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Observations on *Oestrus ovis* L. (Diptera: Oestridae) Myiasis in the Nasal Cavities and Sinuses of the Domestic Sheep (*Ovis aries*) in Zaria, Northern Nigeria

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Abstract: Myiasis due to larval stages of the sheep bot fly, *Oestrus ovis* Linnaeus (Diptera: Oestridae) was observed in 72(62.07%) out of 116 sheep heads examined between September 2003 and February 2004 in Zaria, Nigeria. Prevalence of infestation in rams (66.67%) was higher than in ewes (60.47%) but insignificantly. Monthly prevalence of oestrosis fluctuated between 44% in September and January and 88% in October. Intensity of infestation was highest (26.83 larvae per head) in February and least (2.29 larvae per head) in October. The number of sheep positive for the condition and belonging to each of five age categories (<15 months, 15-22 months, 22-28 months, 28-36 months, > 36 months) did not differ significantly. The burden (intensity) of infestation ranged between 3 larvae per head in sheep aged 22-28 months and 23.40 larvae per head in 28-36 months. The anterior nasal region accounted for a significantly higher number of larvae than the posterior region, which was higher in ewes than rams ($p<0.05$). The distribution of the three larval instars of the nasal bots between anterior and posterior nasal structures did not differ significantly. No significant correlation existed amongst monthly relative humidity, temperature ranges, prevalence and intensity of infestation. The study reveals a high prevalence and burden of ovine oestrosis in northern Nigeria and an inadequacy of therapeutic intervention for the condition.

Key words: Oestridae, *Oestrus ovis*, myiasis, sheep, Nigeria

Introduction

All the dipterous insects belonging to the family Oestridae have species whose larval stages are obligate myiasis producing parasites in the tissues and or orifices of humans, domestic animals and wildlife (Hall and Smith, 1993). *Oestrus ovis* Linnaeus (Diptera: Oestridae) is a prominent member of this family and its veterinary importance stems from its larvae being parasitic in the respiratory passages and frontal sinuses of sheep and goats, throughout its cosmopolitan distribution in tropical and temperate climates. Humans that are actively engaged in sheep and goats husbandry are also at risk of being infested; resulting in catarrhal conjunctivitis, corneal opacity and other forms of visual impairment and or stomatitis including a form of human benign ophthalmomyiasis (Bishopp and Phillip, 1952; Hall and Smith, 1993; Gregory *et al*., 2004; Masoodi and Hosseini, 2004). Pathophysiology of ovine and caprine oestrosis include strong inflammation presenting mucosal hypereosinophilia and mastocytosis, mucus hypersecretion and nasal discharge (Nguyen *et al*., 1996;

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Dorchies *et al*., 1998). Heavy infestations by larval stages of *O. ovis* are rare and manifest as unthriftiness and incoordination; death of the larvae in the sinuses may attract secondary bacterial invasion and cerebral involvement (Horak and Snijders, 1974; Gaaboub, 1978). Perhaps, the activities of the larvipositing adult flies create more dramatic effects on the host animals, as they become restless and anorexic in the bid to prevent larviposition in their nasal orifices.

Several studies have been conducted on the prevalence and pest status of *O. ovis* in small ruminants worldwide, but available literature on the species in Nigeria is rather scanty and limited to its parasitism in goats (Unsworth, 1948, 1949; Ogunrinade, 1977; Adebote *et al*., 2002). Unfortunately, the domestic sheep, which is the favoured host of *O. ovis,* appeared not to have been investigated for oestrosis myiasis in Nigeria. This paper therefore reports on *O. ovis* myiasis in sheep, particularly on its prevalence, larval parasite burden and predilection sites within the nasal passages of the animals in Zaria, northern Nigeria.

Materials and Methods

The study was conducted for six months (September 2003 to February 2004), in Zaria (11°06′N, 07° 44′E) located in the northern Guinea savanna vegetational zone of Nigeria. Weather variables monitored *in loco* during the study period gave the total and mean annual rainfall as approximately 974 mm and 81.1 mm, respectively, falling mainly in June to October. The other months of the year rarely experience rainfall and are dry (less than 10% of annual rainfall; mainly in March to May). Temperatures in the area ranged from 15.2 to 37.4°C (mean: 21-32.5°C), with a mean relative humidity of 56.6 to 66%. The dry season mean relative humidity ranged from 35.7 to 50%; with mean temperatures reaching 33.4°C. Between October and March, the predominant winds are the north-easterlies winds that bring harmattan cold-cum-dust.

Heads of slaughtered sheep were purchased forthnightly from butchers in Samaru and Tudunwada markets in Zaria, Nigeria. Information on the sex of the animals were obtained from the butchers and confirmed by head curvature and horns (ewes being mainly hornless). The age of the animals was estimated based on the number of primary and or permanent incisors pairs in their months (Owen, 1981; Bayer, 1986; Gatenby, 1991). In the laboratory, the heads were dissected longitudinally in dorsoventral planes across the nasal cavities, as far as the frontal sinuses, using a sharp knife. *Oestrus ovis* larvae present on the mucosae of the nasal septa, nasal passages, conchae and frontal sinuses were collected with a pair of fine-tipped forceps. The nasoturbinates and nasal sinuses were rinsed with water and the collected rinsings were examined for nasal bots with a hand lens (Horak, 1977). The number of *O. ovis* larvae recovered per head and identified under X40 magnification of a dissecting microscope as belonging to the first, second and third instars (Zumpt, 1965; Capelle, 1966) and the sites of recovery within the nasal chambers were noted. For convenience, larvae recovered from the nasal septa, nasal passages and conchae were classified as originating from the anterior nasal region, whilst those recovered from the median and dorsal turbinate bones and frontal sinuses were classified to have originated from the posterior nasal region. All the recovered larvae were preserved in 70% alcohol in appropriately labelled specimen bottles.

Weather variables (temperature and relative humidity) in the study area were obtained from meteorological station of the Institute of Agricultural Research, Ahmadu Bello University, Zaria, throughout the duration of the study.

Statistical Analysis

Meteorological data were correlated with the prevalence and intensity of *O. ovis* myiasis in the sheep heads examined. Chi-squared (χ^2) analyses were used to test for significant difference in the number of infected ewes and rams belonging to the various age categories and to check for any sex based significant difference in the distribution of *O. ovis* larvae between the anterior and posterior nasal regions. A two-way analysis of variance (2-way ANOVA) was employed to test for significant difference in the population of the three larval instars of *O. ovis* distributed between the anterior and posterior nasal regions.

Results

A total of 116 sheep heads, belonging to 30 rams and 86 ewes, were examined for *O. ovis* myiasis in this study. Of these, 72 heads belonging to 20 rams and 52 ewes were positive for the infection, which gave a prevalence of 66.67 and 60.07%, respectively and an overall prevalence of 62.07% (Table 1). There was no significant difference between the number of infected rams and ewes ($p>0.05$).

Five age categories (ranging from less than 15 months to over 36 months) were obtained from the dentition of sheep examined (Table 2), ewes and rams within the 22-28 months age categories had the least prevalence (33.33%) whilst those aged 28-36 months had the highest prevalence of 83.33%. All the examined rams aged 28 months and older were positive for *O. ovis* myiasis. Similarly, all the ewes within this age category had the highest prevalence range (64.29-80%). A similar prevalence (64.29%) was recorded in sheep aged less than 15 months and those aged 15-22 months. There was no significant difference ($p>0.05$) in the number of infected sheep belonging to the different age categories. Although, of no significant difference, the ewes almost always had a lower prevalence of infection than the rams (Table 2).

Table 3 shows the burden of the three larval instars of *O. ovis* in each of the five age categories of the sheep examined. A total of 664 larvae, consisting of 358 first instars, 162 second instars and 144 third instars, were recovered from the sheep heads. Sheep within the 22-28 months age bracket had the least larval burden of 3 larvae per head whilst those aged 28-36 months had the highest larval burden of 23.4 larvae per head. In all the age groups, the burden of first instar larvae was consistently higher than those of the other two instars. The highest number of larvae recovered from any one sheep was from an ewe which belonged to the 28-36 months age group, with 58 larvae made up of 26 first instars, 15 second instars and 17 third instars larvae. Another, which was a ram aged 28-36 months had 52 larvae all of which were newly deposited first instar larvae as novel infection. Both animals were examined in February.

The sheep heads examined in February consistently yielded the highest number of each of the three larval instars of *O. ovis*. Sheep examined in October yielded the least number of first instar larvae; while those examined in January gave the least number of second and third instar larvae (Table 4).

In both sexes, a higher population and percentage of larvae were isolated from the anterior (398 = 59.94%), than the posterior site (266 = 40.06%). The population of the larvae was significantly higher in the anterior than the posterior part of the nasal chambers ($p<0.05$) and the number of larvae isolated from the ewes was significantly higher ($p<0.05$) than those recovered from the rams (Table 5).

Table 1: Prevalence of *Oestrus ovis* larvae in heads of slaughtered sheep in Zaria, Nigeria

Sex	No. examined	No. infected	Prevalence (%)
Male	30	20	66.67
Female	86	52	60.47
Total	116	72	62.07

Table 2: Age and sex specific prevalence of *Oestrus ovis* larvae in the nasal Chambers of sheep slaughtered in Zaria, Nigeria

Age group (months)	Sex	No. examined	No. infected	Prevalence (%)
Less than 15	Male	12	8	66.67
	Female	16	10	62.50
	Total	28	18	64.29
15-22	Male	8	6	75.00
	Female	20	12	60.00
	Total	28	18	64.29
22-28	Male	6	2	33.33
	Female	12	4	33.33
	Total	18	6	33.33
28-36	Male	2	2	100.00
	Female	10	8	80.00
	Total	12	10	83.33
Over 36	Male	2	2	100.00
	Female	28	18	64.29
	Total	30	20	66.67

Table 3: *Oestrus ovis* burden in the different age groups of sheep examined

Age group (Months)	Total number of larval instars (mean±SE) First instar	Second instar	Third instar	Mean larval burden	All instars
<15	44 (8.80±1.11) n = 10	26 (3.25±0.62) n = 8	36 (2.57±0.85) n = 14	11.78 n = 18	106
15-22	70 (5.83±1.48) n = 12	50 (3.13±0.69) n = 16	30 (3.75±0.72) n = 8	8.33 n = 6	150
22-28	10 (1.67±0.42) n = 6	2 (1.00±0.00) n = 2	6 (1.50±0.29) n = 4	3.00 n = 6	18
28-36	166 (20.75±6.78) n = 8	34 (8.50±3.75) n = 4	34 (8.50±0.00 n = 2	23.40 n = 10	234
Over 36	68 (4.25±0.55) n = 16	50 (4.17±1.08) n = 12	38 (3.17±1.27) n = 12	7.80 n = 20	156
Total	358 (6.88±0.87) n = 52	3.86±0.58) n = 42	144 (3.60±0.69) n = 40	9.22 n = 72	664

Table 4: Monthly prevalence and mean larval burden of *Oestrus ovis* in sheep examined in Zaria, Nigeria

Month	No. of sheep Examined	Infected	Prevalence (%)	No. (means±SE) of *O. ovis* larval instars First instar	Second instar	Third instar	All instars
2003 September	18	8	44.44	22 (3.67±0.92) n = 6	20 (3.33±0.92) n = 6	30 (7.50±1.45) n = 4	72 (9.00) n = 8
October	16	14	87.50	6 (1.00±0.00) n = 6	10 (1.25±0.16) n = 8	16 (1.33±0.14) n = 12	32 (2.29) n = 14
November	22	18	81.82	54 (5. 40±0.81) n =10	38 (2.71±0.41) n = 14	30 (2.14±0.48) n = 14	122 (6.78) n = 18
December	20	12	60.00	44 (4.40±0.81) n = 10	24 (4.00±1.59) n = 6	24 (12.00±0.00) n = 2	92 (7.67) n =12
2004 January	18	8	44.44	18 (2.25±0.62) n = 8	4 (2.00±0.00) n = 2	2 (1.00±0.000 n = 2	24 (3.00) n = 8
February	22	12	54.55	214 (17.83±5.22) n = 12	66 (11.00±1.27) n = 6	42 (2.00±3.18) n = 6	322 (26.83) n = 12
Total	116	72	62.07	358 (6.88±0.87) n = 52	162 (3.86±0.58) n = 42	144 (3.60±0.69) n = 40	664 (9.22±0.40) n = 72

Table 5: Effect of host sex on the distribution of *Oestrus ovis* larvae in the anterior and posterior nasal structures of sheep

	No. (and percent) of *Oestrus ovis* larvae in		
Sex of sheep	Anterior site	Posterior site	Total
Male	152 (22.89)	74 (11.14)	226 (34.04)
Female	246 (37.05)	192 (28.92)	438 (65. 96)
Total	398 (59.94)	266 (40.06)	664 (100.00)

Table 6: Predilection sites of larval instars of *Oestrus ovis* in the nasal passages of sheep examined in Zaria, Nigeria

	No. of larval instars (mean±SE)			
Site in nasal Chamber	First instar	Second instar	Third instar	Total
Anterior	314 (7.14±1.66) n = 44	116 (4.46±0.88) n = 26	62 (2.58±0.70) n = 24	492
Posterior	44 (2.44±0.50) n = 18	46 (1.92±0.26) n = 24	82 (4.10±0.74) n = 20	172
Total (%)	358 (53.90)	162 (24.40)	144 (21.70)	664

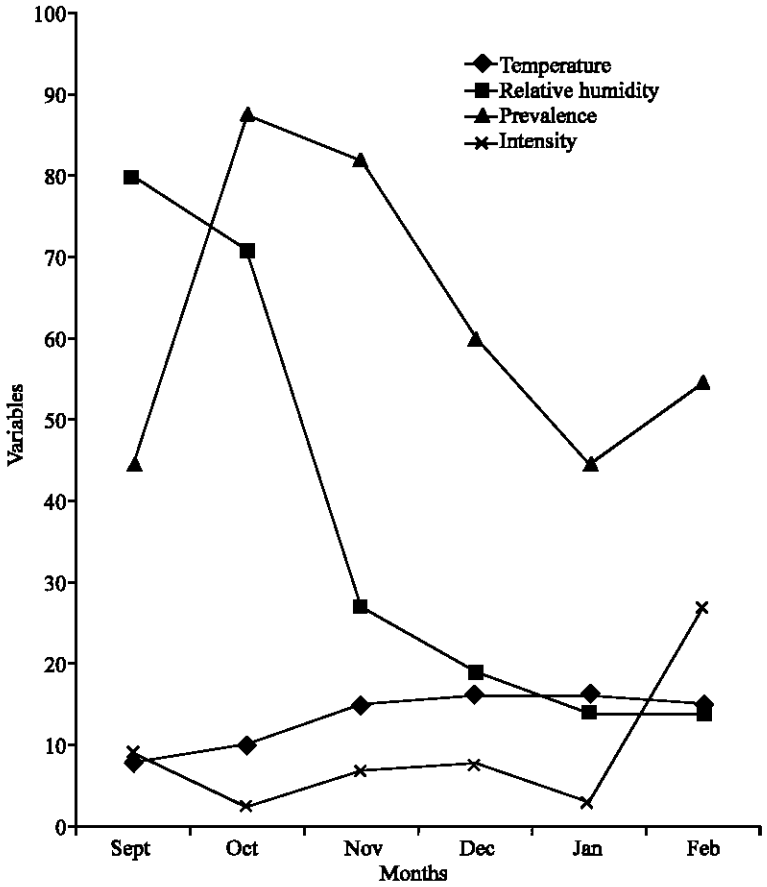

Fig. 1: Effect of Weather variable on prevalence and intensity of *O. ovis* infestation in sheep of Zaria, Northern Nigeria

Over 87% (314/358) of the first instar larvae were isolated from the anterior nasal passages of the sheep. Similarly, more than 71% (116/162) of the second instar larvae occurred on the anterior sites (Table 6). Majority (56.94%) of the third instar larvae occurred in the posterior parts of the nasal chambers; especially in the frontal sinuses of the sheep. There was no significant difference in the distribution of the three larval instars of *O. ovis* between the anterior and posterior nasal chambers of the animals ($p>0.05$).

A non-significant negative correlation existed between the monthly prevalence of *O. ovis* in the sheep and mean monthly ranges of temperature ($r = -0.069$, $p>0.05$). The ranges of mean monthly temperature correlated positively but not significantly with the monthly intensity of *O. ovis* in the animals ($r = 0.20$, $p>0.05$). The mean monthly relative humidity was positively but not significantly correlated with monthly prevalence of *O. ovis* infestation of sheep ($r = 0.184$, $p>0.05$). A non-significant negative correlation existed between mean monthly relative humidity and monthly intensity of *O. ovis* infestation in sheep ($r = -0.35$, $p>0.05$) (Fig. 1).

Discussion

This study recorded a high prevalence of *O. ovis* myiasis in the nasal passages and frontal sinuses of domestic sheep in Zaria, Nigeria. When compared with previous studies of goat in Nigeria, the 62.07% prevalence in this study was higher than the 32.9% prevalence in goats reported by Unsworth (1949) in Kano and the 28.9% prevalence obtained in goats in Zaria, Nigeria (Adebote *et al*., 2002). The prevalence in this study is comparable with the 69.30% seroprevalence in sheep from southwestern Spain (Alcaide *et al*., 2005). The range of mean larval burdens (3.0-23.4) recorded for the various age categories of sheep in this study, far exceeded the 1.5-4.0 mean larval burden range reported by Adebote *et al*. (2002) in goats from the same area. This shows that the domestic sheep was a preferred host of *O. ovis* in Zaria, Nigeria. This finding also corroborates the often reported lower infestation of *O. ovis* in goats than sheep (Buchanan *et al*., 1969; Ranatunga and Weilgama, 1972). Horak and Butt (1977) found an almost identical incidence of oestrosis in South African sheep and goats; although the mean larval burden was higher in sheep than goats. The lower prevalence of the infection in goats than sheep have been attributed to the larvae-expelling snorting courtship of goats, not associated with sheep (Horak and Butt, 1977; Adebote *et al*., 2002). A significant correlation exists between the number of *O. ovis* larvae and the serum antibody levels in the host, a finding of practical value in serodiagnosis of oestrosis (Alcaide *et al*., 2005). Unlike in goats where a highly significant higher prevalence of oestrosis occurred in does than bucks (Adebote *et al*., 2002), the higher prevalence of oestrosis in rams than ewes in this study was not significant. These overt differences in hosts-parasite relationships could be due to behavioral differences between the hosts. Again, snorting which is very common in bucks during mating and does not occur in rams, could be the factor responsible for differences in parasitosis.

The distribution of the three larval instars of the parasite within the anterior and posterior parts of the nasal structures of the sheep was uniform. It was therefore not possible to observe any instar specific predilection site for *O. ovis* larvae in the nasal passages of the sheep. This was not without noticing the preponderance of first and second instar larvae in the anterior parts of the nasal structures (mucosae of the nasal septa and conchae), whilst a majority of the third instar larvae occurred in the posterior parts of the nasal structures (nasoturbinates and frontal sinuses). The significantly higher number of larvae recovered from the anterior nasal region than the posterior region was due to the predominance of first instar larvae which occurred mainly in the anterior region. Adebote *et al.* (2002), found an instar-specific predilection site for *O. ovis* larvae in goats examined in Zaria, Nigeria. The

lengths and diameters of the nasal passages which were greater in sheep than in goats could have been responsible for the absence of instar- specific predilection site preferences of *O. ovis* larvae in the sheep. The stage of larval development of *O. ovis* impact significantly on the humoral immune response of the host (Alcaide *et al*., 2005). None of the 664 larvae isolated from the host was found dead, even after prolonged death of the host, suggesting a very hardy nature and longevity of the nasal bots. This observation, which was also made in goats by Adebote *et al.* (2002), depicts a lack of previous therapeutic husbandry to ameliorate the effects of oestrosis in the sheep. It is therefore pertinent to recommend an improved control strategy, including chemotherapy, for *O. ovis* myiasis in small ruminants in Zaria and elsewhere in Nigeria.

Both temperature and relative humidity have no significant effect on the prevalence and intensity of *O. ovis* parasitism in the sheep. This may be due to slight variations in these weather variables throughout the study in Zaria, with a tropical climate. Moisture has been confirmed to have no effect on the emergence of adult *O. ovis* flies from pupae (Horak, 1977). Temperature influences the percentage of adults emerging from pupae (Rogers and Knapp, 1973). Cobbett and Mitchell (1941) found *O. ovis* to be active all year round in places with moderate winters in the United States of America, but such activity was restricted to the warm summer and early fall days in places with severe winter. Possibility of all year round activity of *O. ovis* fly abound in Zaria, Nigeria because of the hot tropical climate. There is the need to investigate the pest status of *O. ovis* in small ruminants over the course of a year, in order to identify periods critical for the introduction of control measures.

In conclusion, a high prevalence of ovine myiasis due to *O. ovis* larvae was established in the study area. This prevalence of ovine oestrosis was higher than caprine infestation of similar nature earlier reported in parts of Nigeria and confirms a favoured status for the former. The burden (intensity) of infestation varies with the age of the sheep and no instar-specific predilection site was associated with the larvae in the nasal passages of the sheep host.

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