GENERAL CONCLUSION

The information generated from this study has made valuable contributions to the existing knowledge available on several aspects of helminths and their control in domestic equids. The cyathostomes were the most abundant helminths in the donkeys based on the FEC, larval cultures and total helminth counts in the gastro-intestinal tract. During the course of the latter an undescribed cyathostome species, *Cylicocyclus asinus* sp. n., was recorded in seven of the nine necropsied donkeys which brings the total number of *Cylicocyclus* species known in equids to twelve. Ambient temperature and moisture was important for the development and survival of both the egg and larval stages on the pastures. It is indeed this environmental dependence, which forms the basis for the seasonal display of helminth egg production in the host and subsequently the availability of parasitic larvae on pasture.

This is the first in-depth study that was performed in South Africa that clearly shows that the general health and working condition of donkeys are adversely affected by helminth burdens. It is suggested that animals with high helminth parasite burdens will show marked improvement in both general body condition and blood physiology following deworming. Moreover, it is the first controlled study that reveals the beneficial effect of practical and cost-effective helminth control strategies for working donkeys in developing countries. Frequent faecal removal (twice monthly) from the pastures grazed by donkeys will reduce the pasture larval burdens and the helminth re-infection rate, which will ultimately result in a reduction of helminth parasites in the donkeys. The strategic deworming of donkeys with moxidectin in autumn will result in significant reductions in their FEC and total helminth burdens. Based on the present study it is suggested that the strategic timing of deworming will probably reduce the helminth re-infection rates during winter and together with the prolonged residual effect of moxidectin will ensure lower worm burdens in the

host for several months. Finally, it is unmistakable that the greatest residual effect on the host's FEC and the most significant reductions in the helminth burdens will be observed in animals subjected to the combined management system of faecal removal and strategic deworming.

SUMMARY

Twenty-three working donkeys (*E. asinus*), allocated to eight experimental groups, formed part of a 16-month study in South Africa to determine the effect of alternative helminth control methods on their helminth levels and general condition. The results of three alternative control methods and a replicate of each (animals in camps from which faeces were removed once a month, those treated before winter with the anthelmintic moxidectin, and those that was subjected to a combination of these two forms of treatment) were compared to those obtained from a set of controls.

The cyathostomes were the most abundant helminths in the FEC and larval cultures. Both the FEC and pasture larval counts displayed increased activity during the warm and wet months (September to March). Towards the end of the study, the positive effect of monthly faecal removal was exemplified by a 20 % reduction in the hosts' average FEC, which could be attributed to the reduced pasture larval burdens that were recorded in these camps. The animals that received a pre-winter moxidectin treatment and those that were subjected to the combined treatment recorded an average faecal ERP of six to seven weeks following deworming. In addition, 100 % reduction in the nematode eggs and a prolonged suppressive effect on the FEC were recorded in all these animals. Monthly live weights, BCS and blood chemistry values concurred that the general condition differentially improved in the animals following deworming. To determine the total helminth parasite loads and biodiversity, post-mortem examinations were performed on nine donkeys at the end of the study period. Thirty-eight helminth species were recorded. In addition, helminths belonging to one trichostrongylid, one paramphistomatid and one gasterophiliid species were recovered. The as yet unknown cyathostome species, *Cylicocyclus asinus* sp. n. was observed in the ventral colons of seven donkeys. *Cyathostomum montgomeryi* was the most abundant

cyathostome, followed by *C. longibursatus*. *Triodontophorus hartmannae* was the most abundant large strongyle, followed by *S. vulgaris*. The large strongyles were less abundant when compared to the numbers of cyathostomes, but the predilection site of both groups was the ventral colon. Worm burdens for each animal ranged from 3 831 to 29 501. All three experimental management systems resulted in reduced total helminth burdens, which included reductions in the mucosal larval stages in the gut wall, however, the most significant decrease was observed in the donkeys that were subjected to the combined management system.

This is the first study to provide empirical data in South Africa on the pathogenic effect of helminths on working donkeys kept on a low quality diet. In addition, it provides information on the value of alternative control methods that can be used to reduce worm burdens. Regular faecal removal from camps and a single pre-winter treatment with moxidectin proved to be cost-effective methods to control helminth parasites. By following these methods the general health and working capacity of donkeys in southern Africa can be greatly improved.

OPSOMMING

In 'n studie oor 16 maande om die effek van alternatiewe wurmbeheermetodes op die algemene kondisie en inwendige parasietlading van werkende donkies te bepaal is 23 volwasse donkies aan agt eksperimentele groepe toegewys. 'n Stel kontroles is met drie alternatiewe wurmbeheermetodes en 'n herhaling van elk vergelyk: maandelikse misverwydering, ontwurming met moksidektien voor die winter en 'n kombinasie van maandelikse misverwydering en ontwurming voor die winter.

Na ontwurming is verbeterings waargeneem in die maandelikse lewende massa, kondisie-indeks en chemiese bloedsamestelling van die vier eksperimentele groepe. Die klein strongiele was die algemeenste groep in die maandelikse mis-eiertellings (ME) en larwekulture. Tydens die warm en nat maande (September tot Maart) is 'n toename in beide die ME en die aantal larwes op die gras waargeneem. Teen die einde van die studie is die positiewe uitwerking van maandelikse misverwydering uitgewys deur 'n verlaging van 20 % in die gemiddelde ME van gashere. Die verlaging word toegeskryf aan die verminderde larwetellings in die vier kampe. By diere wat voor die winter ontwurm is en dié met die kombinasiebehandeling is wurmeiers weer ses tot sewe weke na behandeling herwin. Albei behandelings het 'n 100 % afname in die ME tot gevolg gehad, gevolg deur 'n verlengde onderdrukkende effek op die ME.

Om die totale wurmladings in die donkies te bepaal is nadoodse ondersoeke op nege diere uitgevoer. Die aantal wurms per dier het gewissel van 3 831 tot 29 501. Die onlangs beskrewe cyathostoomsoort, *Cylicocyclus asinus* sp. n., het deel uitgemaak van die 38 wurmsoorte wat gevind is. Een trigostrongilied, een amfistoom en een gastrofilied is ook gevind. *Cyathostomum montgomeryi* was die algemeenste cyathostoomsoort, gevolg deur *Cylicocyclus longibursatus*. *Triodontophorus hartmannae* was die algemeenste groot strongielsoort, gevolg deur *Strongylus*

vulgaris. Groot strongiele was minder algemeen as klein strongiele; beide het veral in die ventrale kolon voorgekom. Alhoewel beide maandelikse misverwydering en behandeling voor die winter 'n afname van wurms in die dermlumen en -wand tot gevolg gehad het, het 'n kombinasie van dié behandelings tot die grootste afname gelei.

Die studie verskaf die eerste eksperimentele gegewens in Suid-Afrika oor die patogeniese uitwerking van wurms op werkende donkies wat 'n lae kwaliteit dieet gevoer word. Daarbenewens word inligting ook verskaf oor die waarde van alternatiewe wurmbeheermetodes vir die verlaging van wurmladings in die gasheer. Gereelde misverwydering en 'n enkele ontwurming met moksidektien voor die winter blyk koste-effektief te wees. Donkies in Suider-Afrika se algemene kondisie en werkvermoë sal noemenswaardig verbeter indien hierdie wurmbeheermetodes gevolg word.

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