width 0.084 mm. The overall length of the oesophagus is 3.20 mm of which the length of the muscular section is 0.285 mm; distance of the nerve ring is 0.015 mm. The spicule is 0.501 mm long and 0.009 mm wide at its mid-length. The spicular sheath is smooth, without spines. The tail is rounded, 0.009 mm long, provided with two large, rounded ventrolateral papillae connected between each other by a fairly wide dorsal cuticular membrane, forming thus a kind of the pseudobursa.

This species is rather similar to *Capillaria brevispicula* (Linstow, 1873) — a common intestinal parasite of European cyprinids; it can be easily mistaken for the latter species, particularly when the specimens are collected from atypical fish hosts. So far, both these species have been distinguished mainly on the basis of different lengths of the spicule in males; however, the values of the spicule lengths overlap to some extent in the two species and, therefore, this character is not reliable for the species distinction.The only reliable differentiating character is the presence of the cuticular membrane on the male tail of *C. salvelini* (i.e., presence of the pseudobursa) which is absent from *C. brevispicula* (Fig. 1C); there are also certain interspecific differences in the shape of the proximal end of the spicule.

Capillaria salvelini is known as the parasite of salmonid fishes of the Holarctic and it has been reported from fishes of both North America and Eurasia. In Europe it has been recorded from the U.S.S.R. (Murmansk), Norway, Ireland, Great Britain, and Yugoslavia (Polyanskiy Yu. I., Tr. Zool. inst. AN SSSR 12: 113—147, 1952, Čanković M., Delić S., Kiškarolj M., Rukavina J., Parazitofauna slatkovodnih riba Bosne i Hercegovine, 159 pp.,