The Use of Indigeneous Papaya (*Carica papaya*) as an Anthelmintic for the Treatment of Gastro-intestinal Nematodes in Naturally Infected Calves in Suriname

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Summary

In this article, an attempt is made to assess the possibilities of the indigeneous papaya-plant as an anthelmintic in animal husbandry practice in Suriname. A trial was conducted on a dairy farm in the district of Commewijne, whereby three groups of five naturally infected calves each were given different treatments. A first group was treated using a commercial compound, called levamisole, a second group was given a mixture of papaya-leaves and fruits and a third group was not treated and kept as an untreated control-group. The effects of the treatments were established through faecal strongyle-egg counts (eggs per gram faeces). Based on the Faecal Egg Count Reduction Test performed for both levamisole and papaya, one can conclude that the anthelmintic efficacy of levamisole is excellent (100% reduction), but that the anthelmintic efficacy of papaya is insufficient (nearly 60% reduction) to be considered a useful anthelmintic, unless it would be used as a daily feed-supplement in dairy rations.

Samenvatting

In dit artikel wordt nagegaan wat de toepassingen zijn van de inheemse (wilde) papaja als anthelminticum (ontwormingsmiddel) voor de veehouderij in Suriname. Er werd op een melkveebedrijf in Commewijne een proef opgezet, waarbij drie verschillende groepen natuurlijk besmette kalveren drie verschillende behandelingen toegediend kregen. De eerste groep werd behandeld met een commercieel ontwormingspreparaat (levamisole), de tweede groep werd behandeld met een mengsel van papaja -bladeren en -vruchten en de derde groep werd niet behandeld en als controle-groep gebruikt.
Het effekt van deze behandelingen werd nagegaan door het tellen van de via de mest uitgescheiden worm-eieren (eieren per gram faeces). Gebaseerd op deze cijfers werd vervolgens een Faecal Egg Count Reduction Test uitgevoerd waarbij werd nagegaan hoe de eitellingen evolueerden voor en na behandeling met levammisole, respectievelijk papaja. De resultaten van deze test tonen aan dat de werking van levamisole als ontwormingsmiddel uitstekend is (100% reduktie), maar dat de werking van papaja onvoldoende is (bijna 60% reduktie) om als ontwormingsmiddel enig nut te hebben, tenzij het als voeder-supplement aan het dagrantsoen zou toegevoegd worden.

Introduction

Parasitic gastro-enteritis (PGE) is one of the major causes of poor production results in animal husbandry in Suriname. Due to a very warm and humid equatorial climate, heavy clay soils in the coastal area and the non-availability of anthelminitic drugs, PGE is one of the disease entities most encountered in veterinary practice, especially in ruminants.

Due to severe economic distorsions (hyper-inflation) and the abolishment of government subsidies to the livestock sector (structural adjustment programm), anthelmintic drugs have become increasingly expensive and have become uneconomical in relation to off-farm prices (meat, milk, eggs,…). There is therefore a renewed interest in alternative means of anthelmintic treatment, based on "bush medecine" or "oso dresi" (Sur.), in an attempt to lower production costs.

Lots of farmers are now using several types of local plants for their presumed anthelmintic properties. Leaves, fruits, grains and roots are processed in different manners (maceration, milling, cooking) and fed mostly orally to ruminants and pigs.

One of the alternative anthelmintics most often encountered in "bush-medicine" is the wild variety of the papaya, *Carica papaya.* Since very few records exist so far on the alledged anthelmintic properties of this plant in the treatment of PGE in animals, an efficacy trial was undertaken to assess the value of a mixture of papaya-leaves and green fruit flesh as an oral anthelmintic in naturally infected calves.

Materials and methods

The trial was carried out on a dairy farm (melkerij De Ploeg nv.) in the district of Commewijne, a rural area, east of the capital Paramaribo.
15 (fifteen) calves in ages varying from 3 to 6 months and of different breeds, were selected through preliminary faecal sampling of animals and subsequent coprologic examination of the samples. The number of shedded nematode-eggs per gram faeces (epg) was established using the MacMaster technique as described by Thienpont et al.[1]. Only animals, not having been treated during the last 12 weeks and showing an epg of 200 or more were selected for the trial.

These 15 calves were then divided into 3 (three) groups of 5 animals each in order to obtain the smallest possible difference in mean egg-counts for each group. On July 10th, two out of three groups were treated, following sampling of dung.

Group A was treated with a commercial anthelmintic for parenteral use, called levamisole (L-Ripercol® . Levamisolehydrochloride 100 mg/ml for intramuscular use, Janssen Pharmaceutica, Beerse, Belgium), dosed at 100 mg/20 kg liveweight. Levamisole is the most commonly used anthelmintic drug in this country.

Group B was treated with a mixture of young green papaya-leaves and the flesh of the green, unripe fruit. One whole leaf and one whole fruit were used for each calf. Five leaves and five fruits (without the seeds, if present) were cut in small pieces and then blendered with 1750 ml of tap water. Each of the calves were given 350 ml of the mixture by oral administration.

Group C was not treated and kept as a control-group.

Ten days following treatment all animals were sampled once again for faecal egg counts (epg).

The anthelmintic efficacy of papaya and levamisole was evaluated using the Faecal Egg Count Reduction Test (FECRT), as defined by Presidente (1985). Hereby the arithmetic mean faecal egg counts (on day 10 after dosing) of treated animals (T2) are compared with those of non-treated (control) animals (C2) on that same day and taking into account the faecal egg counts of the two groups on day 0 (T1 and C1).

The percentage reduction is then calculated as follows (formula by Presidente, 1985) :

$$\text{Percentage reduction} = 100 \times \left(1 - \frac{T2}{T1} \times \frac{C1}{C2}\right)$$

Reductions of less than 95% are considered unsatisfactory for worm-control since too much of the worm-population in the animal remains alive and thus enhances infection of the pasture through the shedding of eggs.

In an attempt to investigate possible species-variable differences in the response to either of the two treatments, mixtures of dung of each of the groups (one group before treatment, three groups following treatment) were incubated for culture of L3-larvae as described by Skerman and Hillard.[2] Microscopic examination of the immobilised (using lugol) L3-larvae enables us to differentiate and assess the importance of the different species of nematodes involved, using a key-differentiation chart.[3]

Results

The results of the egg-counts on day 0 and day 10 post-treatment and the results of the Faecal Egg Count Reduction Test (FECRT) are presented in table 1. None of the animals suffered of apparent adverse reactions to the treatment with either levamisole nor papaya.

The treatment using levamisole led to a reduction in faecal egg counts of 100%. The treatment using papaya led to a reduction in faecal egg counts of nearly 60%.

Coproculture and subsequent differentiation of L3-stage larvae revealed the presence of several members of the family of the Strongylidae, namely *Haemonchus* spp., *Trichostrongylus* spp., *Coöperia* spp., *Oesophagostomum* spp. and one member of the Strongyloïdeae-family (table 2).

Table 1. Results of the Faecal Egg Count Reduction Test (%) as performed for the treatment with levamisole as well as the treatment with papaya, both using the average epg of each group on the day of treatment (day 0) and ten days post treatment (day 10).

Group	Day 0 (EPG)	Day 10 (EPG)	FECR (%)
Levamisole	1760	0	100%
Papaya	1460	120	59,8%
Controls	425	650	---

Table 2. Results of the L3-differentiation following coproculture of composite faecal samples of each group. Number of larvae counted for each group: n = 100.

Species	Day 0	Day 10 *	
		Controls	Papaya
Haemonchus spp.	4 %	2 %	46 %
Trichostrongylus spp.	36 %	83 %	24 %
Coöperia spp.	58 %	13 %	24 %
Strongyloïdes spp.	2 %	2 %	4 %
Oesophagostomum	0 %	0 %	2 %

(*) no infective larvae where recovered from the levamisole-coproculture since all samples were negative for nematode-eggs.

Discussion

The equatorial Amazon-forest, which extends through Brasil, Venezuela and the three northern Guyana's (Guyana, Surinam and French Guyana), has in recent years become an important medical research area. Hundreds of plants, unknown to Western science are now being tested for their pharmacological properties. "Bush medicine" which has been applied by the indigineous forest-people (Amazon-indians and fled African slaves called "marrons" or "maroons") for centuries, is now being tested with modern technology, using Western standards.
Surinam has long been aware of the value of it's bush medicine and several authors have put their knowledge to paper, allthough very few of these publications have an exclusive scientific (say pharmacological) value. Bush medicine is indeed very closely linked to animism and superstition. Nevertheless, these authors have made an important contribution to science, simply by identifying, discribing and cataloguing hundreds of plants and their alledged medical properties. Actual scientific proof of these pharmacological properties is usually failing. Heyde[4] (1990) describes ten palatable plants and vegetables in Suriname which he claims have anthelmintic properties. One of the best discribed medicinal plants is *Carica papaya,* papaya. Heyde claims the crushed or milled seeds of the papayafruit, the milk and the leaves of the papaya tree, as well as the roots to be suitable as anthelmintics in man.

Rosita Arvigo and Michael Balick[5], reviewing the use of several medicinal plants in "Rainforest Remedies", describe the several recognised medicinal properties of the wild papaya, found in secondary woods, old farmlands and road edges. Papaya has proven to have in vitro antibacterial activity from fresh epicarp tissue (Emeruwa, 1982), ascaricidal activity in dogs from a 1,5 ml/kg dose (Nagaty et Al., 1959), cardiac depressent activity in humans from a hot water extract of the fruit at 0,2 gm/person (Noble, 1947), antifungal activity (Rojas Hernandez et Al., 1981) and antiyeast activity (Tezuka and Kitabake, 1980).

In 1966, H.Kuil[6] published the results of trials undertaken to assess the value of Neem *(Melia azadirachta)* as an anthelmintic. Neem was (and still is) a very popular medicinal (and holy) plant in Suriname, widely used in bush-medecine, as well as animal husbandry. Nevertheless, Kuil found no significant decrease in the egg shedding (epg) of Neem-treated calves. The value of papaya was not investigated.

In Zaïre, Kasonia[7] (1991) investigated the veterinary use of several plants. Papaya does not figure on the list of plants with anthelmintic properties, nor any other medical property for that matter.

The results found during this trial - taking into account the limited number of animals in the trial and taking into account the limitations and constraints of coprological examination as a means to assess nematode-infestations in the host[8] - indicate an excellent action of levamisole in ruminants. Inspite of the extended and sometimes exaggerated use of this drug in the past years, there would seem to be no reason to suspect anthelmintic-resistance of nematodes against levamisole. This conclusion is confirmed by similar trials currently being undertaken in young sheep[9].

The FECR-test using papaya as an anthelmintic indicates an insufficient action. The average epg following treatment remains at a level of approximately 60% of the level prior to treatment, which is totally insufficient to be considered an anthelmintic. However, it is obvious that papaya has some kind of property which enables it to (temporarily or permanently) suppress egg shedding, presumably through a decrease in the number of eggs and/or the number of worms.

The species recovered from coproculture of faecal samples coincide with the results found by Kuil[10] in the late sixties. There is no proof of any species-related response to the treatment with papaya. The distribution of the species involved is quite different prior to and following treatment, but so is the distribution in the control group. None of the species would appear to be especially sensitive or resistant to papaya.

Allthough this trial reveals an unsatisfactory action of papaya as an anthelmintic drug, the authors think there is still some ground for further testing of this plant. It would be interesting to investigate the anthelmintic action of the plant using higher dosages and using other parts of the plant; the seeds for instance, are said to have powerful medicinal (and presumably anthelmintic) properties.

At this point, the only way papaya could be useful as an anthelmintic in animal husbandry, would appear to be as an feed-additive, in which animals get fed papaya leaves and fruits on a daily basis, thus suppressing the development of the wormpopulation in the animal.

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