EVALUATION OF INFESTATION LEVEL OF CATTLE BY THE TICK RHIPICEPHALUS MICROPLUS IN NEW CALEDONIA

Naves M. [1], Hue T. [2], Camoin M. [2]

[1] INRA, UR143, Unité de Recherches Zootechnique, 97170 Petit Bourg, Guadeloupe
[2] Institut Agronomique néo Calédonien, BP 73, 98890 Païta, Nouvelle-Calédonie

Abstract :
The cattle ticks represent a particularly important danger for ruminant production, because of the losses which they cause directly, or because of the infectious diseases with which they are associated. In New Caledonia, as in other tropical regions, the tick *Rhipicephalus microplus* represents a real plague, leading to very important losses in cattle herds. Moreover, since a few years, the efficiency of acaricide treatments classically used marks time and resistance of the parasites becomes widespread. So, the development of alternative methods of control of the infestation by the ticks is nowaday essential. Among these, the identification of more resistant lineages of cattle to the ticks, or the culling of the most sensitive animals, are interesting tools to decrease the impact of the ticks in the herds. The evaluation of the level of individual infestation represents therefore a particularly interesting tool for the herd survey. An assessment grid of the individual infestation by the ticks in the cattle raised in New Caledonia was worked out, and applied periodically for more than a year, in 4 herds, on a total of about 600 animals. This semi quantitative grid allows a relatively fast and precise evaluation of the level of infestation, by taking into account the number of engorged females and the importance of the infestation by the immature stages. The number of engorged females on one side of the body is either counted, or estimated according to a classification in 5 or 7 classes (from 0 to more than 100 ticks), according to the ease of the observation of the ticks on the animals. For the immature stages, the observations are realized in three physical locations of preferential infestation by the ticks (tail, perineum, neck), following a classification in 4 classes in each location. Finally, these notes are combined in a score of degree of infestation, which varies in a continuous way from 0 to more than 100. This score follows a Poisson distribution, the most common statistical distribution in parasitism phenomena. The individual evaluation of the level of infestation of the animals can be useful within a research program but also for the breeders, as a management tool of the herd. Various applications are in progress on the field in New Caledonia. First of all, the evaluation of the infestation by the breeders to identify the most infested individuals is a useful management tool. It allows estimating if all or part of the herd must be treated, and, after several counting, to identify animals most regularly infested in order to cull them first. Previous studies also demonstrated that the culling of the most sensitive animals allowed reducing by 7 the global infestation of the herd in 15 years. The identification of resistant lineages of cattle to the ticks requires a more important implication of the breeders with the realization of regular counting and the follow-up of the genealogies of animals. Such a study started in New Caledonia, on about 300 individuals of known filiation. Finally this method allows to compare the degree of infestation of the animals of various breeds and to estimate their behavior against ticks in a given context. The method tested in New Caledonia is operational. Its application in the herds represents a usable additional tool in alternative strategies of fight against the ticks. It also interests the breeders in the tropical regions who face the danger of the tick *Rhipicephalus microplus*.

Introduction

The ticks of the cattle represent a danger particularly important for herbivores, because of the losses which they cause directly, or by the diseases with which they are associated. In New Caledonia, as in other tropical regions, the tick *Rhipicephalus microplus* causes very heavy direct losses in the cattle herds. Since a few years, the efficiency of the current acaricides decreases, and the phenomena of resistance of the parasites to the products become widespread. So, the implementation of alternative methods of control of the infestation by the ticks is today essential. Among these, culling of the most sensitive individuals and the identification of more resistant lineages of cattle are interesting tools to decrease the impact of the ticks (Hue and al ., 2014). The evaluation of the individual level of infestation is then a tool of particularly useful follow-up. A notation grid of the individual infestation level of the cattle by the ticks was worked out, and is applied for more than a year, in four herds in New Caledonia.

Material and methods

This semi quantitative grid allows a relatively precise evaluation of the infestation, by taking into account the number of engorged females, and the intensity of the infestation by the immature stages. The number of engorged females on one side of the body is either counted exactly, or estimated according to a classification in 5 classes (0 ;]0 ;20] ;]20 ;50] ;]50 ;100] ; >100) or 7 classes (0 ;]0 ;10] ;]10 ;20] ;]20 ;30] ;]30 ;50] ;]50 ;100] ; >100), according to the ease of the observation of the ticks on the animals. A score of adult stage infestation is then assigned, corresponding to the number of adult ticks counted, or to the median value of the class of infestation. For the immature stages, the observations are realized in three physical locations of preferential infestation by the ticks (tie of the tail, perineum, neck), following a notation in 5 classes in every location (0 ; 1 ; 2 ; 3 ; 4). A score of infestation by the immature stages is assigned, which is the sum of the scores attributed at each of the three locations, multiplied by 10. In the end, average of both scores is

calculated to establish an average score of degree of infestation, which varies in a continuous way from 0 to more than 100. In total, we obtain 882 scores of infestation, on 454 individuals (from 1 to 8 observations by animal), observed during 28 visits, between August, 2014 and April, 2016. They animals belong mainly to the breed Limousine (419 notations on 211 individuals) and Charolais (363 notations on 163 individuals), but also in other bovine breeds. Besides, we obtain the filiations of 151 cattle Limousin and 156 cattle Charolais. The final scores underwent a log transformation, with the aim of the realization of variance analyses, by means of the procedures GLM and MIXED of the software SAS ®. The models included the direct effects of the herd, the season, the breed, the sex, the age, and the random effect of the father of the animal.

Main Results

This evaluation grid may have various applications in New Caledonia. First of all, the evaluation of the infestation by the breeders themselves is a tool particularly interesting for the management of the herds, because it allows to assess if all or part of the herd have to be treated against the ticks. The realized notations show that the average score of infestation of a herd can vary from 3 to 92 (average 29 +/-23). Furthermore, 13 % of the individuals carry 39 % of the parasitic load of the herd, while 9 % are not infested.

The application of this grid also allows identifying animals most regularly infested, in order to cull them first. Indeed, on all the measures, the repeatability is about 0.42, what shows that these measures are a good indicator of the sensibility of animals. An Australian study showed that the reform of the most sensitive animals allowed to reduce by 7 the global infestation of the herd in 15 years (Frisch and al., 2001).

Besides, analyses intra breed, for Limousine and Charolais animals, showed that the random effect of the sire is very significant ($p<0.0001$), with an average level of infestation varying, between the extreme "families", from 1 to 40 in Limousin breed, and from 10 to 80 in Charolais. These first results give encouraging perspectives for the selection of animals onto this criterion.

This method also allows to compare the degree of infestation of various breeds and to estimate their level of sensitivity or resistance against the ticks in a given context. On a small studied sample (168 animals of 8 races), the breeds Charolais and Limousine appear the most sensitive breeds, with levels of infestation respectively 6.7 times higher and 3.4 times higher than the Brahman breed, which is the most resistant. Droughtmaster and Senepol breeds present levels of infestations 1.5 times higher than Brahman. The breeds Belmont Red, Santa Gertrudis, and the crossing Brahman x Limousin, presents intermediate levels, 2.6 times higher than Brahman (table 1).

breed	Ln(score+1)	Std Err	Score	Diff.[1]
Brahman	1.80	0.23	6.0	a
Senepol	2.22	0.27	9.2	ab
Droughtmaster	2.24	0.34	9.4	abc
Belmont Red	2.65	0.31	14.2	abc
Bramousin	2.71	0.49	15.1	abcd
Santa Gertrudis	2.88	0.27	17.8	bcd
Limousin	3.01	0.16	20.3	cd
Charolais	3.71	0.30	40.8	d

[1] Different letters indicate a significant difference between breed ($p<0.01$)

Table 1: Level of infestation according to the breed

Conclusions

The method raised and tested in New Caledonia is operational. Its application must be pursued to validate the first results. It represents however an easily usable tool in cattle management, as an alternative strategy for the control of tick infestation, in tropical regions confronted with the tick *Rhipicephalus microplus*.

The authors thank the heads of the farms and the technicians of the stations of the Chambre d'Agriculture and of Port Laguerre, the herd of the UPRA-NC and the farm Moglia for their availability and their implication during surveys.

Bibliografic references

Frisch, J.E., O'Neill C.J., Kelly M.J. 2001. Using genetics to control cattle parasites - The Rockhampton experience. Int. J. Parasitol. 30:253-264

Hüe, T., Hurlin J. C., Teurlai M., Naves M. 2014. Comparison of tick resistance of crossbred Senepol × Limousin to purebred Limousin cattle. Trop. Anim. Health Prod. 46:447–453.