PRODUCTIVE PERFORMANCE AND GENETIC PARAMETERS IN THE TROPICAL MILKING CRIOLLO CATTLE IN MEXICO

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INTRODUCTION

The first Tropical Milking Criollo (CLT, by its spanish acronym) herd was stablished in 1971 in Mexico with cows from Rivas, Nicaragua and sires and semen from Turrialba, Costa Rica, by Dr. Jorge de Alba and cofounders of a civil organization, the Mexican Association of Animal Production (AMPA). In Mexico most of the original criollos (cattle brought to the Americas from Spain during the colonial epoch) were disappearing by that time. De Alba and Kennedy (1985) described extensively the Turrialba herd, now disappeared. Results from the original mexican herd of the CLT breed were given by de Alba and Kennedy (1994). In contrast to the present study, in those studies pure and crossbred cows were included. Heritability of milk production ranged from .17 to .27 for the Mexican and Turrialba herds; in the former cows were milked once a day with the presence of the calf, in the latter milking was done twice a day without the calf. After moving the original herd from Tamaulipas to North Veracruz, nowadays, most of the descendant cows from that herd are located in Central Veracruz under the supervision of an academic institution, while the rest are in private hands. Objectives of this study were to estimate productive and reproductive performance, and genetic parameters of the CLT population that has produced under mexican conditions.

MATERIAL AND METHODS

Data source. Data were collected from seven CLT herds located in the tropical low lands of Tamaulipas and Veracruz states of the Gulf Coast of Mexico. Climatic conditions are hot subhumid and humid, average temperatures are high around 25 ^{o}C, rainfall ranges from 1120 to 1600 mm per year, maximum altitude is 16 m (García, 1988). Cows were fed mostly from grazing native and introduced pastures, like *Cynodon plectostachyus* and *Panicum maximun*; reproductive management use visual heat detection and artificial insemination (AI); cows were milked once a day with the calf presence, and sanitary practices were minimal (vaccination, severe mastitis treatment, etc.). Number of cows and records per trait used after screening are presented in table 1. Recording period was from 1974 to 1997. Productive and reproductive records of cows without sire and dam, birth date, unexplained incomplete or interrupted lactation, lactation record <50 d or < 100 kg, interrupted lactation by calf dead, severe mastitis, cow sold while lactating, lactations of cows < 600 d age at first parturition, and calving interval out of 290 to 610 days, were eliminated. Data were not equally distributed among herds; AMPA´s two herds had 82.4% of the total lactations. Traits studied were 305-day milk production (MP), lactation length (LL), age at first parturition (AFP), services per conception (IC) and calving interval (CI). Milk weighing was done after separating the calf from its mother for 24 hs.

Statistical analyses. Univariate analysis were performed for each trait studied. The individual animal model used for cows with records was:

$$\mathbf{y = Xb + Z_1a + Z_2pe + e}$$

where **y** is an Nx1 vector of records by trait, N is the total number of records; **b** is a vector of fixed herd-year-season effects with rainy (June to November) and dry (December to May) seasons, and parturition number (1 to 6, and 7 or greater); **a** is a vector of random additive genetic values IDN (0, $A\sigma^2$ a), A is the additive relationship matrix; **pe** is a vector of random permanent environmental effects IIDN (0, $I\sigma^2$ pe), I is the identity matrix; **e** is a vector of residuals effects IIDN (0, $I\sigma^2$ e); **X**, $\mathbf{Z_1}$ and $\mathbf{Z_2}$ are known incidence matrices which assign fixed, random additive genetic and random environmental effects to records **y**. The pedigree of animals with records were traced back to six generations during a period of thirty years. For MP a total of 637 animals were involved in the analysis, from which 66 were males. Estimates of genetic parameters were obtained by REML using DFREML (Meyer, 1991a; 1991b).

RESULTS AND DISCUSSION

Descriptive statistics for the traits studied are in table 1. Mean MP of 1111±383 kg was lower than the production level obtained by the CLT breed under better conditions in Costa Rica (de Alba y Kennedy, 1985); this result is an evidence of the very hard conditions in which the cows were producing, but in agreement with the cow´s performance obtained before in Mexico, milking once a day with the presence of the calf (de Alba and Kennedy, 1994). LL of 318±76 d is longer than the observed in other tropical cattle; sire selection from bulls sons of superior cows must have eliminated short lactations. Longer lactations for cattle producing under very adverse conditions with frequent scarcity of forages, low technology and milking with the calf presence, could not be necessarily a positive achievement. Although AFP reached almost 40 months, the number of IC was very low and it is an indication of the good ability of the cycling CLT cow to get pregnant when served by AI. However, a long CI of 14.5 months implies that in average the CLT cow got pregnant 100 days after parturition. Reproductive and survival traits would be very important at the time to select a tropical breed for the setting of a tropical dairy program.

Table 1. Descriptive statistics for some productive and reproductive traits in the Tropical Milking Criollo cattle in Mexico.

Trait	N	n	Mean	s.d.
305-day milk production, kg	330	856	1111	383
Lactation lenght, d	323	884	318	76
Age at first parturition, d	366	366	1207	220
Inseminatios per conception	330	1023	1.57	0.9
Calving interval, d	229	680	451	780

N = number of cows; n = number of records; s.d. = standard deviation.

Heritability estimates of MP (table 2) agreed with results obtained before (de Alba and Kennedy, 1994); however in this study no crossbred cows were included, but also milking was realized once a day with the calf presence. These estimates are lower than accepted values for dairy cows in temperate areas in which milking is done two or three times a day without the

calf presence. These results are an indication that genetic improvement for MP would be slower in the CLT breed producing under a low level technology. Heritability of AFP was the highest of all traits studied and much bigger than the obtained before (0.7±.08) by de Alba and Kennedy (1994). Growth speed could be an important trait not only from improving the age at which the CLT cow starts her productive life, but also if some males were taken for beef production. Heritabilities of LL, IC and CI were low (<.07), like in other dairy breeds of cattle. These results are an indication that for reproductive traits, better management practices, until local conditions permits, would be an alternative for improving these traits. In general cow repeatability estimates (table 2) were high and medium, permanent environmental effects were important for production traits, other effects (genetic and environmental) rather than additive genetic should be involved in determining production performance of cows.

Table 2. Heritability (h^2) and repetability (r) of some productive and reproductive traits in the Tropical Milking Criollo cattle in Mexico.

Trait	h^2	s.e	r	s.e.
305-day milk production, kg	0.17	0.09	0.5	0.09
Lactation lenght, d	0.06	0.11	0.38	0.11
Age at first parturition, d	0.26	0.15	-	-
Inseminations per conception	0.01	0.03	0.01	0.04
Calving interval, d	0.05	0.09	0.25	0.08

s.e. = standar error.

CONCLUSION

Although the CLT breed in Mexico has very good quality records and pedigree information from several years, condition not encountered for many other tropical breeds and herds, a small number of cows and records do exist. Production level of the CLT is superior to the average milk production of other tropical herds, and can be improved by selection. Observed lactation length in these CLT cows corresponds to temperate dairy breeds. Age at first parturition is large, but it observed the biggest heritability for the traits studied. The number of AI services per conception were low, which is an indication that the CLT cow is very fertile while cycling. Attention should be placed shortly after parturition to the CLT cow, in order to reduce mean and variability of calving interval. Research to study genetic evaluation and trends is warranted. If the CLT breed will be preserved it must have a protagonistic role in tropical dairying in the near future.

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Genetic make-up of animals control their structural configuration and productive abilities either via single genes or by multiple genes situated in different loci. Genes are compost of nucleotide sequences packaged into chromosomes in the nucleus. Milk production is largely affected by a combination of factors namely; genetic make-up in terms of the use of improved breeds selected for milk production, a favourable nutritional environment and improved managerial practices. Consequently, genetic make-up of dairy animals plays a great role in the variation of milk yield and composition. Milk production is, therefore, a factor of genotype-environment interactions. The tropical milking criollo (TMC) cattle is a Bos taurus adapted that can produce high quality milk feeding exclusively on pasture. In this study, the lactation of TMC was studied and a genetic evaluation was carried out using a random regression model for 119 sires and 602 cows, with 15 377 test-day yield records from herds of MÃ©xico, (10 475) and Nicaragua (4902), from 1974 to 2006.Â Genetic parameters of purebred and crossbred Milking Criollos in tropical Mexico. Article. Apr 1994.Â Lactational models showed a worse performance than the RRL models with the same number of parameters. For RRL models, all criteria except the Bayesian information criterion, favoured the most complex model. Adjustment of milk yield for lactation length should be expected to remove more genetic than phenotypic variation, thus reducing selection efficiency in relation to unadjusted yield. Selecting individuals on an optimum index of lactation yield and length would be more efficient for improving yield than selecting on yield alone, while both criteria would have practically the same efficiency for selection on progeny test. This result could be applied to reduce milk recording frequency without losing selection accuracy. Culling on lactation length before selecting on yield would have little effect on individual selection efficiency.Â Alba J de, Kennedy BW (1985) Milk production in the Latia-American milking Criollo and its crosses with Jersey. Anim Prod 41:143â€“150. Google Scholar. Tropical Milking cattle of Mexico (LT) is a criollo breed naturalized to hot climates (de Alba, 2011). Due to the small size of its current population -less than 1,000 pure heads (AMCROLET, 2015)- LT is considered endangered (FAO, 2013; 2015).Â The gene origin parameters were estimated to determine genetic variability (Table 2). The founders (f) and alleged ancestors (a) in the PLT were lower.Â The difference of f and fe indicates the loss of genetic variability in the original PLT population, as a result of the unequal contributions of the founders by preferential use of some parents (Boichard et al., 1997); this decrease also occurred in the PCP to a lesser extent. The fe (38%) decrease in the PCP is due to a limited number of individuals coming from the PLT (Cervantes et al., 2009).