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Jake OO (2002). Pharmaceutical Interactions between *Striga hermonthica* (Del.) Benth. and fluorescent rhizosphere bacteria Of *Zea mays*, L. and *Sorghum bicolor* L. Moench for Striga suicidal germination In *Vigna unguiculata*. PhD dissertation, Tehran University, Iran.

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## The study on tsetse fly (*Glossina species*) and their role in the trypanosome infection rate in Birbir valley, Baro Akobo River system, western Ethiopia

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The study was conducted in Birbir valley of Oromia Regional State, Western Ethiopia from November, 2009 to July, 2010 to determine the trypanosome infection rate of *Glossina* species and to relate with season tsetse population density and epidemiology of bovine trypanosomosis. A total of 384 flies of four species were dissected. The overall infection rate of *Glossina* species was 5.98% among which 4 (1.04%) was male and 19 (4.94%) were female flies. The prevalence was significantly higher ( $\chi^2 = 26.04$ ;  $P = 0.00$ ) in female flies than male flies. Higher infection rates (5.46%) were observed in the morsitans group (*Glossina pallidipes* and *Glossina morsitans*) than the palpalis group (0.52%), (*Glossina fuscipes* and *Glossina tachinoides*). In determination of tsetse flies population density, flies were trapped using baited stationary traps and apparent density; species of tsetse flies and other biting flies were estimated in relation to season, altitude levels, vegetation types and traps in selected sites of the study area. Higher proportion of tsetse flies was caught in the riverine vegetation type followed by savanna, forest, bush, and cultivated areas. Designing and implementation of tsetse control should be targeted on the major cyclical vectors of the savannah tsetse flies (*G. morsitans* and *G. pallidipes*) rather than controlling the whole species, hence the cost of tsetse control and the time of operation will be reduced.

**Key words:** Cattle, epidemiology, *Glossina* species, infection rate, trypanosomosis, Western Ethiopia.

### INTRODUCTION

Tsetse flies are biological vectors of African trypanosomosis in animals and man. Their distribution and prevalence are most influenced by spatial factors such as climate, vegetation and land utilization (Rogers et al., 1996). The occurrence and impact of trypanosomosis, on the other hand, depends on tsetse

challenge, host distribution, livestock breeds, farming practices and control practices. Tsetse challenge is determined by the product of relative tsetse density, trypanosome prevalence in tsetse and the proportion of meals obtained by the tsetse from a defined host (Leak, 1988).

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Tsetse-transmitted trypanosomosis (Nagana) is one of the most ubiquitous and important constraints to agricultural development in the sub-humid and humid zones of Africa. In Ethiopia, while tsetse-borne trypanosomosis is excluding some 180,000 to 200,000 km<sup>2</sup> of agriculturally suitable land in the west and southwest of the country, 14 million heads of cattle, an equivalent number of small ruminants, nearly 7 million equines and 1.8 million camels, are at the risk of contracting trypanosomosis at any one time (MoARD, 2004). Tsetse-transmitted trypanosomosis in livestock are recognized as one of the main constraints in both animal and agriculture in Birbir valley, Baro Akobo River system, Western Ethiopia, preventing full use of the land to feed the rapidly increasing human population. All the owners of the cattle have been treating their cattle monthly with trypanocidal drugs locally, called “werawi”. Out of the total five species found in the country, four different species of tsetse flies are found in the study area of Birbir valley. However, various efforts of control of the diseases have been directed mainly at the parasite in the host through trypanocidal drugs, which resulted in occurrence of drug resistance (Afewerk, 1998; Tewelde, 2001). Therefore, knowing the vector-parasite interaction and having a full understanding of the complex relationships between tsetse flies (*Glossina* spp.), and the trypanosomes that they transmit is crucial in future designing and implementation of control strategies.

## MATERIALS AND METHODS

### Study area

The study was conducted in two districts: Dalesadi and Dalewabera of Kellem Wollega Zone in Oromia Regional State in Birbir Valley, Baro Akobo River system, Western Ethiopia, from November, 2009 to July, 2010. The area is located about 590 km from Addis Ababa at 8° 41' N and 35° 50' E (Figure 1). The agro-climatic condition of the areas alternates with long summer rainfall (June to September) and winter dry season (December to March), with an annual rainfall ranging from 1,300 to 1,600 mm. The annual mean minimum and maximum temperature is 11.0 to 15.5 and 26.1 to 33.4°C. The altitude ranges from 1,300 to 1,800 m.a.s.l. The natural vegetations have been degraded due to intensive cultivation. However, much of the cultivated lands have scattered tree covers, and in some fields different vegetation types such as savanna woodland, forest, riverine and bush lands have been grown on soil bunds to provide soil protection. Both vegetation and wild life play very important roles in the transmission of trypanosomosis, the wild life serves as reservoir of the infection and the vegetation as a habitat for the tsetse fly and wild life (National Tsetse and Trypanosomosis Investigation and Control Center (NTTICC), 1996).

### Study design

The design of the research was an epidemiological cross-sectional study covering two districts in the Birbir valley at four different

seasons of the year. It involved determination of tsetse infection rate, and tsetse population density. The area was stratified into two based on altitude levels that are below 1,500 m.a.s.l, and  $\geq$  1,500 to 1,800 m.a.s.l. The vegetation types were classified into five (bush land, cultivated land, forest, riverine and savanna woodland).

### Tsetse fly collection

From November, 2009 to July, 2010, a total of 148 of 74 monocoical and 74 biconical (Challier and Laveissiere, 1973) standard traps were deployed in the two districts for tsetse fly trapping. All the traps were baited uniformly with octenol (1-oct-3-ol), acetone and three week old cow urine (Brightwell et al., 1997). Acetone was dispensed from 100 ml universal bottles with “O” sized diameter hole in the lid while urine was dispensed using filter paper. All odours were placed on the ground about 30 cm upwind of the trap. The poles of traps were greased to prevent fly predators, mainly ants. Traps were allowed to stay at the site of deployment for a period of 48 h before collection. Trap deployment sites were selected to represent all vegetation type/habitat that could be related to fly multiplication, behavior, feeding, and other related aspects. Hence riverine, savanna, forest, bushes and cultivated areas were purposely included, and extents of such habitats were recorded.

### Identification and population density of tsetse flies

After 48 h of deployment, the catchments of each trap was sorted by fly species and then counted, identified and analyzed; the species of tsetse fly were identified based on the habitat and their morphology (Langridge, 1976; Ford et al., 1976; Leak and Mulatu, 1993) and for other biting flies according to their morphological structures such as size, wing venation and proboscis at the genus level (Wale and Shearer, 1997). The apparent density, species of tsetse flies and other biting flies were determined in relation to season, altitude levels, vegetation types and traps in selected sites of the study area. Tsetse flies were sexed just by observing the posterior end of the ventral aspect of the abdomen using hand lens and finger palpation. Male flies were identified by their enlarged hypopygium in the posterior ventral end of the abdomen. The apparent density of the tsetse fly was calculated as the number of tsetse catch/trap/day (Leak, 1999).

### Infection rate determination

Tsetse flies were trapped using monopyramidal/conical traps which were deployed along riverside and within the nearby vegetation. The flies were collected from the trap, and before dissecting them the number of each sex and species of tsetse flies were recorded.

### Ageing of tsetse flies

**Male tsetse:** The age estimation was done according to the degree of wear or fraying observed on the hind margin of the wing. According to the degree of wear, flies were assigned to one or other of the six categories as described by Jackson (1946) and Challier (1965). After giving the wing fray category, the age was estimated using directions for estimating the mean age of a sample of tsetse flies, and mean wing fray was calculated as the sum of each category total divided by the sum of fly number for each category

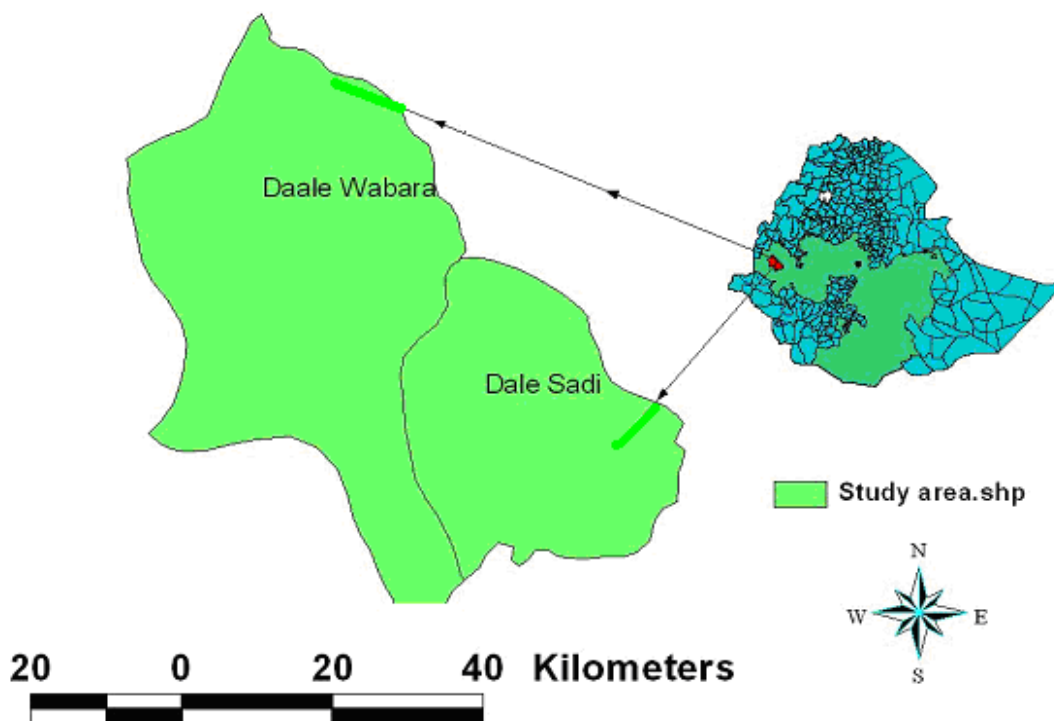


Figure 1. Location map of the study area.

and finding the given value on the table as given in the Food and Agriculture Organization (FAO) Training manual for tsetse control personnel (FAO, 2000).

**Female tsetse:** This method was used for the ageing of the female tsetse flies, and the flies were age graded according to the contents of the uterus and the relative development of the four ovarioles. Ageing of the female tsetse flies using ovarian age determination was done by carrying out tsetse dissection and observing the contents of the uterus and the relative size of the follicles in each of the two ovarioles and in each of the two ovules that constitute each ovary. The sub-division of each of the age category was done as described by Saunders (1962) and followed as illustrated in the FAO Training manual for tsetse control personnel (FAO, 1979).

**Dissection of tsetse flies**

Wings were removed from the flies and the degree of wing fray was

$$\text{Infection rate (IR)} = \frac{\text{Number of tsetse flies infected}}{\text{Total Number of tsetse flies dissected over a given period}} \times 100$$

**Data analysis**

Data collected based on the study methodology were inserted in to Microsoft (MS) Excel Sheets Program (Microsoft Corp.) to create a database and transferred to the statistical package for social sciences (SPSS) software programs of the computer before

scoring on a scale of 1 to 6 (Jackson, 1946). Then, freshly killed tsetse flies were dissected under a dissecting microscope using 0.9% normal saline. A cover slip was then put on each part of the slide where the proboscis or salivary glands or the midgut (including the proventriculus) were placed, and trypanosome infections in the tsetse flies were identified using a compound microscope at a magnification of x400 using the methods of Lloyd and Johnson (1924). Parasites found in the midgut, salivary glands and mouth parts were regarded as *Trypanozoon*; "*Trypanosoma brucei*-type", those located in the mouth parts and midguts were *Nanomonas*; "*Trypanosoma congolense*-type", while those found in the mouth parts only were put in the group of *Duttonella*; "*Trypanosoma vivax*-type infection", immature infections, when only the midgut was found infected. The Infection rate (IR) was calculated using the following formula:

analysis. Descriptive statistics, confidence interval, Student's t-test, Pearson's correlation, chi-square test, multinomial logistic regression, and analysis of variance (ANOVA) were used to express results and variables like the apparent fly catches in relation to season, altitude levels, vegetation and trap types. The SPSS version 16.0 software of the computer program were applied

for the statistical analysis. For the data on fly survey, since the number of flies caught varied widely, the data was transformed to a logarithmic scale using the transformation  $y = \ln(x + 1)$  before the statistical analysis. Then, Student's t-test was used to compare the difference of mean fly catch between the monoconical and biconical traps and between seasons.

## RESULTS

### Population density of tsetse flies

From 148 traps deployed using 50 traps in late rainy, 38 traps in dry, 30 traps in early rainy and 30 traps in wet seasons of the study period, a total of 1,546 tsetse flies were caught. Of which, 582, 263, 322, 379 flies were caught during the late rainy, dry, early rainy and wet seasons, respectively. The fly per trap per day of *Glossina* species were found to be 5.82, 3.46, 5.36 and 6.31 in the late rainy, dry, early rainy and wet seasons, respectively. The number of fly caught in the late rainy season is higher or greater than the number caught in the wet season but the density is higher in the wet season than late rainy season because it was due to difference number of traps used (Figure 2).

The different habitats of vegetation were assessed during the fly survey period and there was a variation in percentage distribution of tsetse flies in five vegetation types (Figure 3). The highest proportion of tsetse flies was caught in the riverine vegetation type ( $\chi^2 = 3.937$ ,  $P = 0.002$ ) followed by savanna, ( $\chi^2 = 35.687$ ;  $P = 0.008$ ), forest ( $\chi^2 = 28.00$ ;  $P = 0.003$ ), bush, ( $\chi^2 = 233$ ;  $P = 0.000$ ) and lastly cultivated areas ( $\chi^2 = 114$ ;  $P = 0.000$ ).

During the study period, a total of 1,258 biting flies from 3 different genera such as *Tabanus*, *Stomoxys* and *Chrysops* with the population density of 280, 674, 304, were respectively collected (Table 1). The late rainy season showed higher abundance of biting flies (437) than the dry season which is only about (74) total biting flies captured. The higher abundance of mechanically trypanosome transmitting flies (*Stomoxys*, *Tabanus*, and *Chrysops*) was also observed during the wet and early rainy seasons.

Comparative studies on the relative efficiency of the two traps which are commonly used for catching *G. pallidipes*, *G. morsitans*, *G. fuscipes* and *G. tachnoides* were made in the Birbir valley, western Ethiopia. There was significant difference between trap types for the mean catches of tsetse flies ( $\chi^2 = 4.35$ ,  $P = 0.002$ ). The biconical and monoconical traps were used for trapping the fly species during the study period. The relative efficiency of the two traps was found to be different in the populations of tsetse caught (Table 2). The monoconical trap was more efficient and significantly ( $P < 0.05$ ) higher than the biconical trap in collecting flies of all the species

found in the Birbir valley river basin.

Altitude has also a significant effect on the apparent density of tsetse in all seasons (Table 3). In the late rainy season, the lowland areas (<1500 m) recorded higher apparent density of 7.52 fly/trap/day than the midland areas ( $\geq 1500$  to 1800 m) with 5.02 fly/trap/day while during the dry season, the apparent density of tsetse was 4.73 fly/trap/day in lowland and 1.89 fly/trap/day in midland. In the early rainy season, the apparent density of tsetse was 7.6 fly/trap/day in low land and 3.13 fly/trap/day in midland while 7.9 fly/trap/day in lowland, and 4.73 fly/trap/day in midland during the wet season (Table 3).

### Trypanosome infection rate in tsetse

A total of 384 tsetse flies were dissected during the late rainy, dry, early rainy and wet seasons of the study period (2009 to 2010). The overall trypanosome infection rate of *G. pallidipes*, *G. morsitans*, *G. fuscipes* and *G. tachnoides* in all seasons were 5.88, 10.56, 1.04 and 3.44%, respectively. These results showed that *G. morsitans* has the highest trypanosome infection rate (10.56%) followed by *G. pallidipes* (5.88%), *G. tachnoides* (3.44%), and *G. fuscipes* (1.04%). The total trypanosome infection rates of all *Glossina* species in four seasons was 5.98%. The overall trypanosome infection rates of the morsitans group (*G. pallidipes* and *G. morsitans* in all seasons with infection rates of 5.88 and 10.56%, respectively) was significantly ( $P = 0.001$ ) higher than those of the riverine group (*G. fuscipes* and *G. tachnoides* with infection rates of 1.04 and 3.44%, respectively) during the study period. The infection rate of *G. morsitans* was higher than the other three species 10.56% ( $\chi^2 = 49.59$ ,  $P = 0.000$ ). The trypanosome infection rates of the morsitans group (*G. pallidipes* and *G. morsitans*) during the late rainy, dry, early rainy and wet seasons were 11.76, 3.3, 4.08, 7.5, 15.78, 12.5, 9.67, 8.16%, respectively. Higher trypanosome infection rates of both *G. pallidipes* and *G. morsitans* were observed during the late rainy season of the year (11.76 and 15.78%), respectively (Table 4).

Higher trypanosome infection rate in *Glossina* species were observed during the late rainy season (8.45%) than the other seasons (Table 5). The prevalence of *T. congolense* (4.16%) was significantly ( $P = 0.000$ ) higher than the prevalence of *T. vivax* infection (1.82%). The proportions of infected flies with *T. congolense* and *T. vivax* during the four seasons were 8.45, 5.81, 4.85 and 5.64%, respectively (Table 5). The major parasite species infecting the highest proportions of tsetse flies was *T. congolense*, with overall infection rate of 4.16% as compared to second parasite species *T. vivax* which was

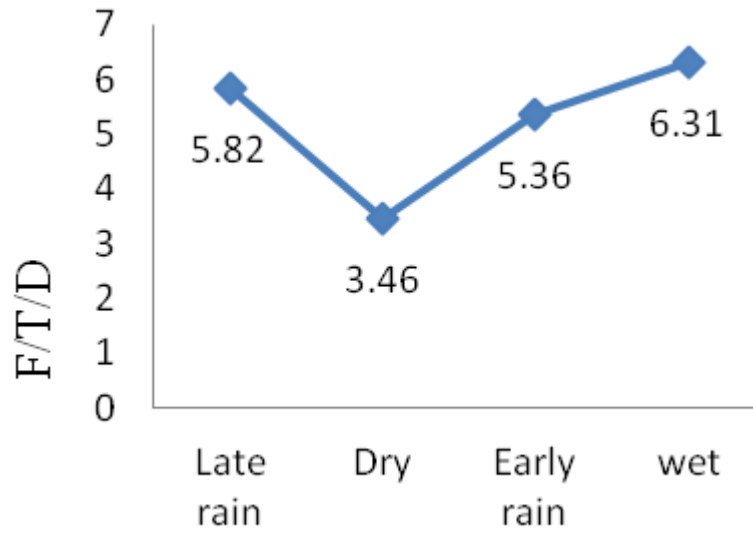


Figure 2. Apparent densities of *Glossina* species in different seasons.

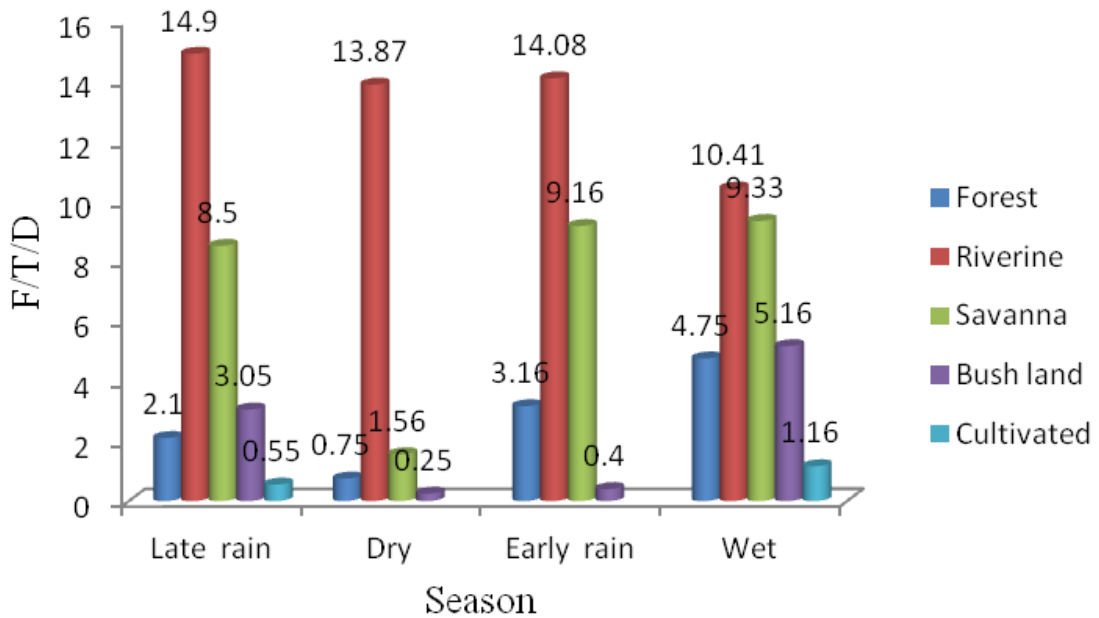


Figure 3. Percentage catches of *Glossina* species in five vegetation types.

found only in seven flies out of 384 total dissected flies (Table 5). The comparison of age and sex effect on the trypanosome infection rates of *Glossina* species are presented in the (Table 6). The average age (in days) for the trapped female flies were 26, 30, 27 and 31 while 19, 17, 20 and 22 were for trapped males during late rainy, dry, early rain and wet seasons, respectively (Table 6).

The difference in infection rates between male and female were closely associated with difference in mean age of the flies (Table 6).

The total infection rates of trypanosome in female flies (4.94%) was significantly ( $P = 0.001$ ) higher than the male flies 1.04% (Table 6). The number of infected female tsetse flies with trypanosome out of the total

**Table 1.** Other biting flies captured during the study period.

Season	Other flies			Total
	<i>Tabanus</i>	<i>Stomoxys</i>	<i>Chrysops</i>	
Late rainy	93	213	131	437
Dry	9	65	0	74
Early rainy	63	205	102	370
Wet	115	191	71	377
Total	280	674	304	1258

**Table 2.** The average fly catches in two trap types from November 2009 to July, 2010 in Birbir valley, Baro Akobo River system, Western Ethiopia.

Season	Trap type	Mean fly catches/trap/day			
		<i>G. pallidipes</i>	<i>G. fuscipes</i>	<i>G. morsitans</i>	<i>G. tachnoides</i>
Late rainy	Biconical	1.2	0.48	0.38	0.06
	Monoconical	2.66	3.02	2.82	1.02
Dry	Biconical	0.63	0.18	0.07	0
	Monoconical	2.13	1.92	1.44	0.6
Early rainy	Biconical	1.23	0.33	0.23	0.1
	Monoconical	2.5	2.3	3.1	0.93
Wet	Biconical	1.13	0.56	1.26	0.1
	Monoconical	3.3	2.5	3.36	0.43

( $\chi^2 = 4.35$ ,  $P = 0.002$ ).

**Table 3.** Apparent densities of different tsetse species in different altitude levels of the study area in Birbir river basin.

Altitude (m)	Season	<i>Glossina</i> species				Total	F/T/D
		<i>G.p</i>	<i>G.f</i>	<i>G.m</i>	<i>G.t</i>		
<1500	Late rainy	139	103	99	35	376	7.52
≥1500	Late rainy	54	72	61	19	206	4.12
<1500	Dry	85	51	38	17	191	5.02
≥1500	Dry	20	29	17	6	72	1.89
<1500	Early rainy	81	49	67	31	228	7.6
≥1500	Early rainy	31	30	33	0	94	3.13
<1500	Wet	82	61	78	16	237	7.9
≥1500	Wet	51	30	61	0	142	4.73

*G.p*= *Glossina pallidipes*, *G.f*= *Glossina fuscipes*, *G.m*= *Glossina morsitans*, *G.t*= *Glossina tachnoides*, F/T/D = fly per trap per day

dissected flies in each and all seasons was greater than that of the infected male tsetse flies (Table 6). The results of average trypanosome infection rates of *Glossina*

species (*G. pallidipes*, *G. fuscipes*, *G. morsitans* and *G. tachnoides*) by sex of the flies were summarized and presented in Table 7. In four seasons and both sexes,

**Table 4.** Trypanosome infection rate of *Glossina* species by season in Birbir valley.

Season	Glossina species								Total dissected Percentage (%)
	<i>G. pallidipes</i>		<i>G. morsitans</i>		<i>G. fuscipes</i>		<i>G. tachinoides</i>		
	N	Infected (%)	N	Infected (%)	N	Infected (%)	N	Infected (%)	
Late rainy	17	2 (11.76)	19	3 (15.78)	24	1 (4.16)	11	0	71(8.45)
Dry	30	1 (3.3)	24	3 (12.5)	19	0	13	1 (7.69)	86 (5.81)
Early rainy	49	2 (4.08)	31	3 (9.67)	23	0	0	0	103 (4.85)
Wet	40	3 (7.5)	49	4 (8.16)	30	0	5	0	124 (5.64)
Total	136	8 (5.88)	123	13 (10.56)	96	1 (1.04)	29	1 (3.44)	384 (5.98)

Season;  $\chi^2 = 16.22$ ;  $P = 0.001$

**Table 5.** The number of tsetse flies dissected by season and the percentages found infected with the various types of trypanosomes over the study period (2009 to 2010).

Season	Infections found						$\chi^2$ - value	P-value
	<i>T. congolense</i>		<i>T. vivax</i>		Total			
	N	Infected (%)	N	Infected (%)	N	Infected (%)		
Late rainy <sup>a</sup>	71	4 (5.63)	71	2 (2.81)	71	6 (8.45)	16.22	0.001
Dry	86	4 (4.65)	86	1 (1.16)	86	5 (5.81)	-	-
Early rainy	103	2 (1.94)	103	3 (2.91)	103	5 (4.85)	-	-
Wet	124	6 (4.83)	124	1 (0.8)	124	7 (5.64)	-	-
Total <sup>b</sup>	384	16 (4.16)	384	7 (1.82)	384	23 (5.98)	3.22	0.000

<sup>a</sup> $\chi^2$ -Test assessing the significance of the variation of trypanosome infection prevalence in tsetse by season. <sup>b</sup>Refers to the variation in percentages of the total number of tsetse found infected with *congolense*-type and *vivax*-type trypanosomes.

**Table 6.** The number age and sex of dissected tsetse flies and the trypanosome infection rate (%).

Season	Fly dissected	Sex		Age in days		Infection rate		P-value
		M	F	M	F	M	F	
						N (%)	N (%)	
Late rainy	71	28	43	19	26	2 (2.8)	4 (5.6)	P=0.001
Dry	86	34	52	17	30	0	5 (5.8)	
Early rainy	103	38	65	20	27	1 (0.97)	4 (3.88)	
Wet	124	42	82	22	31	1 (0.8)	6 (4.8)	
Total	384	142	242	19.5	28.5	4 (1.04)	19 (4.94)	

total of 136, 96, 123 and 29 flies of *G. pallidipes*, *G. fuscipes*, *G. morsitans* and *G. tachinoides*, respectively were dissected and examined for the presence of any trypanosome parasite species. Regardless of the sex of tsetse flies, the overall trypanosome infection rate of *G. pallidipes*, *G. fuscipes*, *G. morsitans*, and *G. tachinoides* were 5.88, 1.04, 10.6 and 3.44%, respectively. Significant differences was observed in trypanosome infection rate

between male and female dissected which were 1.04 and 4.94%, respectively higher in females ( $\chi^2 = 26.04$ ;  $P = 0.000$ ) than males.

## DISCUSSION

Results on fly survey in this study have revealed the

**Table 7.** The total number of male and female dissected *Glossina* species and the overall infection rate (IR) over the study period (2009 to 2010).

Parameter	G.p	G.f	G.m	G.t	Total	$\chi^2$ -value	P-value
Total number of tsetse dissected	136	96	123	29	384		
Total number of tsetse infected	8	1	13	1	23		
Overall infection rate (IR %)	5.88	1.04	10.6	3.44	5.98%		
Number of male flies dissected	49	34	43	16	142	26.04	0.000
Number of male flies infected	1	1	2	0	4 (1.04%)		
Number of female flies dissected	87	62	80	13	242		
Number of female flies infected	7	0	11	1	19 (4.94%)		

G.p= *G. pallidipes*; G.f = *G. fuscipes*; G.m= *G. morsitans*; G.t= *G. tachnoides*.

presence of four *Glossina* species and other biting flies including *Stomoxys*, *Chrysops*, *Tabanus*, in the Birbir valley, Baro Akobo river system. The overall apparent density of flies was 5.22 flies/trap/day (F/T/D). Seasonal comparison of fly catches during the study seasons at Birbir and Ketto river basin indicate that there is a remarkably significant variation in fly density and species. The Student's t-test method was employed to compute the variation between *Glossina* species in different seasons. Relatively lower fly catch was observed in the dry season of the study period. The apparent density of the different flies was significantly very high during the wet seasons. Similar results were reported by Msangi (1999), Mohamed and Dairri (1987) and Leak (1988). This could suggest an absolute increase in the number of tsetse flies due to favorable environmental conditions (Brightwell et al., 1997; Leak and Mulatu, 1993).

Sex ratio and age composition of the flies were assessed, with exception of *G. tachnoides*, higher numbers of female and adult flies were recorded during the present study. Similar results have been reported by Msangi (1999) and Mohamed and Dairri (1987). Leak (1999) showed that in unbiased sample, female would comprise between 70 to 80% of the mean population. The different habitats of vegetation were assessed during the fly survey period and there was a variation in percentage distribution of tsetse flies in five vegetation types. Relatively higher flies were caught during the wet season in all vegetation types while most tsetse populations were captured in the riverine than in other vegetation types during dry period. This was also indicated by Rogers and Randolph (1985).

Most tsetse populations show regular fluctuations which are correlated with seasonal changes in temperature and relative humidity during the hot season. The biconical and monoconical traps were used for trapping the fly species during the study period. The relative efficiency of the two traps was found to be different in the

populations of tsetse caught (Table 2). The monoconical trap was more efficient and significantly ( $P < 0.05$ ) higher than the biconical trap in collecting flies of all the species found in the Birbir valley river basin.

Similar report of this finding is indicated by Leak et al. (1988) that biconical trap was not efficient in collection of *G. morsitans*. Here, the reason was that biconical trap was not moveable when compared to monoconical trap. The geographical distribution of the whole species found in Birbir valley was along river valley of a gallery forest protected for coffee production and savanna woodland in the lower Birbir and Ketto river basin. Earlier works by Krug (1971), Ford et al. (1976) and Langridge (1976) had established the tsetse geographical limit at 1,600 m.a.s.l, and later Tikubet and Gemechu (1984) have shown that the upper limit reaches to 2,000 m.a.s.l while in the present survey the maximum limit was 1,800 m.a.s.l. Most of the tsetse flies were caught in the lowland areas hence the apparent density decreases as altitude increases. This survey result supports earlier works by Langridge (1976) and Leak (1999) indicated that climate, which is largely dependent on altitude has an impact on tsetse population.

The observed variation in the trypanosome infection rate of *Glossina* species can be explained with reference to the preferences in terms of habitat and hosts which affects the epidemiology of animal trypanosomosis (Riordan 1977). The morsitans group inhabits the savanna woodland which in addition to large extensive area is more likely to be the habitat of domestic livestock and of game animals which serves as reservoir of trypanosome infection. The palpalis group is usually in habitats in the area largely confined to gallery forest where the degree of contact with livestock is limited. There is therefore likely to be present, a low trypanosome infection rate. The current finding is in agreement with the work of Riordan (1977). In the higher infection rate and wider distribution (Ford et al., 1976), the morsitans group may

play the highest role in the cyclical transmission of trypanosomosis in domestic animals and are considered as potential vectors. Regardless of the sex of tsetse flies, the overall trypanosome infection rate of *G. pallidipes*, *G. fuscipes*, *G. morsitans*, and *G. tachnoides* were 5.88, 1.04, 10.6 and 3.44%, respectively. Significant differences were observed in trypanosome infection rate between male and female dissected which were 1.04 and 4.94%, respectively higher in females ( $\chi^2 = 26.04$ ;  $P = 0.000$ ) than males as a result of age differences. All the four *Glossina* species encountered in this finding are capable of transmitting the trypanosomosis; however, their infection rates would be influenced by season age and their habitat. Older flies are more likely to mature with trypanosome infection than younger, this is because an older fly will have more chance to become infected and an older fly will have more time for its infection to become mature (FAO, 2000).

## Conclusion

All species of tsetse flies found in Ethiopia except *G. longipennis* were the main vectors of pathogenic trypanosome in the Birbir river basin; however the major cyclical vectors are the savannah tsetse flies, particularly *G. morsitans* and *G. pallidipes*, therefore, designing and implementation of tsetse control should be targeted on the vectors of the savannah tsetse flies (*G. morsitans* and *G. pallidipes*) rather than controlling the whole species, hence the cost of tsetse control and the time of operation will be reduced

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## Case Report

## Management of exudative epidermitis (greasy pig disease) in 4 week old piglets

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An outbreak of dermatological disease in piglets from backyard piggery in Makurdi Benue State, Nigeria was investigated and detected to be "Greasy pig disease" which was also confirmed by bacteriological identification of the etiology as *Staphylococcus hyicus*. The disease is characterized by exudative inflammation of the epidermis in pigs. The natural infection and characteristic lesions were observed in the piglets which include; abscess that varied from small nodular type to deep intramuscular containing pus, ulcerative-crusted skin lesion on the cheek region, emaciation and general weakness. From the 16 piglets in the farm, 10 piglets were found to present signs typical to the disease, and the bacterium was identified from 7 piglets out of the 10 clinical cases. The causative agent *S. hyicus* was identified by bacterial culture. Based on antibiotic disc sensitivity test, the organism was sensitive to rifampin, levafloxacin, ciprofloxacin and norfloxacin and was resistant to amoxycillin, erythromycin, chloramphenicol and ampicillin.

**Key words:** Management, exudative, epidermitis, piglets and *Staphylococcus hyicus*.

### INTRODUCTION

Exudative epidermitis (EE), also known as "greasy pig disease", is a skin infection mainly affecting neonatal and newly weaned piglets, characterized by lesions ranging from localized lesions of a few mm in diameter to a generalized condition covering the entire body. The condition has been recognized for over 150 years and reported worldwide. It occurs sporadically and can be of economic significance as a cause of mortality and a cause of poor growth rate (Wegener and Skov-Jensen, 2006). *Staphylococcus hyicus* is generally considered the causal agent, and in particular, virulent strains of *S. hyicus* that produce exfoliative toxins (Andresen et al., 2005; Wegener and Schwarz, 1993). Both virulent and avirulent strains of *S. hyicus* can be isolated from the skin of healthy or diseased pigs (Park and Kang, 1986). There may be other factors associated with virulence as well as

toxin production but these factors are not yet well defined. Other staphylococci including, *Staphylococcus aureus* (van Duijkeren et al., 2008), *Chromogenes* (Andresen et al., 2005), and *Staphylococcus sciuri* (Chen et al., 2007) can produce exfoliative toxins and have been isolated, although rarely, from cases of EE.

It is generally agreed that along with the presence of the causative bacteria there is a requirement for skin wounds which allow the bacteria to invade the epidermis. In addition, there are environmental and host factors that are important in determining whether disease occurs or not (Wegener and Skov-Jensen, 2006). Exudative epidermitis is found worldwide and is a common disease problem in young pigs. The highest prevalence and most severe clinical signs of the disease are generally reported in suckling pigs within the first week of life (Wegener and

Skov-Jensen, 2006).

The most important virulent factor in the pathogenesis appears to be the production of exfoliative toxins. Recently, Nishifuji et al. (2008) explained the mechanism of action of staphylococcal exfoliative toxins which act as "molecular scissors". Virulent strains of the bacteria produce exfoliative toxins that cause the loss of keratinocyte cell-cell adhesion in the superficial epidermis (Nishifuji et al., 2008).

*S. hyicus* is a commensal of the skin of pigs, and due to abrasion or cuts of the skin, the organism enters and causes epidermitis where the greasy exudates is noticed, hence the name "Greasy pig disease" (Park and Kang, 1986). In acute cases, the death occurs within 3 to 5 days. The organism was isolated from clinical case from a backyard farm in Makurdi, Benue State, Nigeria.

## MATERIALS AND METHODS

Swabs were collected from wound or pus from the 10 clinically affected animals. The swabs were cultured for isolation and identification of the bacteria. The swabs were collected from different sites of lesion and mostly cheek region where the abscess and exudates were common. The surface of abscess was first disinfected with the rectified spirit and was incised open for collection of pus swab to avoid unnecessary contamination. The swabs were streaked on 5% sheep blood agar in order to detect the type of haemolysis produced by the organism and also to study the colony characteristics, and the swab was also streaked in Mac konkey's Agar. The culture was kept overnight (24 to 48 h) at 37°C and the colony reading was done the next day.

The organism was then stained with differential stain (Gram's method) modified by Preston and Morrell (1962) to study the reaction (that is, positive or negative.) Motility was tested by hanging drop method which is one of the characters for identification in the first stage. Catalase test was conducted with 3% H<sub>2</sub>O<sub>2</sub> (hydrogen peroxide) for the production of catalase enzyme. Oxidase test was conducted for cytochrome oxidase activity of the organisms. The method described by (Kovacs, 1956; Cowan and Steel, 1974) that is, with tetra methyl compound. The commercially available "DD 018 (oxidase) bacteriological differentiation disc" was also used. Oxidation and fermentative reaction test was conducted in order to find out whether the attack on the carbohydrate is by oxidation or fermentation by the method described by Koontz and Faber (1963).

The above tests were conducted for first stage identification of the *Staphylococcus*. Further in second stage, other bio-chemical tests were conducted for the identification of species. Slide coagulase test was conducted on slide by adding culture on the rabbit plasma for detection of bound coagulase enzyme produced by the bacteria described by Cadness-Graves et al. (1943). A loopful of *Staphylococcus* culture emulsified in a drop of distil distilled water is taken on a slide, and a loopful of rabbit plasma is added and mixed well with bacterial suspension for detecting the clumping within 1 to 2 min. The test is also considered as a basic tests for classification of pathogenic and non-pathogenic *Staphylococcus*. The test is still a reliable test and widely used for recognition of potentially pathogenic *Staphylococcus*. Voges-Proskaur (VP) test was carried out basically for acetylmethyl-carbinol production. Acetylmethylcarbinol may be broken down and used as carbon source by *Staphylococcus* (Bailey and Scott, 1962).

Acid production from the following sugars was detected with lactose, maltose, mannitol, salicin, sucrose, trehalose. Sensitivity tests were conducted for following antibiotics, rifampin, amoxicillin,

levofloxacin, erythromycin, ciprofloxacin, chloramphenicol, norfloxacin, ampicillin, gentamycin and streptomycin. The test was carried out with Mastering-S (Mast diagnostic) for gram positive bacteria.

## RESULTS

The organism *S. hyicus* was isolated and identified as described in material methods. Initially, identification was based on morphology and culture and later stage identified the organism, with bio-chemical properties.

### Morphology and staining reactions

The organism was a gram positive cocci, in single cells, in pairs and short chains and clusters of aerobic and facultative anaerobic.

### Cultural and bio-chemical properties

The colonies on sheep blood agar are creamy white and circular and some of the colonies were alpha-haemolytic, some were non-haemolytic. No growth was detected in Mac konkey agar. The organism was non-motile, catalase positive, and oxidase negative. It evinced fermentative attack on carbohydrate (O-F test). Coagulase was positive. Coagulase is not usually produced, although Underdahl et al. (1965) reported that some strains they examined were coagulase positive. Earlier, Teranishi et al. (1987) had concluded that the disease was caused by a coagulase-negative micrococcus which he named *Micrococcus hyicus*, later the organism was renamed as *S. hyicus*. Later, *S. hyicus* was detected as coagulase-positive by 5 different methods (Anon., 2009).

Many enzymes like coagulase are toxic to tissues (Ma et al., 2002). Rabbit plasma contains fibrinogen that is being converted into fibrin by *Staphylococcal* coagulase enzyme. VP was negative but *Staphylococcus* needs longer incubation of up to 10 days, and gave greater number of positive results (Cowan and Steel, 1974). Acid production from following sugars were detected; lactose, sucrose and trehalose (Table 1).

In all the tests, the organism was highly sensitive to rifampin, levofloxacin, ciprofloxacin and norfloxacin and were resistant to amoxicillin, erythromycin, chloramphenicol and ampicillin (Table 2). Bergey's manual classified it as a bio-type 2 of *Staphylococcus epidermidis* (*albus*). *S. hyicus* differs antigenically from *S. epidermidis*. Although some antigens are shared, antiserum to *S. hyicus* that has been absorbed with *S. epidermidis* can be used to distinguish *S. hyicus* from non-pathogenic skin *Staphylococci*. *S. hyicus* was divided into two sub-species viz *S. hyicus* subsp *shyicus* (non-pigmented) and subsp. *Chromogens* (pigmented) by Aarestrup and Jensen (2002). The natural hosts for *S. hyicus* are cows and swine.

**Table 1.** Acid production from sugars.

S/No.	Tests	Results
1	Gram's Reaction	Cocci
2	Motility	Non-motile
3	Anaerobic	Growth
4	Catalase	Positive
5	Oxidase	Negative
6	O-F (Oxidative /Fermentative)	Fermentative
7	Coagulase	Positive
<b>Acid Production from Sugars</b>		
8	Lactose	Positive
9	Maltose	Negative
10	Mannitole	Negative
11	Salicin	Negative
12	Sucrose	Positive
13	Trehalose	Positive
14	VP (Voges-Proskauer) test	Negative

**Table 2.** Sensitivity of organism.

S/No.	Atibiotic	Sensitivity
1	Rifampin	+++
2	Levofloxacin	+++
3	Ciprofloxacin	+++
4	Norfloxacin	+++
5	Gentamycin	+
6	Streptomycin	+
7	Amoxycillin	Resistant
8	Erythromycin	Resistant
9	Chloramphenicol	Resistant
10	Ampicillin	Resistant

The *S. hyicus* was isolated from 7 of the clinical cases. Out of 10 samples cultured, bacterial organism *S. hyicus* was isolated. The organism was isolated with the basic techniques and the facility available in the laboratory. The clinical lesions noted were initially a nodular growth (inflammatory) type and later covered with greasy exudates and then followed with thick crust. Often, abscess was noted (Figures 1 and 2). The sites included mostly cheek, neck and head. However, the investigation also reveals that the majority of the abscess cases can be due to *S. hyicus* and also the dermatitis as of the investigation was conclusive of greasy pig disease.

#### Treatment plan and advice to client

Based on the sensitivity test result obtained, the pigs were placed on:

1. Enrofloxacin 7.5 mg/kg (i.m) × 3/7.

**Figure 1.** Infected piglet showing encrusted areas on the cheek region.**Figure 2.** Infected piglet showing encrusted, scab and abscessed areas on the cheek region.

- Multivitamin injection 1 ml/10 kg body weight (i.m) × 5/7.
- The affected piglets should be isolated.
- The wallow site should be changed.
- A veterinarian should be contacted whenever any problem is observed within the herd rather than instituting treatment by self.
- Soft bedding should be provided (for example, chaffed straw).
- Records of all events on the farm should be properly kept.

**Table 3.** Haematological results.

Parameter	PCV (%)	Total WBC ( $\times 10^9/L$ )	MONO ( $\times 10^9/L$ )	BASO ( $\times 10^9/L$ )	Lymph ( $\times 10^9/L$ )	EOSIN ( $\times 10^9/L$ )	NEUTR ( $\times 10^9/L$ )
Normal	26-35	11-22	0-1	0-0.5	3.8-16.5	0-1.5	0.7-6.0
Sample	24	3.0	0	0	1.59	0	1.41

**Table 4.** Variation in rectal temperature ( $^{\circ}C$ ) and respiratory rates (Cpm) and heart rate (Bpm).

Parameter	Normal	Piglet 1	Piglet 2	Piglet 3
Temperature ( $^{\circ}C$ )	38.7-39.8	38.9	37.7	37.6
Respiration rate (Cpm)	32-58	59	60	57
Heart rate (Bpm)	70-120	115	110	120

**Table 5.** Follow-up result post therapy record of rectal temperature ( $^{\circ}C$ ) and respiratory rates (Cpm) and heart rate (Bpm) .

Temperature	Piglet 1	Piglet 2	Piglet 3
17/8/12	37.6	38.5	38.3
18/8/12	37.7	38.1	38.1
20/8/12	38.0	38.3	38.5
<b>Respiratory rate (Cpm)</b>			
17/8/12	60	58	60
18/8/12	59	61	59
20/8/12	58	56	55
<b>Heart rate (Bpm)</b>			
17/8/12	110	117	110
18/8/12	105	120	120
20/8/12	120	110	100

8. Some of the boars should be sold off and more sows bought.

Changes in the hematological parameters of the apparently normal piglets and clinically ill ones were examined (Table 3) and variation of rectal temperature ( $^{\circ}C$ ), respiratory rates (Cpm) and heart rate (Bpm) in some of the piglets were taken and compared (Table 4). Follow-up result post therapy record of rectal temperature ( $^{\circ}C$ ) and respiratory rates (Cpm) and heart rate (Bpm) as shown by (Table 5) and a remarkable change in signs and recovery was observed post therapy (Figure 3).

## DISCUSSION

The isolation and identification of *S. hyicus* was conspicuous for the disease "greasy pig disease". The *S. hyicus* produces various toxins like epidermolytic toxins

and pyrogenic exotoxins, protein A and enterotoxin. The disease is of systemic involvement and can be fatal. The death in the disease is due to dehydration, protein and electrolyte loss, and cachexia. *Staphylococci* are one of the major groups of bacteria inhabiting skin (Schwartz, 2002). During the days before farrowing, the organisms multiply in the sow's vagina and infect the piglets during the process of birth or soon after. The suckling piglets are usually infected by their dams, but cross infection occurs after mixing at weaning. Other contributing factors include: (1) Sharp teeth cut on the skin around the mouth during competing for teat and fighting at weaning, (2) abrasion on knees from suckling and from poor concrete surfaces or metals, (3) faulty injection (without proper sterilization), (4) mange giving skin damage. Field evidences suggested that the environmental stress of various kinds including agalactia and intercurrent infection also predisposes the disease.

The *S. hyicus* is highly contagious and spreads rapidly from one group to the other. A vesicular type of virus may be a predisposing factor. Trading of animals has been shown to be an important factor in spread of disease which usually takes about 2 weeks after the infected animal has been brought into clean premises. The first signs of the disease are listless and reddening of the skin in one or more piglets in the litter. Affected pigs become depressed and refuse to eat. Body temperature may be elevated early in disease but thereafter is normal. The skin thickens, reddish brown spots appear from which the serum exudates, and pain is evident in acutely affected pigs. Often, there is suppurative inflammation of the external ear and catarrhal inflammation of the eyes. The feet are nearly all affected with erosion of coronary bands heel, hoof may be shed in rare cases. The disease was detected mostly on cheek region (Figures 1 and 2).

The disease produces variety of symptoms from where the entire body becomes covered with a moist, greasy exudates to a more chronic condition where the onset is slower and the skin is more wrinkled. The principal lesion



**Figure 3.** Recovery in piglets post therapy.

is an inflammatory exudative reaction in the corium and upper layers of the dermis. As the disease progress over the body surfaces, the skin becomes thickened and layers of the epidermis peel off. Milder form of disease may present as a dandruff scaling or as a reddish-brown spots on the ears and other body areas. Pigs begin to recover about 14 days after the elisions appear and are fully recovered in 30 to 40 days. Some pigs are often affected with ulcerative glossitis and stomatitis.

In sows, the lesion are seen commonly behind the face and eyes. Severely, affected piglets die often due to dehydration and septicaemia/toxaemia. It has been suggested that the biotin requirements of affected swine is greatly increased by factors produced by *S. hyicus* which causes biotin deficiency and contributes to the lesion *S. hyicus* and occurs frequently on the skin of healthy cattle (Devriese, 1984) and was also isolated from the animal products and slaughter house effluents (Devriese and Hajek, 1980). *S. hyicus* subsp. *Hyicus* has also been isolated from intramammary infection of bovines (Brown, 1983). The organism *S. hyicus* was also isolated from the goat's milk (Poutrel, 1984). The organism *S. hyicus* has also been found in naturally occurring lesions of dermatitis of the lower limb of horses and similar lesions over the neck and back of donkeys also has been recorded. Experimentally, the organism can cause lesions in horses similar to those of exudative epidermititis. *S. hyicus* also can occur in poultry (Devriese, 1984) and may be responsible for mild infections (Devriese, 1980). *S. hyicus* subsp. *Chromogenes* has been isolated from the dermatic lesion of cats (Devriese, 1984). The organism has also been implicated in "seborrhic dermatitis" of pigmy goat. Human beings also may become infected with this organism.

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Full Length Research Paper

## Early bite wounds in dogs in Ibadan, South-West Nigeria

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**A study was conducted in Ibadan, South-West Nigeria between 2005 and 2009 to determine the prevalence, risk factors and management protocols employed in early bite wounds in dogs. Review of case records, physical examinations and administration of structured questionnaire were used to obtain information with regard to the number of cases of early bite wounds presented, signalment, anatomical features, treatment modalities and response. Prevalence of early bite wounds was 11.73%. Sex, breed, anatomical features and management exhibited significant influence on the incidence of early bite wounds. Effectiveness of management protocols was low with significantly high recurrence rate. The results showed a significantly high association between early bite wounds and aural hematoma and otitis externa.**

**Key words:** Dog, ear, fly, bite wounds.

### INTRODUCTION

Diseases of the ear constitute an important part of small animal practice; they are a source of annoyance both to the animal and to the owner. Aural diseases do not as a rule cause death of the patient and, therefore, do not receive the attention they deserve.

The external ear in the dog consists of two skin-covered cartilages and is composed of the auricle or pinna which varies in size, shape and general conformation (Evans, 1993). The location of the ear flap makes it vulnerable to various insults of diverse nature, prominent among which is trauma (Cechner, 1990).

A significant proportion of the dog population in Nigeria is found in the southern subtropical region where insect activities are most pronounced and early bite wounds constitute a menace. Although, the ear of the dog is one of the least thought of in terms of infection, surveys of small animal practice have shown that the treatment of ear diseases, particularly otitis externa, accounted for more than 10% of professional time (Lane, 1982). Since

surgical intervention is the treatment of choice for canine aural diseases, a high incidence of post-operative complications had been attributed to pre-operative infection of aural structures (Stephenson, 1991; Rosey and Luttgen, 2000).

Reports of previous workers suggested that scratching, rubbing and head-shaking which are natural responses to aural irritation caused by early bite and other agents had facilitated the establishment of aural diseases with grave consequences (Dickson and Love, 1992; Rosey and Luttgen, 2000). Early bites in dogs is one of the factors attributed to the development of aural hematoma (Mastousek, 2004; Griffin, 1994; Jalil Falih, 2010).

Unpublished reports suggest that 4 out of every 10 dogs in Ibadan, the location of the present study, have early bite wounds. To the best of our knowledge, studies have not been published to report the prevalence, risk factors and management of early bite wounds in dogs. These are the objectives which this study sought to

**Table 1.** Incidence of early bite wounds in dogs.

Clinic	Number of cases presented at the clinic	Number of cases with early bite wound	Prevalence (%)
Clinic A	203	39	2.93
Clinic B	210	17	1.19
Clinic C	155	27	1.88
Clinic D	138	16	1.12
Clinic E	315	20	1.40
Clinic F	180	15	1.05
Clinic G	222	34	2.37
Total	1432	168	11.73

achieve

## MATERIALS AND METHODS

Case records from some selected private and public veterinary clinics and hospitals were reviewed between 2005 and 2009 to determine the number of cases in dogs presented with early bite wounds, treatment modalities employed and the response.

Another parallel study was also conducted during the same period with the administration of structured questionnaire to resident clinicians drawn from the same clinics and hospitals. The questionnaire sought to obtain information specifically on the description of each dog presented with early bite wound with reference to anatomic features such as the hair coat color, shape of the ear, location of ear wound on the pinna, color of the head and ears. Information was also sought with respect to management protocols employed and response to treatment. Access to information being sought was facilitated by the need for owners of dogs with early bite wounds to make repeated visits to the clinic during the course of the disease. We were able to obtain the relevant information and carry out physical examination during one or more of the visits.

Data obtained from case records, physical examinations and response to questionnaire were collated and subjected to statistical analysis. The distribution of the cases of bite wounds based on the parameters assessed was expressed as percentages of the total cases presented in the period under review.

## RESULTS AND DISCUSSION

A total of 1,432 cases were attended to at the various clinics during the four year period under review. Out of these, 168 cases of early bite wounds were reported with a total incidence of 11.73% (Table 1).

The distribution of breed, age, sex and management methods employed in dogs with early bite wounds are shown in Figures 1, 2, 3 and 4, respectively. Sex, breed and management methods had significant influence on the incidence of early bite wounds. The incidence of early bite wound was the highest in dogs between 1 and 2 years of age, but decreased with increasing age. Incidence was significantly higher in Alsatian breed than other breeds. Male dogs had significantly higher incidence of early bite wounds than females. Dogs managed intensively had higher percentage incidence of early bite

wounds than those managed extensively.

The distributions of shape of the ear, location of wound on the ear and occurrence of associated ear infection with early bite wound are summarized in Figures 5, 6, 7 and 8, respectively. Incidence of early bite wound was the highest in dogs with large floppy ears. Neither convexity nor concavity of the ear influenced the location of bite wounds. Aural hematoma and otitis externa were found in association with 54% of dogs presented with early bite wounds. The treatment protocol employed in the management of early bite wounds and response is presented in Table 2. Response to management was successful without recurrence in 61 cases (36.31%), while recurrence occurred in 107 cases (63.69%).

The veterinary clinics covered in this study were carefully selected based on their relatively heavy case loads and adequacy of medical record documentation. Of the 1,432 cases presented during the period of investigation, 168 (11.73%) were treated for early bite wounds. German Shepherd breed was the most represented (56%), followed by Mongrel (24%), Rottweiler (16%), while other breeds had less than 4% representation. This finding did not represent the true incidence of early bite wounds in these breeds, but rather, owners' preference for the breeds and also a reflection of the locality in which the study was conducted. There was an inverse relationship between age and incidence of early bite wounds. Incidence was highest in dogs between 1 and 2 years age bracket. The decrease in incidence with age might be ascribed to increasing toughness of cutaneous tissue with age and/or increased resistance to bite due to the scars formed from previous bite wounds.

The observed significantly higher incidence in males than females might be as a result of disproportionate representation rather than any other sexually related factor. However, in the area of study, where most dogs were kept in confinement in none-fly proof, unkempt kennels, incidence was higher when compared with animals with free movement. This illustrates the probable role of environmental hygiene as a factor in the etio-pathogenesis of early bite wound in dogs.

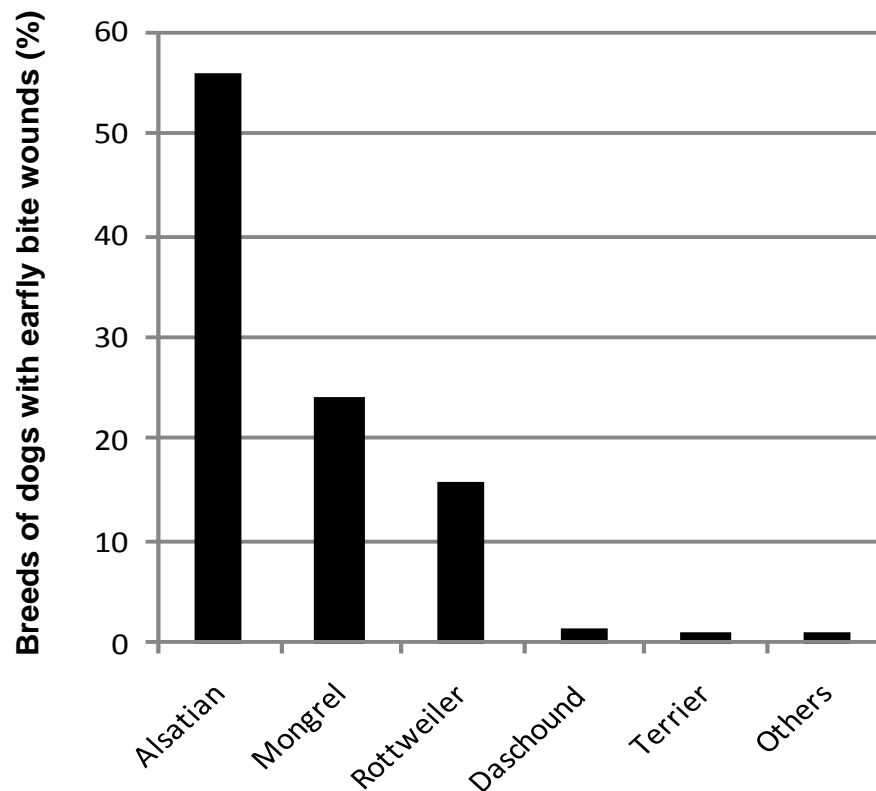
Hair coat color seemed to influence the incidence of early bite wounds in this study. Dogs with dark hair coat



**Table 2.** Response to treatment protocol employed in the management of early bite wounds in dogs.

S/N	Treatment regime	Number and percentage (%) of cases managed	Response	
			Positive	Recurrence
1	Wound healing oil only	24 (14.28)	5 (20.83)	19 (79.17)
2	Antibiotic wound spray only	32 (19.04)	6 (18.75)	26 (81.25)
3	Fly repellent ointment only	23 (13.69)	8 (34.78)	15 (65.22)
4	Healing-oil + fly repellent	37 (22.02)	18 (48.64)	19 (51.36)
5	Healing oil + antibiotics	29 (17.26)	12 (41.37)	17 (58.63)
6	Healing-oil + antibiotics + fly repellent	12 (7.20)	8 (66.66)	4 (33.34)
7	Sulphur ointment	1 (0.60)	0 (0.00)	1 (100.00)
8	Healing oil + antiparasitic (Amitrax) bath	10 (5.95)	4 (40.00)	6 (60.00)
-	Total	168 (100)	61 (36.31)	107 (63.69)

\*Percentages in parentheses.

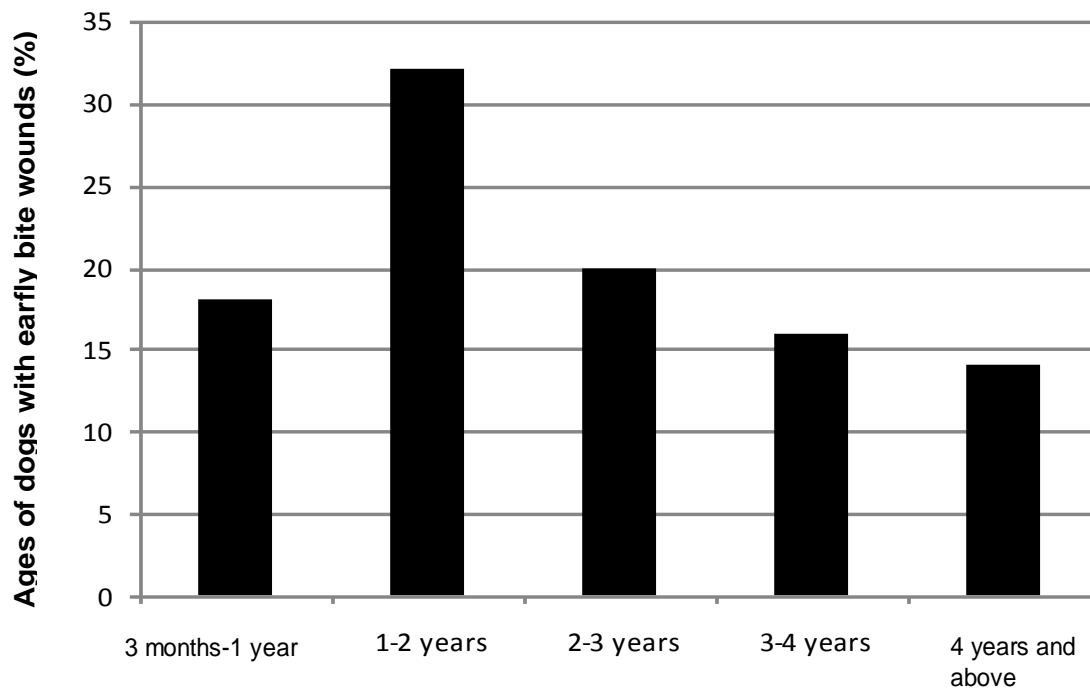
**Figure 1.** Breed distribution of dogs with early bite wounds.

seemed to be more predisposed to early bite wound than those with light-colored hair coat. This might be related to the preponderance of dogs with dark hair coat among the cases presented rather than anatomical predisposition.

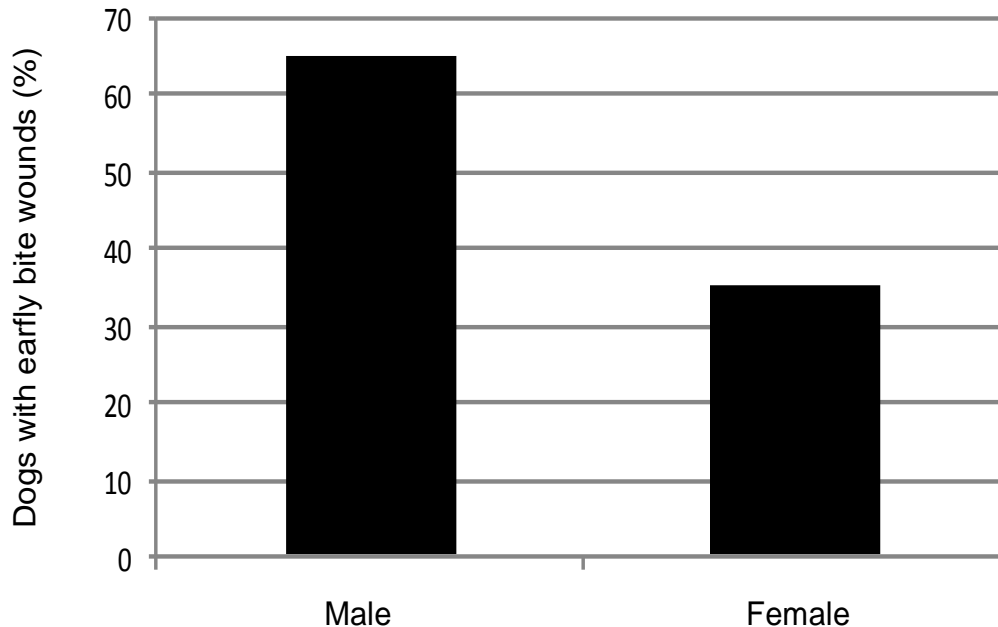
The shape of the ear also appeared to play a significant role in the incidence of early bite wounds in the dogs investigated. Dogs with large floppy ears had higher incidence than those with erect ears. Convexity or concavity of the ear did not influence the location of bite wounds. The exact role of cutaneous architecture and

spatial distribution of hair follicles as factors in the etio-pathogenesis of early bite wounds is presently not clear and needs further investigation.

We observed a close association between early bite wound and other ear infections. Otitis externa and aural hematoma co-existed in 33 and 18% of cases with early bite wounds, respectively. The reason for this might be ascribed to severe scratching, head shaking and irritation that normally attend bite wounds. The skin covering the concave surface of the ear flap is more firmly attached to



**Figure 2.** Age distribution of dogs with early bite wounds.



**Figure 3.** Sex distribution of dogs with early bite wounds.

the auricular cartilage. When injured by scratching or rubbing, small blood vessels between the skin and cartilage are ruptured and a hematoma may result. We presume that an association may exist between isolated

pathogens from ear bite wound and other ear infections, especially otitis externa. This is, however, a subject for future investigation. The effectiveness of the management protocol for early bite wound may be considered

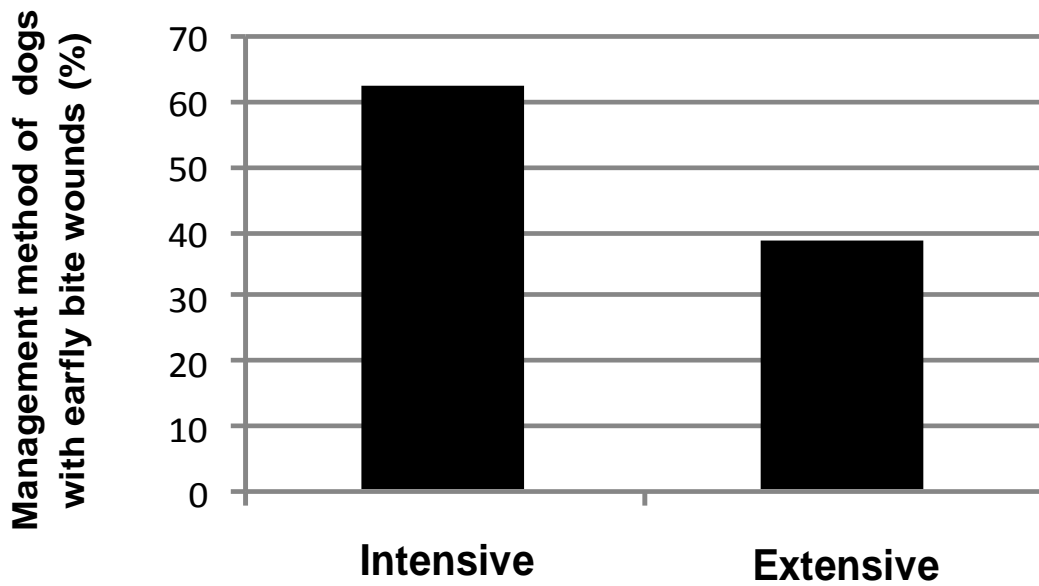


Figure 4. Percent distribution of management method of dogs with early bite wounds.

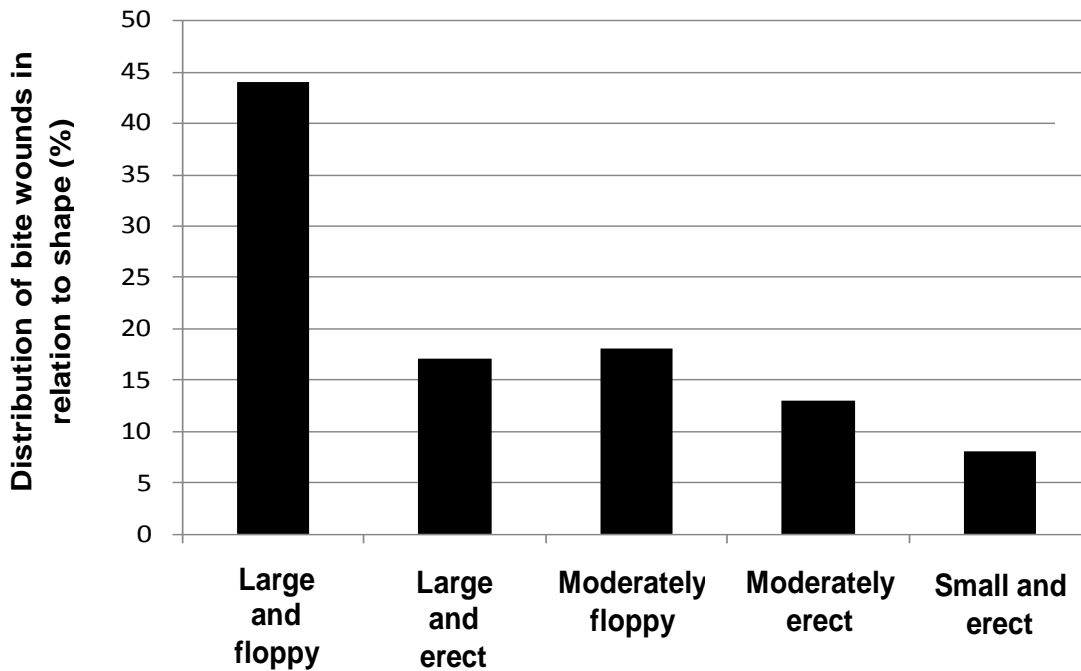


Figure 5. Percent distribution of shape of ear of dogs with early bite wounds.

as low in all the clinics covered by this study. Majority of the treatment regimes employed in the medical management of early bite wound resulted in high rate of recurrence. This further confirms observations from previous workers with regard to the futility and frustrating

nature of treatment of early wounds in dogs (Stephenson, 1991; Rosey and Lutten, 2000; Dickson and Love, 1991). However, treatment protocol that incorporated a combination of an antibiotic, healing oil and fly repellent had the least rate of recurrence. Early bite

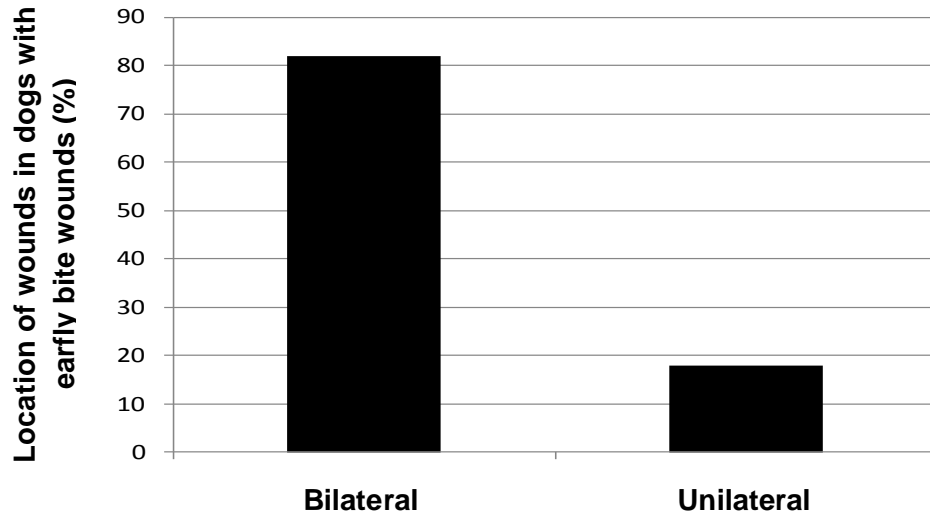


Figure 6. Percent distribution of location of bite wounds.

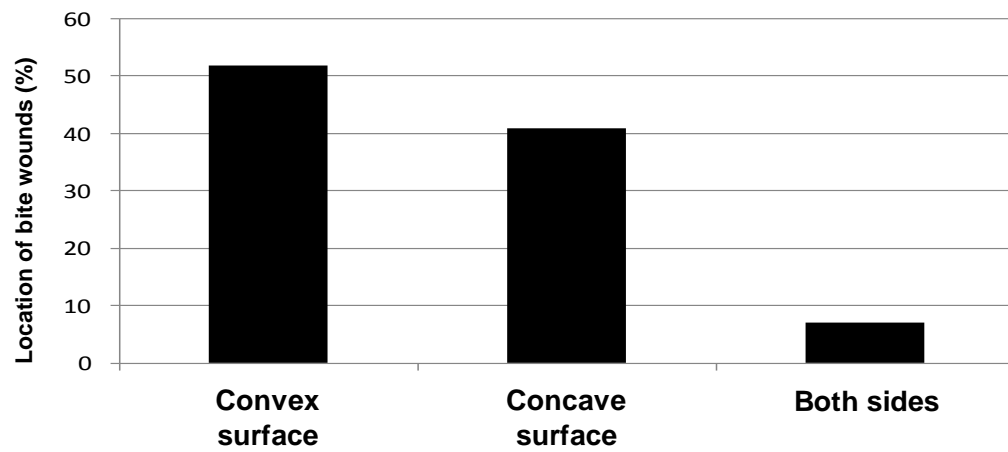


Figure 7. Location of bite wounds in relation to surface of ear affected.

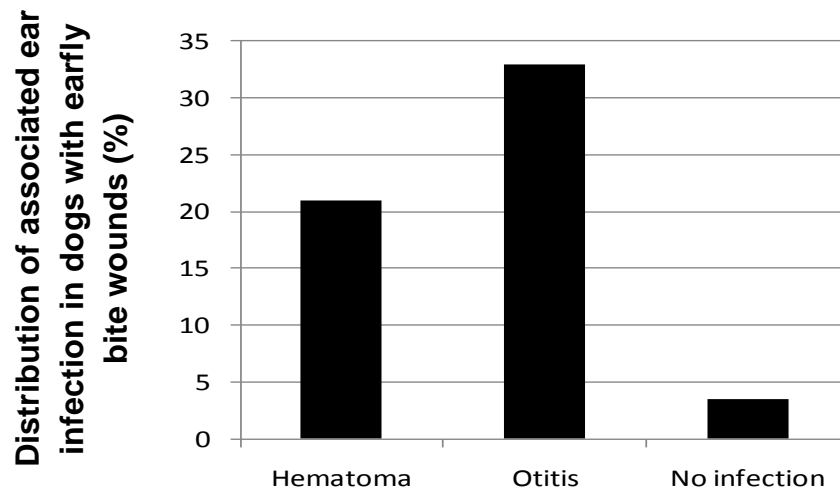


Figure 8. Early bite wounds and associated ear infection.

wound constitute a source of annoyance both to the dog and to the owner. It also poses a therapeutic challenge to the clinician. Efforts at preventing fly bite should be accorded greater attention than hitherto.

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## *UPCOMING CONFERENCES*

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International Conference on Coelenterate Biology, Eilat, Isreal, 1 Dec 2013



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