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Enteric Coccidia in Free-ranging American Bison (*Bison bison*) in Montana

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ABSTRACT: Four *Eimeria* species have been reported from American bison (*Bison bison*): *E. auburnensis*, *E. bovis*, *E. brasiliensis*, and *E. canadensis*. We report on finding two additional species: *E. ellipsoidalis* and *E. zuernii*. In 1993, the prevalence of these six species in 31 yearling bison in a recently-established herd on private ranchland in Montana (USA) was: *E. bovis*, 97%; *E. canadensis*, 90%; *E. zuernii*, 32%; *E. ellipsoidalis*, 32%; *E. auburnensis*, 9.7%; and *E. brasiliensis*, 3.2%. Eimerian oocysts also were recovered from five (14%) of 36 bison in 1993 from West Yellowstone; the species involved were: *E. canadensis*, *E. bovis*, *E. zuernii* and *E. auburnensis*.

Key words: American bison, *Bison bison*, coccidia, *Eimeria ellipsoidalis*, *Eimeria zuernii*, *Eimeria bukidnonensis*, Montana.

Commercial ranching of the American bison (*Bison bison*) is becoming increasingly popular in Canada, and especially in the western United States. There is little information concerning parasites of the American bison, but knowledge of the possible deleterious effects of parasites on productivity may be of economic importance to the rancher.

The first record of coccidia of American bison was *Eimeria smithi*, now regarded as a synonym of *E. bovis* (Levine and Ivens, 1970), recovered from a bison pair in the Leningrad (now St. Petersburg) Zoological Gardens in Russia (Rastegaïeff, 1930). Ryff and Bergstrom (1975) found *E. bovis* and three further *Eimeria* species in bison on a ranch in Wyoming: *E. auburnensis*, *E. brasiliensis*, and *E. canadensis*, all of which were initially described from cattle.

Our objective was to determine the prevalence of coccidial oocysts in a newly-established bison herd on a ranch in Gallatin and Madison counties (45°27′ to 45°33′N, 111°16′ to 111°31′W) southwest of Bozeman, Montana (USA). At least 80% of the founding stock of the herd comprised bison from ranches in Utah and Wyoming (USA), while additional bison were introduced from ranches in Colorado, Florida, Idaho, Oklahoma, South Dakota, and Texas (USA), and from the National Bison Range, Moiese, Montana.

About 175 fecal specimens were initially collected in 1990 from about 1,500 newly-introduced bison ranging in age from a few months to 3-yr-old cows and bulls to determine the *Eimeria* species present. In addition, eight yearling bison brought in from a Florida ranch were examined separately. In 1993, after the herd had become established, the prevalence and predominance of the various *Eimeria* species in the herd were determined. For comparison, fecal specimens of 36 bison from West Yellowstone, Montana (44°40′N, 111°06′W) were examined for the presence of coccidial oocysts.

Presence of coccidial oocysts was determined by sodium nitrate flotation using the Ovassay kit (Pitman-Moore, Inc., Mundelein, Illinois, USA). Specimens with high oocyst counts were selected for species identification. Fecal specimens were thoroughly mixed with at least 20 × their volume of an aqueous 2.5% (w/v) potassium dichromate solution, strained through cheesecloth to remove coarse matter, placed in thin layers in Petri dishes and allowed to sporulate for at least 14 days at 25 C. Specimens then were stored at 4 C until evaluated. To retrieve oocysts, a centrifuge tube was filled half way with the specimen and the remainder filled with 2 M sucrose solution until a positive meniscus was formed. A coverslip was placed on the tube, which was then centrifuged at 1,200 rpm for 10 min. The coverslip was

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TABLE 1. Prevalence and predominance of six *Eimeria* species in yearling American bison from an established herd in Montana in 1993.

	Heifers	Bulls	Total
Number of bison	15	16	31
E. bovis	15[a] (11)[b]	15 (15)	30 (26)
E. canadensis	13 (5)	15 (3)	28 (8)
E. zuernii	7 (0)	3 (0)	10 (0)
E. ellipsoidalis	6 (0)	4 (0)	10 (0)
E. auburnensis	2 (0)	1 (0)	3 (0)
E. brasiliensis	1 (0)	0	1 (0)

[a] Number of bison infected with this species.
[b] The number of bison in which this species was the most numerous. Equal numbers of *E. bovis* and *E. canadensis* oocysts were counted in one heifer and three bull specimens; both species were therefore regarded as being predominant.

removed, placed on a slide and the edges sealed with nail polish. The slide was scanned in parallel sweeps and all oocysts seen were identified. Measurements were made with an ocular micrometer. Species identification was based on descriptions and illustrations by Levine and Ivens (1970), Levine (1973, 1985) and Ryff and Bergstrom (1975).

Fecal specimens were collected from 16 yearling bulls and 15 heifers to determine the prevalence and predominance of the various *Eimeria* species. The number of oocysts per gram of feces was determined as follows. Two grams of feces were thoroughly mixed with water and passed through a strainer into a 15 ml centrifuge tube which was then filled with water. After centrifuging at 1,200 rpm for 10 min the supernatant was discarded and the sediment resuspended in aqueous $MgSO_4$ solution (specific gravity 1.2). The solution was added until a positive meniscus was formed. A coverslip was placed on the tube, which was centrifuged at 1,200 rpm for 10 min. The coverslip was removed, placed on a microscope slide and the edges sealed with nail polish. Oocysts present were counted in parallel sweeps at 200× magnification. Recovery of sporulated oocysts for species identification was the same as described previously. Slides were scanned in parallel sweeps and the first 200 oocysts seen were identified. Only specimens from which >100 oocysts were recovered are included in the analysis. We used the statistical analysis package MSUSTAT developed by Richard E. Lund, Montana State University, Bozeman, Montana.

Eimeria species present in the initial survey of 1990 included: *E. auburnensis*, *E. bovis*, *E. brasiliensis*, *E. canadensis*, *E. ellipsoidalis* and *E. zuernii*. The latter two species have not been reported previously from American bison. Three species only, *E. auburnensis*, *E. bovis* and *E. canadensis*, were found among the eight Florida bison.

The mean oocyst count per gram of feces of 15 yearling heifers was 123 (SD = 198; range 8 to 621) and of 16 yearling bulls 26.4 (SD = 42.6; range 0 to 169). The difference was not significant (t = 1.849; P = 0.0751). The prevalence and predominance of the six *Eimeria* species found are shown in Table 1. The percentage distribution of oocysts in six fecal specimens in which >100 oocysts were identified was as follows: *E. bovis* 55%, *E. canadensis* 40%, *E. zuernii* 2.9%, *E. ellipsoidalis* 1.6%, *E. auburnensis* 0.3% and *E. brasiliensis* 0.1%.

Oocysts were recovered from five of the 36 West Yellowstone bison; three calves and two cows. *Eimeria canadensis* was present in all five animals, *E. bovis* in three, *E. zuernii* in two, and *E. auburnensis* in one bison.

Although enteric coccidia tend to be fairly host specific, American bison are susceptible to *Eimeria* species described from cattle (Ryff and Bergstrom, 1975). Thus, our finding of *E. ellipsoidalis* and *E. zuernii* was not unusual. The prevalence of the six *Eimeria* species in yearling bison differed markedly from that in cattle in Montana (Jacobson and Worley, 1969); although *E. bovis* also was predominant in cattle, it was recovered from 61% of the calves and 30% of adult cattle only. *Eimeria canadensis* was recovered from 5% of the calves and 3% of the adult cattle, while *E. auburnensis* was recovered from

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32% of the calves and 12% of the adult cattle, respectively.

The clinical implications of our findings are unclear. Overt coccidiosis has not been described in bison (Thorne et al., 1982), but both *E. bovis* and *E. zuernii* are regarded as pathogenic in cattle (Levine and Ivens, 1970). This should be borne in mind when an etiological diagnosis of enteritis in bison is sought.

Eimeria bukidnonensis was erroneously reported from bison by Pellérdy (1963, 1965), and was subsequently cited by Ryff and Bergstrom (1975) and Thorne et al. (1982). Pellérdy (1963, 1965) regarded *E. thianethi*, originally described from cattle and water buffalo *Bubalus bubalis*, not American bison, in the Republic of Georgia (previously USSR) by Gwéléssiany (1935) as a synonym of *E. bukidnonensis*. The confusion over hosts may have arisen as the term "buffle" was used in the original French, while collection site ("Géorgie") may have been confused with the State of Georgia (USA). Levine and Ivens (1970) and Levine (1973, 1985) rejected the synonymy and retained *E. thianethi* as a valid species. Pellérdy (1974) subsequently corrected the error without comment by listing *E. thianethi* as a parasite of water buffalo and not of American bison.

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