SHEDDING OF THE JUVENILE AND WINTER HAIR COATS OF MOOSE (ALCES ALCES) WITH EMPHASIS ON THE INFLUENCE OF THE WINTER TICK, DERMACENTOR ALBIPICTUS

W.M. Samuel, D.A. Welch and Mark L. Drew

Department of Zoology

University of Alberta

Edmonton, Alberta, Canada T6G 2E9

Abstract: The sequence of the first hair molt was documented for 16 pen-reared, calf moose of Alberta. Although timing of initiation of molt varied, the sequence was as follows: (1) eyes, nose, lips and ears; (2) mid-dorsal and mid-ventral areas; (3) back and sternum; (4) sides and face; (5) the shoulders, neck and legs. Shedding of the winter hair was determined for 7 tick-free and 4 tick-infested, captive, moose aged approximately 7-16 months observed from December to September. Moose with the winter tick (Dermacentor albipictus) had lost hair by late January; much of their winter coat was gone by late April, replaced by the summer coat. Moose without ticks did not begin shedding winter hair until late April. The different sequence of hair loss between the two groups is described.

Little has been published on pelage change of moose. Several authors (Murie 1934, Skuncke 1949 in Peterson 1955, Peterson 1955, Kaletsy 1965, Kozhukhov 1965, and Markgren 1966) describe loss of the "juvenile" hair, while Peterson (1955), Knorre (1959) and Kozhukhov (1965) deal briefly with shedding of the winter hair. Although most authors mention pelage changes only briefly, Kaletsy (1965) recorded shedding of the juvenile hair for 4 calves examined every 5 days for several months.

The present study was initiated in an attempt to characterize the timing and sequence of late winter-early spring alopecia on moose with the winter tick, Dermacentor albipictus, and compare that with the spring molt of moose without ticks. That D. albipictus causes major loss of the winter coat is now established (Glines and Samuel 1984, McLaughlin and Addison 1986). Results presented here indicate that the timing and sequence of winter hair loss are very different for infested and tick-free moose. Information on the timing and pattern of the first molt seen in calves over summer is presented to add to the existing literature on this subject; it has nothing to do with interactions of moose and winter ticks.

METHODS

Shedding of the Juvenile Coat

A total of 16 calves reared at University of Alberta facilities (described in Welch et al. 1985) were examined and photographed (lateral surface) at approximately weekly or biweekly intervals between June and mid-September for initiation and sequence of the first pelage change.

Limited data (observations, in September) were collected for 5 other captive calves. Eight, 8 and 5 calves were observed in 1980, 1981 and September 1982, respectively. Extent of molt was determined from silhouette diagrams made from color slides that were taken between 18 July and mid-September. Percent loss of the juvenile hair from the planar area of the torso was measured on these diagrams using an acetate grid (16/cm^2).

Shedding of Winter Hair

Tick-free moose - Seven moose aged approximately 7-16 months and without D. albipictus were examined and photographed (lateral surface) between December and September, 1980-1981 (n = 6), and 1981-1982 (n = 1) for initiation and sequence of the spring molt. Limited data were collected in April-May for 2 other calves. Silhouette diagrams were made from color slides taken between 25 April and mid-September.

Moose with ticks - The timing and sequence of winter hair loss were documented for 4 moose aged approximately 7-16 months and infested with D. albipictus. Three calves were infested experimentally with 30,000 tick larvae in October, 1980 (see Glines 1983 for details); one calf was infested with 30,000 larvae on 15 October, 1981 (Drew 1984). Moose were examined as above. Silhouette diagrams of tick-induced alopecia and replacement of winter by summer hair were made either on the date of examination or later, from color slides. Percent loss of winter hair from the planar area of the torso was measured on a composite set of diagrams using an acetate grid (16/cm^2).

Terminology for hair types follows Sokolov (1982).

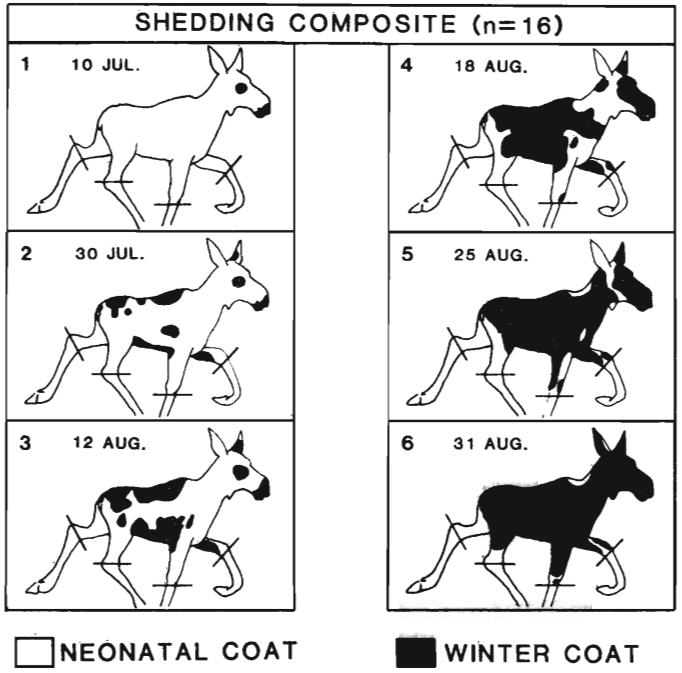

Figure 1. Composite diagram showing sequence of the juvenile molt in captive calf moose of central Alberta. Approximate typical dates are provided.

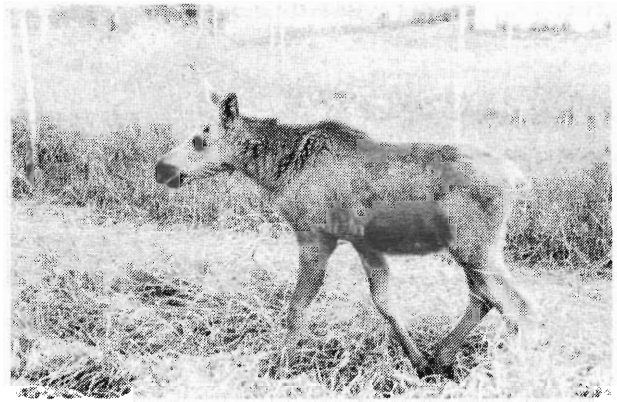

Figure 2. Typical shedding pattern for calf in late July (cf. Fig. 1.3). Picture taken on 30 July.

RESULTS

Calves-Summer

The light, reddish-brown neonatal hair of the 16 calves began shedding between early and mid-July around the eyes, nose and lips (Fig. 1.1) and the convex surface of the ears (Fig. 1.2). By late July, juvenile hair was shed from mid-dorsal and mid-ventral areas (Figs. 1.2, 2). The replacement hair was dark, gray-brown in color. By mid-August (Figs. 1.3, 1.4), molting of the face and the area uniting the ventral and dorsal surfaces had occurred. Only the mane retained neonatal hair by late August (Fig. 1.6). It was impossible to determine

when the juvenile coat was shed on the lower legs. This area appeared to molt last; i.e., sometime between late August and mid-September.

Spring Molt of Tick-free Moose

The 7 tick-free calves did not shed any winter hair until late April; shedding began on the hindleg, ears and around the eyes (Figs. 3.1, 4.1). The long winter hair (= "pile" of Sokolov 1982) was a bleached tan-gray color dorsally and a dark reddish-brown ventrally. Shedding of short-haired regions of the body, such as the face and lower legs, was very difficult to determine except for the ears. Molting progressed rapidly from mid- to late May (Figs. 3.4, 3.5; 4.4) to late June (Figs. 3.8, 4.9).

Moose had a shaggy look in May (Fig. 5), the shag consisting mainly of underlying "fur" (Sokolov 1982) and some pile. Underlying fur was shorter in length, but similar in color to the pile. Black summer hair appeared on the hind legs and ears by late April (Figs. 3.1, 3.2; 4.1). As winter hair was shed, summer black hair began showing through the fur in small patches (Figs. 3.6; 4.6, 4.7).

The last of the obvious winter shag occurred in small patches on the bell, mane, and sides (Fig. 3.6) in mid-June. Thereafter, it became difficult to determine when summer hair had replaced winter hair. By early July, these now-yearlings were essentially as black as they would get and the summer coat was very oily and shiny (Fig. 6). It was impossible to determine whether the lighter-colored, dorsal hair seen on some moose in late June and later was winter hair still to be shed, or the beginning of the next winter coat. Whatever, the dorsal hair became lighter and longer over summer. Moose were a brownish-gray dorsally and

reddish-black ventrally by late August (Fig. 7) and appeared to have a full winter coat by mid-September.

Pelage Change in Calves with Ticks

Hair on the neck of calves experimentally infested with 30,000 D. albipictus was severely damaged or broken by 21 January, approximately 14 weeks after exposure to ticks (Fig. 8.1). Hair breakage and/or loss spread to the shoulders (Fig. 8.2) and perianal region (Fig. 8.3). Alopecia was the result of extensive rubbing, licking, scratching with the hind feet, and chewing (unpub.). By late February, hair on ~30% of the silhouette (Fig. 8.2) was severely damaged or broken. Damage reached 65% of the planar area of the torso by 12 March (Fig. 8.3). Inevitably, moose would groom/rub until bare skin was visible on the shoulder (Fig. 8.3) and summer hair would appear in this area first (Fig. 8.5).

Much (~75%) of the winter hair was severely damaged by mid-April (Fig. 8.6) resulting in a "ghost" moose; a popular designation given to such moose in Alberta and owing to the light gray color of the proximal parts of the dorsal pile and fur. The summer coat was essentially complete by mid-May (Fig. 8.8).

DISCUSSION

Molt of the juvenile hair of 4 captive moose calves from the "Eastreensko" forest of the Soviet Union begins in early August, about 1 month later than the present study, and progresses similarly (Kaletsy 1965) to that described for our calves. Kaletsy stated that molt begins

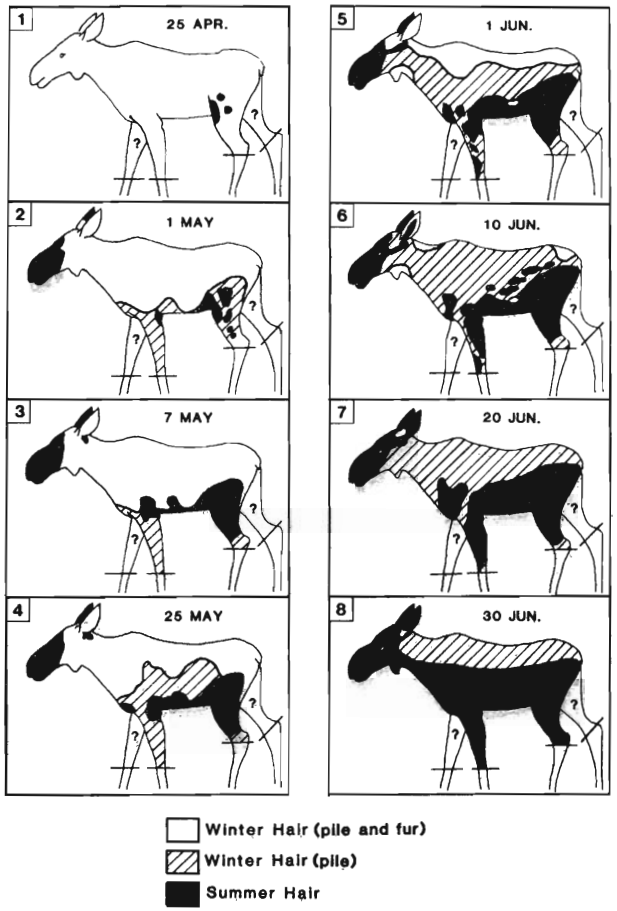

Figure 3. Composite of spring molt sequence for 7 captive, tick-free moose calves of central Alberta. Approximate typical dates are shown.

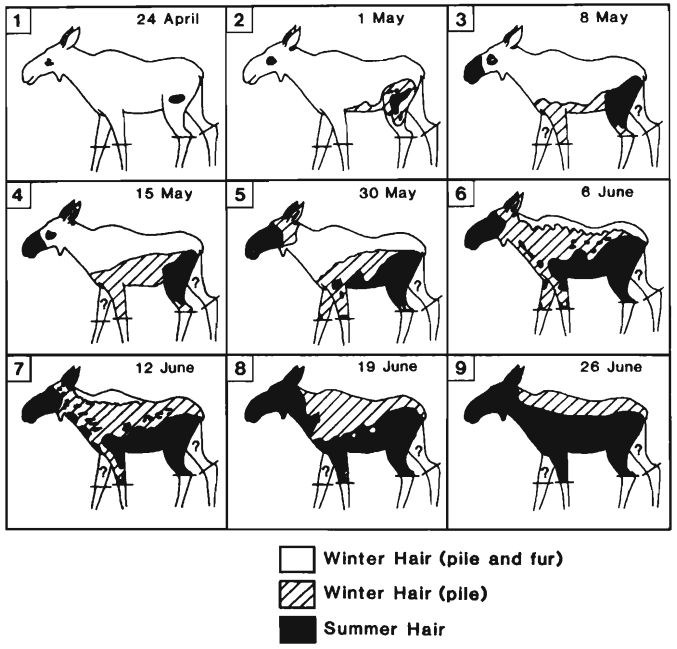

Figure 4. Spring molt of a captive, tick-free moose (No. 48), 1982, showing typical timing and sequence of hair loss and replacement.

in the "saddle" of the back, lower surface of the body and the ears. This is followed by molt of the shins, face, lateral sides, thigh, neck, shoulder and foreleg in roughly that order. The molt is complete in late September. Markgren (1966), who briefly described pelage change in

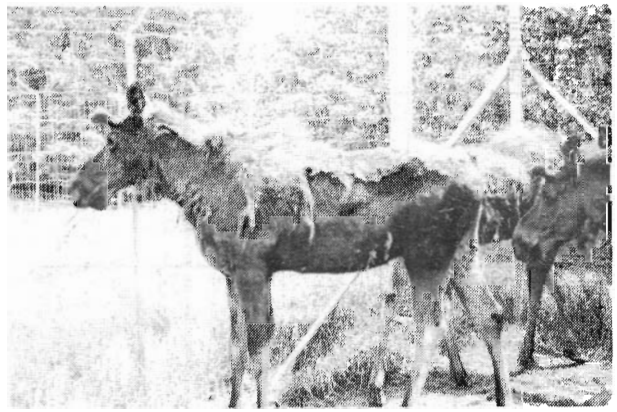

Figure 5. Typical molt pattern for tick-free yearling moose in late May (cf. Figs. 3.5 and 4.6). Picture taken, 30 May.

2 captive calves from Sweden, reports that the first change begins in mid-August on the forehead and ears. In short order, areas of molt include the lower legs (also reported by Kaletsy, 1965), mid-back, and parts of the hind legs. From these areas the molt "spreads" and is complete by early October.

Kozhukhov (1965), describing various aspects of "moose breeding" on an experimental farm in the Pechora-Ilych Game Reserve along the upper Pechora River of Russia, states that calves are born between 10 and

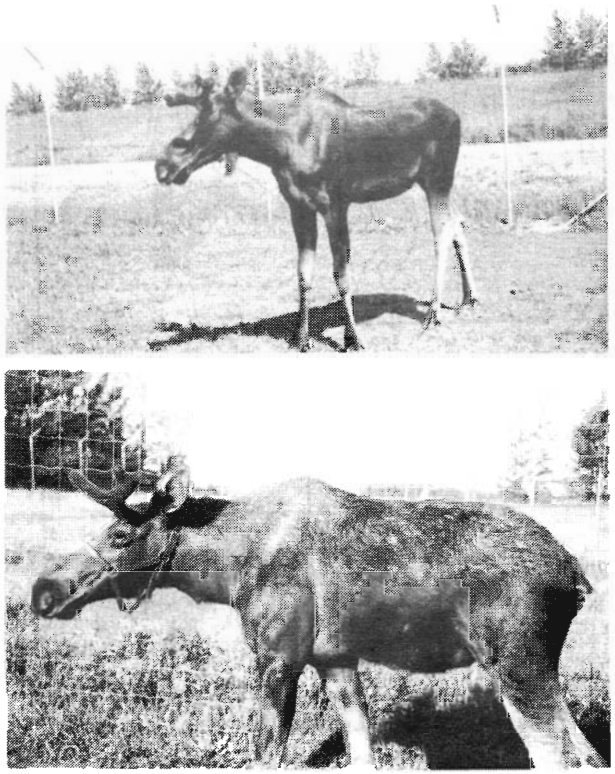

Figure 6. Typical black, shiny, oily summer coat of tick-free yearling moose. Picture taken 26 June.

Figure 7. Typical late summer hair coat of tick-free yearling moose. Picture taken 30 August.

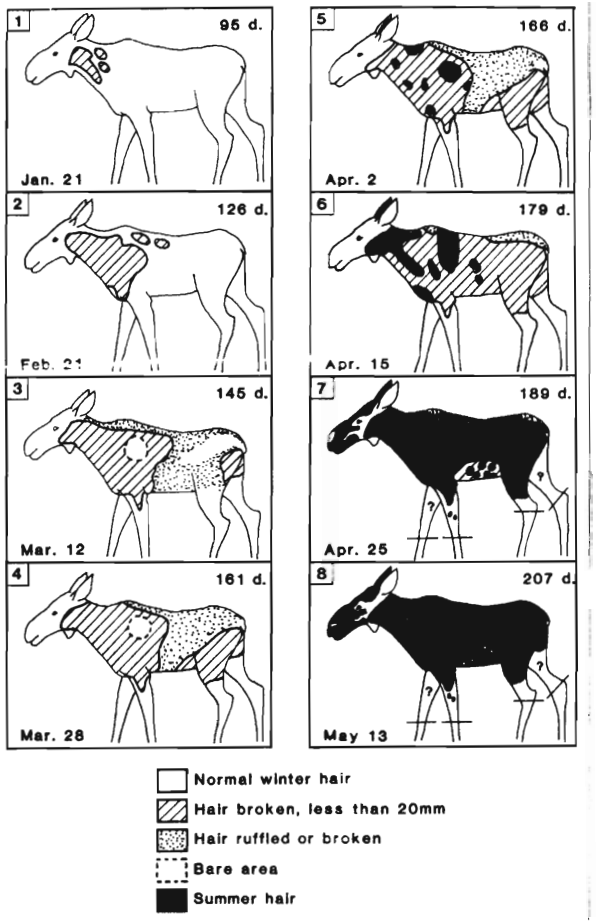

Figure 8. Composite of hair breakage/loss sequence for 4 moose calves each infested with 30,000 Dermacentor albipictus by date and days post exposure.

30 May. They molt from July to September (later "in moose with low fatness"). In Ontario the juvenile coat is gone "after 2 or 3 months (Peterson 1955:77). On Isle Royale, only the face, mane and legs have juvenile "remnants" by mid-August (Murie 1934).

Thus, 1 1/2 to 2 months is the standard length of time for the juvenile molt. It begins between early July and mid-August, varying between geographic regions. The sequence of this molt has not been reported previously for moose of North America, but results here were similar to those of Kaletsy (1965).

The normal spring molt of tick-free moose and the premature loss of the winter coat induced by the winter tick, Dermacentor albipictus, were very different in both time of initiation and sequence of hair loss. Tick-induced premature loss of the winter coat resulted in a summer coat premature in onset of visibility by anywhere from 1 to 1 1/2 months. Peterson (1955:79) reports that the spring molt begins in early May for moose of Ontario. While this timing is in agreement with present findings, the sequence of shedding ["shoulder hump region, proceeding along the sides of the neck and back of the ears and backwards over the body (Fig. 14)"] is likely reference to a moose with Dermacentor albipictus. Indeed, the hair loss pattern on the moose shown in Peterson's Figure 14 is virtually identical to that in Fig. 8.2 of this paper and the "light" tick-induced hair loss category of Samuel and Barker (1979).

Data presented here for the spring molt and tick-induced hair loss should be treated as preliminary. For example, assessing hair loss from lateral-view photographs probably underestimates early damage in certain body regions such as the perianal area (see McLaughlin and Addison

1986). Also, a systematic sampling of hair types from various regions of the body (see Sokolov 1982) over time is required along with more detailed observation of seasonal changes in growth, molt patterns, pigmentation and structure. Both male and female moose from several age cohorts should be studied. Nonetheless, results here are a start.

ACKNOWLEDGEMENTS

Special thanks go to many summer assistants, especially David Lawley, who helped raise, care for, and photograph calves. T.M. Stock made the figures. This study was funded by the Alberta Fish and Wildlife Division; the Alberta Recreation, Parks and Wildlife Foundation; the Boreal Institute, and; the Natural Sciences and Engineering Research Council.

LITERATURE CITED

DREW, M.L. 1984. Reproduction and transmission of the winter tick, Dermacentor albipictus (Packard) in central Alberta. M.Sc. Thesis, Univ. of Alberta, 209 pp.

GLINES, V.M. 1983. The winter tick, Dermacentor albipictus (Packard, 1869): its life history, development at constant temperatures, and physiological effects on moose, Alces alces. M.Sc. Thesis, Univ. of Alberta, 143 pp.

GLINES, M.V., and W.M. SAMUEL. 1984. The development of the winter tick, Dermacentor albipictus, and its effect on the hair coat of moose, Alces alces, of central Alberta, Canada. pp. 1208-1214 in D.A. Griffiths and C.E. Bowman (eds.). Acarology VI, Vol. 2. Ellis Horwood Ltd., Chichester, England, 1296 pp.

KALETSY, A.A. 1965. Juvenile molt of moose: Its connection with daily forage intake and measurements of animal weights. Biology and hunting of moose, Moscow, 293 pp. [In Russian]

KNORRE, E.D. 1959. Ecology of the moose. In G.A. Novikov (ed.). Transactions of the Pechora-Ilych State Game Preserve, Issue VII, Komi Book Publishers, Syktyrkar. [Translated from Russian, Can. Wildl. Serv. Transl. No. TR-RUS-85. 240 pp. typescript].

KOZHUKHOV, M.V. 1965. Gigiena losevodstva [Hygiene of moose breeding]. Biologiia i promysel losya [Biology and hunting of moose]. Vol. 2, Moscow, Rossel 'khozizdat, pp. 162-218. [Translated from Russian, Can. Wildl. Serv. Transl. No. 338768. 77 pp. typescript.]

MARKGREN, G. 1966. A study of hand-reared moose calves. Viltrevy 4:1-35.

MCLAUGHLIN, R.F., and E.M. ADDISON. 1986. Tick (Dermacentor albipictus) induced winter hair loss in captive moose (Alces alces). J. Wildl. Dis. 22 (in press).

MURIE, A. 1934. The moose of Isle Royale. Misc. Pub., Mus. Zool., Univ. of Michigan, No. 25, pp. 1-44.

PETERSON, R.L. 1955. North American Moose. Univ. of Toronto Press, 279 pp.

SAMUEL, W.M., and M.J. BARKER. 1979. The winter tick, Dermacentor albipictus (Packard, 1869), on moose, Alces alces L., of central Alberta. Proc. N. Am. Moose Conf. and Workshop 15: 303-348.

SOKOLOV, V.E. 1982. Mammal skin. Univ. of California Press, Berkeley and Los Angeles, Calif., 695 pp.

WELCH, D.A., M.L. DREW, and W.M. SAMUEL. 1985. Techniques for rearing moose calves with resulting weight gains and survival. Alces 21: 475-491.