CONTROL OF BOVINE FASCIOLOSIS IN INDONESIA

Suhardono [1], Roberts J.A.[2], Copland J.W.[3], Copeman D.B.[2]

Le principal facteur de risque de l'infestation bovine à Fasciola gigantica dans les zones rizicoles de Java-Ouest est le pâturage, l'abreuvement ou l'alimentation à base de paille de riz en provenance de champs récemment récoltés. Des recommandations pour le contrôle parasitaire sont basées sur la gestion des pâturages et des fourrages, la gestion des effluents et des canards infestés par Echinostoma revolutum. Le contrôle par la gestion des pâturages comprend l'interdiction au bétail d'accéder aux rizières après récolte, pendant au moins les cinq semaines qui suivent la mise à sec des rizières pour s'assurer de la non survie des métacercaires.
Avant d'être utilisée comme fourrage, la paille de riz fraîchement récoltée doit être exposée au soleil pendant au moins trois jours ou séchée à l'ombre pendant quatre semaines pour supprimer les métacercaires. Une alternative consiste à n'utiliser pour l'alimentation du bétail que la partie distale des tiges de riz, les métacercaires n'étant présents que dans le tiers inférieur de la tige. Le contrôle biologique à base d'excréments de 5 à 10 canards naturellement infestés par E. Revolutum est très efficace car cela réduit la population de Lymnea rubiginosa dans les champs à risque près des étables. Il est nécessaire de placer la basse-cour à canards au-dessus des canaux d'évacuation des effluents pour que les excréments de canard et de bovin pénètrent dans les rizières simultanément, ou bien mélanger les fèces de canard et de bovin avant de les utiliser comme engrais dans les rizières. Le stock de fèces collectés sous forme de tas est laissé au soleil pendant un mois avant d'être utilisé comme fertilisant, afin de réduire le nombre d'oeufs viables de F. gigantica d'environ 80 %. Un simple traitement annuel avec du triclabendazole, 6 semaines après la dernière récolte de la seconde moisson de riz dans une zone donnée permet un bon contrôle de la douve. Le traitement anthelminthique à des moments stratégiques, bien qu'efficace, est d'utilisation limitée pour le contrôle distomien du fait de son coût élevé et du besoin de traiter la plupart des animaux qui partagent des pâturages communs.

INTRODUCTION

Throughout much of the humid tropics, especially in south-east Asian region, the clear shallow, slow moving water in rice fields provides an ideal and vast habitat for the aquatic lymnaeid snails that are the intermediate host of *F. gigantica.* Cattle and buffaloes form an integral part of the farming system in such areas. They subsist mainly on crop residues and herbage from areas not under crop and, when rice is being harvested, rice stalks form a major component of their diet. Such a system provides the ideal setting for maintenance of infection with *F. gigantica* and it is little wonder that fasciolosis is such a common parasite of cattle and buffaloes in areas where irrigated rice is produced intensively (Edney and Muchlis, 1968).

However, little control is practiced because the extent of the problem is largely unrecognised by farmers (the disease is common and unspectacular, and the main clinical signs of failure to thrive and reduced exercise tolerance are similar to those of poor nutrition or regarded as "normal"), modern anthelmintics are expensive, and there is no reliable information on the benefits of control.

The literature on control of fasciolosis due to infection with *F. gigantica* is small relative to the amount on *F. hepatica* and largely unhelpful to the farmer or extension worker wishing to institute a program on control. Since 1982 the Commonwealth Agricultural Bureau has catalogued only 23 references on *F. gigantica* concerned with control and all relied on chemotherapy. However, with the exception of Srikitjakarn *et al.* (1988) in Thailand, and Bhatia *et al.* (1989) in India, authors simply reported on the efficacy of the drug under study and did not seek to determine the optimum protocol. They also ignored the reality that the high cost and unavailability of such products preclude their use as an option for most farmers in developing countries where *F. gigantica* is endemic; a sentiment expressed by Roberts and Suhardono (1996) in their recent review of approaches to control of fasciolosis in ruminants. For this reason strategies based on biological control were a major focus of this study.

Observations were made over four years from 1992 to 1996 in Surade, west Java, Indonesia. The area has an agricultural system based on production of two crops of irrigated rice in most years followed by a period of about 3 to 4 months when the land is left fallow or used to produce dry-land crops. Farmers commonly kept up to three Ongole cattle or water buffaloes which provided the main source of draught power to prepare the land for planting rice. During harvest time fresh rice stalks were a major constituent of their diet. They were allowed to graze recently harvested fields during the day and were fed fresh rice stalks when penned at night. Dung collected from pens was stored and used at the time of planting rice in nearby fields as fertiliser or drained with effluent from the pen into adjacent rice fields.

1 Balitvet, P. O. Box 52, Bogor, West Java, Indonesia
2 Australian Institute for Tropical Veterinary and Animal Science, James Cook University, Townsville, Australia 4811
3 Australian Centre for International Agricultural Research, G. P. O. Box 1571, Canberra, Australia 2601

METHODS, RESULTS AND CONCLUSIONS

A tracer study, using Ongole cattle belonging to farmers in villages, was undertaken to determine when animals were becoming infected with *F. gigantica.* Each month for 13 months a new group of 7 cattle from each of 5 villages were treated with triclabendazole to eliminate existing infection with *F. gigantica* and, commencing 12 weeks after treatment, their faeces was monitored for eggs of *F. gigantica* (sensitivity 1 egg per gram) until week 28. Over 80 percent of infection of cattle with *F. gigantica* occurred during the period when rice from the two annual crops was being harvested, from January to about June. It was also shown (by feeding Merino sheep) that infection could be acquired both from the sediment in water from rice fields and from fresh rice stalks. Moreover, 98 percent of the flukes which were derived from feeding fresh rice stalks to Merino sheep were from the bottom 10 cm (the portion previously immersed in water).

On the basis of these observations it was concluded that the main risk factors for infection of cattle with *F. gigantica* in the study area were eating fresh rice straw or grazing or drinking from recently harvested rice fields. Fields within about 50 metres of a cattle pen were considered the highest risk as *Lymnaea rubiginosa* (the only intermediate host of *F. gigantica* in Indonesia) from these fields had the highest prevalence of infection with *F. gigantica.* The virtual absence of infection in *L. rubiginosa* in rice fields more than about 200 metres from a village suggests that allowing animals access to fodder from such fields should be safe but this was not tested.

Storage of faeces collected from cattle pens, in a heap in the sun reduced the number of viable eggs of *F. gigantica* by about 80 percent after one month but 10 percent were still viable after 14 weeks. This was about twice the rate of degradation of eggs in dung stored in heaps in the shade and was attributed to the higher temperature recorded in dung exposed to the sun than in shaded dung. It is thus possible to substantially reduce the number of viable eggs of *F. gigantica* in dung used as fertiliser in rice fields by storage for at least one month in the sun.

The practical possibility of successful biological control of infection with *F. gigantica* in *L. rubiginosa* by echinostome flukes was demonstrated. The ability of larval echinostomes to aggressively antagonise other larval flukes in their snail hosts and parasitic castration of snails by larval echinostomes is well documented (Lie, 1973; Lie et al., 1973; Estuningsih 1991). However, previous workers were unable to devise a practical method of applying this observation for control of *F. gigantica* in the field. This was achieved by adding faeces from 5 to 10 ducks naturally infected with *Echinostoma revolutum* to bovine faeces used as fertiliser in rice fields, or by locating the duck pen over the effluent drain from a cattle pen before it entered an adjacent rice field. This strategy was able to almost eliminate infection with *F. gigantica* in *L. rubiginosa* from rice fields close to a cattle pen that would otherwise constitute the greatest source of infection for stock. However, there has been farmer-resistance to application of this novel means of control because ducks may be concurrently infected with schistosomes, the cercariae of which cause dermatitis when they penetrate the skin of rice-field workers.

The effectiveness of a single anthelmintic treatment in July, applied six weeks after the last of the seasonal rice harvest, was used to test a number of the epidemiological observations made in this study. This interval was chosen as being sufficient time for metacercariae on rice stubble to die (desiccated metacercariae died in 4 weeks in laboratory studies) and so remove the opportunity for further infection of stock from this source. Treatment then also gives the longest period of freedom from infection before the start of the next harvest, and prevents infection of snails in the first rice crop. Moreover, it was reasoned that the 4-month prepatent period of *F. gigantica* in cattle and the two months it takes from infection of *L rubiginosa* to encystment of metacercariae in rice fields, would further enhance the effectiveness of this method of control. These predictions proved correct. A high level of control was achieved with more than 80% of animals still with no detectable fluke eggs in their faeces 12 months after treatment. Furthermore, treated animals less than two years of age grew significantly faster than controls and treated adults had one third more calves and about twice the draught performance of controls when this strategy was applied over two successive years. Despite these potential advantages of anthelmintic treatment, it is not considered a viable option for widespread control because of farmer-resistance to the high cost of the drug and the need to treat a high proportion of animals which share common grazing, to be effective. Furthermore, the success of this strategy relied on a lengthy period of no or little natural transmission, enabling a whole generation of snails to remain virtually free from infection and thus break the annual cycle or transmission. Consequently, it is unlikely that such a strategy would provide effective control in areas where irrigation allowed continuous or asynchronous rice cropping throughout the year.

This study demonstrated a number of strategies for control of infection with *F. gigantica* in cattle involving fodder and grazing management, reduction of viable eggs of *F. gigantica* in dung used as fertiliser in rice fields, and use of echinostomes to displace *F. gigantica* from *L. rubiginosa*, all of which may be applied with little disruption to existing farming systems in Indonesia. Moreover, the principles underlying these methods should be equally applicable in areas with one annual rice crop or continuous cropping. Although providing effective control, use of an annual strategic treatment with anthelmintic is not recommended for reasons of cost, but it would be a useful tool, especially if used with other methods of control, in regions where cost is not an over riding constraint.

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