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TEMPORAL DENSITY OF TRICHOSTRONGYLID LARVAE ON A COMMUNAL PASTURE IN A SUB-TROPICAL REGION OF PAKISTAN

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ABSTRACT

Seasonal density of trichostrongylid nematode larvae was investigated on a pasture used for communal grazing of livestock, using standard procedure of pasture larval count. For this purpose, herbage samples were collected from a posture near Faisalabad at fortnightly intervals over a 12 month period from July 2000 to June 2001. The larvae of *Haemonchus (H) contortus*, *Trichostrongylus* species, *Ostertagia* species and *Cooperia (C) curticei* were recorded from the pasture throughout the year. However, the nature and intensity of larval contamination varied among different months. *H. contortus* larvae were in the highest numbers, followed by those of *Trichostrongylus* species, *C. curticei* and *Ostertagia* species. A trend of higher contamination of pasture was found during February to April, which coincides with the lambing season of sheep and goats; and July to September which is normally monsoon in the study area. Standard pasture management integrated with strategic treatments of sheep and goats for nematode infections are suggested.

Key words: Seasonal availability, pasture contamination, Trichostrongylids, sub-tropics.

INTRODUCTION

In Pakistan, major share of national sheep population comes from the small flocks maintained by the landless families or small land holders in the villages. These sheep flocks are the main stay of the livelihood of these people, as they sell sheep to meet their day-to-day needs. Sheep flocks are grazed on canal banks, roadsides and crop residues in the fields. Canal banks are the only permanent pastures used for communal grazing of sheep. Therefore, animals usually remain under-fed and victim of diseases. The helminths are the permanent parasites of sheep and their prevalence has been reported very high (25 to 92%) throughout Pakistan (Khan *et al*., 1989; Qayyum, 1996). Among helminths, gastrointestinal nematodes carry high importance because of their insidious and severe pathological effects (Sykes, 1994), resulting in high production losses (Iqbal *et al*., 1993)

There are a number of factors that can influence the prevalence of gastrointestinal nematodes. The main source for infection, however, remains the pastures contaminated with infective stages of these nematodes. The epidemiological significance of contaminated pastures further increases under traditional sheep husbandry system, communal grazing and in the absence of strategic worm control programmes in developing countries like Pakistan. The development of nematode eggs to infective larvae and the survival of these larvae on pasture are influenced by ambient temperature, rainfall and other environmental conditions. Investigations carried out on nematode larvae ecology in some parts of sub-Saharan Africa (Onyali *et al*., 1990), Europe, Australia and the Pacific islands (Besier and Dunsmore, 1993) have shown that the rate of development and the longevity of eggs vary at different temperatures and humidity and in different geo-ecological regions.

The ultimate sufferers in terms of economic damages due to production losses caused by the nematode infections of sheep are the poor farmers, who are unaware of the role of pastures and other factors in the worm control (Afaq, 2003). This paper reports the seasonal density of trichostrongylid larvae for grazing livestock on a communal pasture in a sub-tropical region of Pakistan selected as a model to develop a strategic worm control programme.

MATERIALS AND METHODS

Study area

Pakistan is divided into different agro-ecological zones on the basis of climate, rainfall, ambient temperature and potential land use. One of its zones selected for the present study is “irrigated agro-ecological zone” in the province of Punjab. The district Faisalabad of this zone was selected for the present study. Climatically, the study area is subtropical and receives an annual rainfall of about 150-350 mm. The temperature is highest in June, before the onset of monsoon season. During summer, the daily maximum temperature exceeds 40°C and seldom declines below 24°C. Relative humidity is lowest during April-May and rises during the monsoon season (Table 1). One year cycle is divided into four seasons viz. winter (December-February), spring (March-April), summer (May-September) and autumn (October-November). Summer also includes monsoon season (July-August).

Animal management

In the study area, sheep farmers lead a sedentary life in villages. They, and their flocks, live in mud, bricks or thatched and mud-plastered houses in winter. The flocks are taken out in the morning for grazing on canal banks, roadsides, crop stables, fallow and common lands and brought back to the holding by sunset. There are two lambing seasons in the year: first in March-April and the second in October-November. Lambs are allowed to accompany their dams to pasture as soon as they are able to walk. Culling is commonly practiced in male lambs before the start of the breeding season or when money is needed.

Pasture larval counts

The herbage samples for the recovery of larvae were collected from a selected pasture (about three acres of land) near Faisalabad at fortnightly intervals over a 12 month period from July 2000 to June 2001. For this purpose, the procedure described by Urquhart *et al*. (2000) was followed. The nematode larvae were examined under a microscope and identified according to the morphological characteristics given by MAFF (1979), Soulsby (1982) and Urquhart *et al*. (2000).

RESULTS AND DISCUSSION

Larvae of *H. contortus*, *Trichostrongylus* spp. *Ostertagia* spp. and *C. curticei*, although with varying numbers, were recorded through out the study period from selected pasture (Figures 1 and 2). The pasture larval counts were lower during November through January, whereas a higher trend was recorded from February to October.

These results support those of Grant (1981), who reported that most rapid development of larvae occurred in summer with peak larval burden on pasture being reached in six to eight weeks, resulting in heavy infection in lambs from September onwards. A warm and moist summer is well suited to the development and survival of the free-living stages of nematodes. Moreover, these months are important for grazing of sheep due to availability of green pastures. However, it was interesting to note that there was high increase in the larval counts from February to March with a fall during April, May and June. A fall in the larval counts from November to January might be due to high mortality of free-living stages as a result of the depletion of energy reserves associated with low temperature and inadequate rain in winter season (Kates, 1950). Moreover, the availability of green pastures was reduced during these months. Therefore, the current findings are supported by the climatic data which indicate better rainfall or the post rainfall effect during February to October compared with that during November to January (Table 1). Similar observations on the availability and abundance of nematode larvae during rainy season have been made previously (Dorny *et al*., 1995; Amarante and Barbosa, 1998). The pasture larval counts (Figs. 1 and 2) recorded in the current study is in line with previous findings on the prevalence of different species of nematode infecting sheep in the study area (Khan *et al*., 1989; Sajid *et al*., 1999). The pasture contamination, therefore, has direct influence on the population dynamics of nematodes like that of *Trichostrongylus colubriformis* (Barnes and Dobson, 1990).

The total pasture larval counts on dry matter basis were higher during August and September, whereas they remained lower during November to January (Fig. 2).

Table 1: Monthly mean ambient temperature (ºC), humidity (%) and total rainfall (mm) for the year 2000-2001 in the study area

Months	Minimum temperature	Maximum temperature	Average relative humidity	Rainfall
July	27.0	36.4	68	92.8
August	27.5	37.6	60	49.2
September	24.5	36.1	58	27.4
October	19.3	35.0	57	0.0
November	12.2	27.5	64	0.0
December	6.0	23.2	65	12.0
January	4.7	16.5	80	0.0
February	8.7	24.3	61	0.0
March	13.7	29.8	48	3.0
April	19.6	32.8	45	26.0
May	26.5	42.0	32	8.5
June	27.5	37.6	56	140.5

Source of data: Meteorological Unit, Department of Crop Physiology, University of Agriculture, Faisalabad, Pakistan.

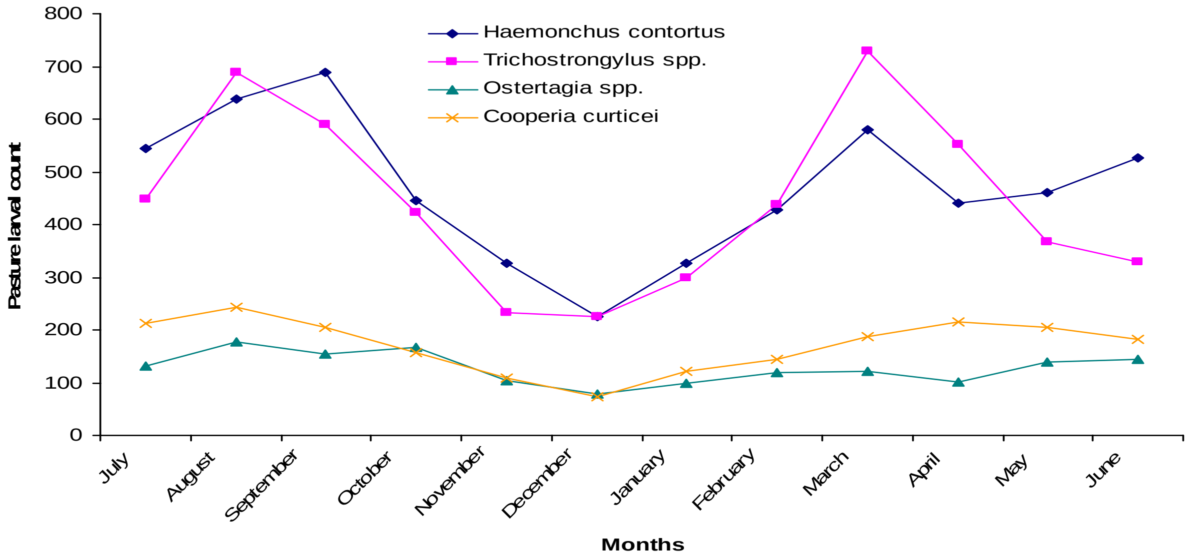

Fig. 1: Month-wise distribution of different species of Trichostrongylid nematodes of sheep on Pasture.

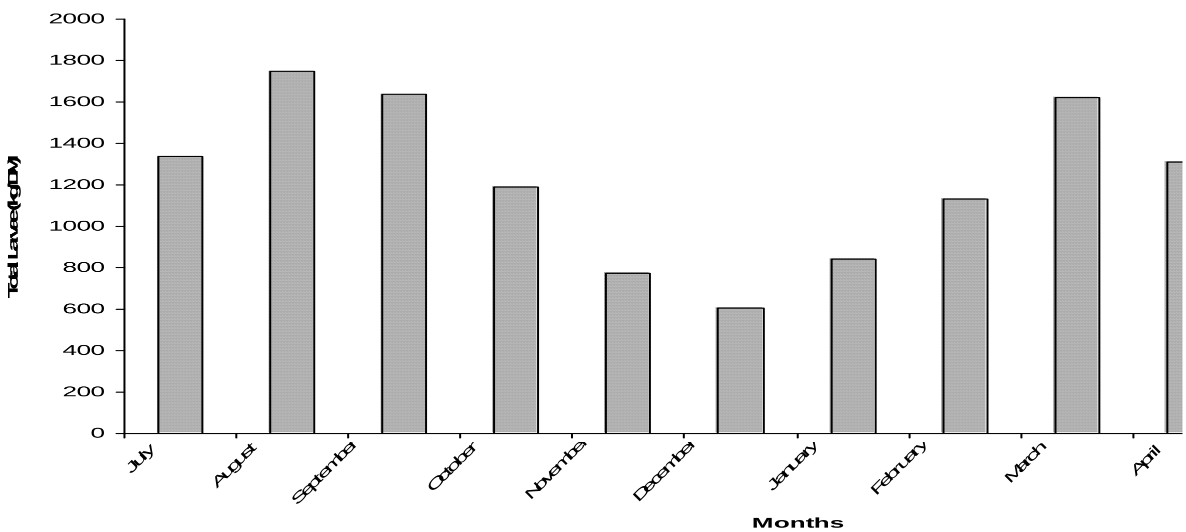

Fig. 2: Month-wise prevalence of total larval counts (kg^{-1}DM) of Trichostrongylid nematodes of sheep on pasture under natural conditions.

These findings are in line with those of Gupta *et al*. (1987), who observed that rainy season in sub-tropical countries, like Indian subcontinent, favoured the development of Trichostrongylid nematodes. *H. contortus* larvae were the most prevalent on pasture, followed by *Trichostrongylus* species, *C. curticei* and *Ostertagia* species (Fig. 1). The higher larval prevalence of *H. contortus* can be due to the fact that this nematode has a relatively short generation interval and ability to take the advantage of favorable environmental conditions (Grant, 1981). The mean monthly maximum atmospheric temperature of 18°C or above and total monthly rainfall of 50 mm are conducive for translation and transmission of *H. contortus* (Gordon, 1953). Therefore, the climate of the study area seems to be very conducive for the propagation of *H. contortus* larvae.

The pre-patent period for *H. contortus* in sheep on an average is 15 days (Soulsby, 1982). Thus, the contamination of pasture by ewes produces a peak in larval availability in summer and, when ingested by lambs, results in heavy infection capable of producing disease in late July, August and September (Armour, 1980). The larval development of *H. contortus* occurs optimally at relatively high ambient temperatures, high humidity, microclimate of faeces and herbage and high rainfall (Urquhart *et al*., 2000). Generally, temperature favorable for the development and translation of the free-living stages of *H. contortus* may have a diurnal fluctuation between 23.3 and 11.6°C (Dinnik and Dinnik, 1961) and mean monthly rainfall exceeding 50 mm (Grant, 1981). Therefore, all these factors were favorable for the larval development of *H. contortus* from March to September and this effect continued even to October. Relatively low rate of *Haemonchus* larvae during winter months (November to January) may be attributed to unfavorable climatic conditions like low temperature that retard the development of free-living stages, as at 9°C no development of these larvae takes place (Soulsby, 1982).

The prevalence of *Trichostrongylus* larvae on pasture showed a different trend compared with *H. contortus*. It was the highest in March, followed by August and September and decreased from November to January (Fig. 1). *Trichostrongylus* species are generally considered as cool-season parasites (Southcott *et al*., 1976), as they thrive best at mean monthly temperatures ranging from 2.8 to 18.3°C and disappear when temperature exceeds 20°C (Gordon, 1953). The eggs and infective larvae of *Trichostrongylus* species have been reported to have a high ability to survive under adverse weather conditions like cold or desiccation (Urquhart *et al*., 2000). However, findings of the present study regarding relatively low prevalence of *Trichostrongylus* species during winter months do not support the theory of being cool-season parasites. Rather, these findings are consistent with those of Gupta *et al*. (1987), who did not observe any conducive effect of cool season on the *Trichostrongylus* species.

The prevalence of *Ostertagia* larvae was high from August to October; whereas it decreased from November to April (Fig. 1). The contributory factors for an increase in the prevalence of *Ostertagia* species seem to be the eggs deposited by the infected sheep in the first half of the grazing season from April to June which give rise to potentially dangerous populations of infective larvae from June to October. The present findings do not support the conclusions that the free-living stages of *Ostertagia* species thrive better in cool moist conditions (Gordon, 1953).

The prevalence of *C. curticei* larvae followed the trend of *H. contortus* infection, being higher from March to October with a peak in August, whereas it remained relatively low during November to February (Fig. 1). These findings are typical of *C. curticei* infection in sheep reported in other parts of the world (McCulloch and Kasimbala, 1968; Beveridge and Ford, 1982; El-Sayed, 1997; Stear *et al*., 1998).

The infected animals coming for grazing are the main source of pasture contamination. Therefore, management of infected animals is the most important part of a worm control programme. Peri-parturient stress, extreme weather conditions, poor nutrition and lactation stress are the crucial factors which also play significant role in pasture contamination through increasing nematode faecal egg output by the animals during these periods (Pandey *et al*., 1990; Rahman and Collins, 1992; Fleming, 1993; Etter *et al*., 1999). In many parts of the world, parturition of grazing animals is synchronized to occur with the climate favorable to pasture growth, which is also suitable for development and survival of free-living stages of most helminths (Wedderburn, 1970). The maturation of hypobiotic larvae has also been proposed to be responsible for peri-parturient rise and *H. contortus*, *Trichostrongylus* and *Ostertagia* genera were reported to be the major egg contributors during the spring rise phenomenon (Yazwinski and Featherstone, 1979).

Based on the results of the present study it can be concluded that the pastures used for sheep grazing remain contaminated with nematode larvae throughout the year. Therefore, these pastures play an important role in the epidemiology of nematode infections of sheep which warrants education of the farmers to deworm their animals before they are released for grazing, particularly in the start of spring, onset of monsoon and autumn. Since communal grazing is in practice under the traditional sheep husbandry system of Pakistan, a community participation approach be followed for awareness about pasture management and deworming programmes.

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