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QWeCI

Quantifying Weather and Climate Impacts on Health in Developing Countries

Milestone 5.3d – Field campaign report year two

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Dissemination Level		
PU	Public	PU
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

Entomological field studies on malaria vectors

As in the first year study, the global approach in the field studies was to estimate entomological parameters described in the LMM. The six villages selected were maintained. They belong to four different land cover/land use and included: Barkedji and Niakha in wooded savannah, Keur Bandji in steppe, Kangaledji in bared soils, Wouro Samba Kibel and Wouro Sileymani in shrubby savannah.

Anopheline mosquitoes were collected every fortnight from July to December using two sampling methods: (i) capture of females landing on human from 07:00 pm to 06:00 am indoor and outdoor and (ii) pyrethrum spray catches of resting females in selected dwellings.

After collection, mosquitoes were sorted, counted and identified morphologically to *Anopheles* species. A random sample of females from each species were then dissected to extract ovaries and to determine the mosquito reproductive age. The blood meals from freshly fed females collected by pyrethrum spray collections were squashed and dried onto filter paper for host source identification in the laboratory. The origin of blood meals was identified as human, bovine, ovine, chicken and horse using an ELISA.

Results

Mosquito collections

From July to December 2011, 20 937 mosquito specimens (6 961 from human-landing collections and 13 976 from pyrethrum spray collections) represented by 4 genus and 22 species were collected. The genus *Anopheles* was less represented and represented 8.4% of the species collected. Whatever the collection method considered, *An. gambiae* was the prevalent species followed by *An. pharoensis*. Between villages, *An. gambiae* was more abundant in villages situated in wooded savanna (Barkedji and Niakha) and in a lesser extent in bared soils (Kangaledji).

Anopheles gambiae **populations dynamics**

Between the 6 villages selected, the highest mean human biting rates (number of bites per human per night) were recorded in Barkedji, Niakha and Kangaledji villages (figure 1). The mean biting rates were respectively 1.5, 2.5 and 0.8. Significant differences were observed between the 6 villages ($F_{6,66}$=3.5, p<0.01). When pairwise comparisons were done, the mean biting rates were significantly different only between Niakha (wooded savanna) and the villages from steppe and shrubby savanna respectively Keur Bandji (p=0.01), Wouro Samba Kibel (p=0.03) and Wouro Sileymani.

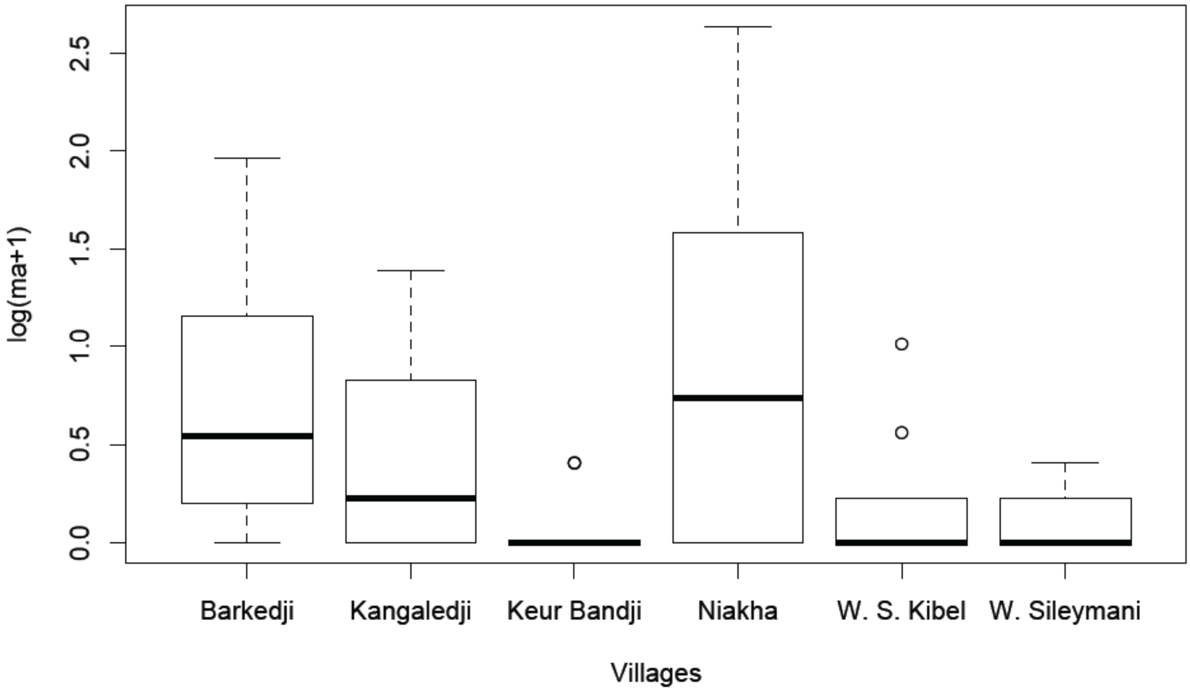

Figure 1: Spatial variations of the Human Biting Rate for the species of the *An. Gambiae* complex in the 6 villages selected from July to December 2011

Considering the temporal variations (figure 2), no mosquito was collected during the second week of July at the beginning of the survey. The biting rates varied between 0.01 bite per human per night (bpn) in the last week of July (J2) to 3.7 bites per human per night (O2). The biting rates were low at the beginning of the rainy, increased regularly reaching 3.7 bpn (O2) and decreased in the second week of November (N1) reaching 0.04 bpn in the last week of December (D2).

Within each village, significant variations were observed (figure 3). The densities were low in Wouro Sileymani (shrubby savanna) and Keur Bandji (steppe). The variations profiles were similar in Niakha and Barkedji (wooded savannah) with three different peaks of densities (Figure). The same profile was observed in Wouro Samba Kibel (shrubby savannah) and Kangaledji (bare soils).

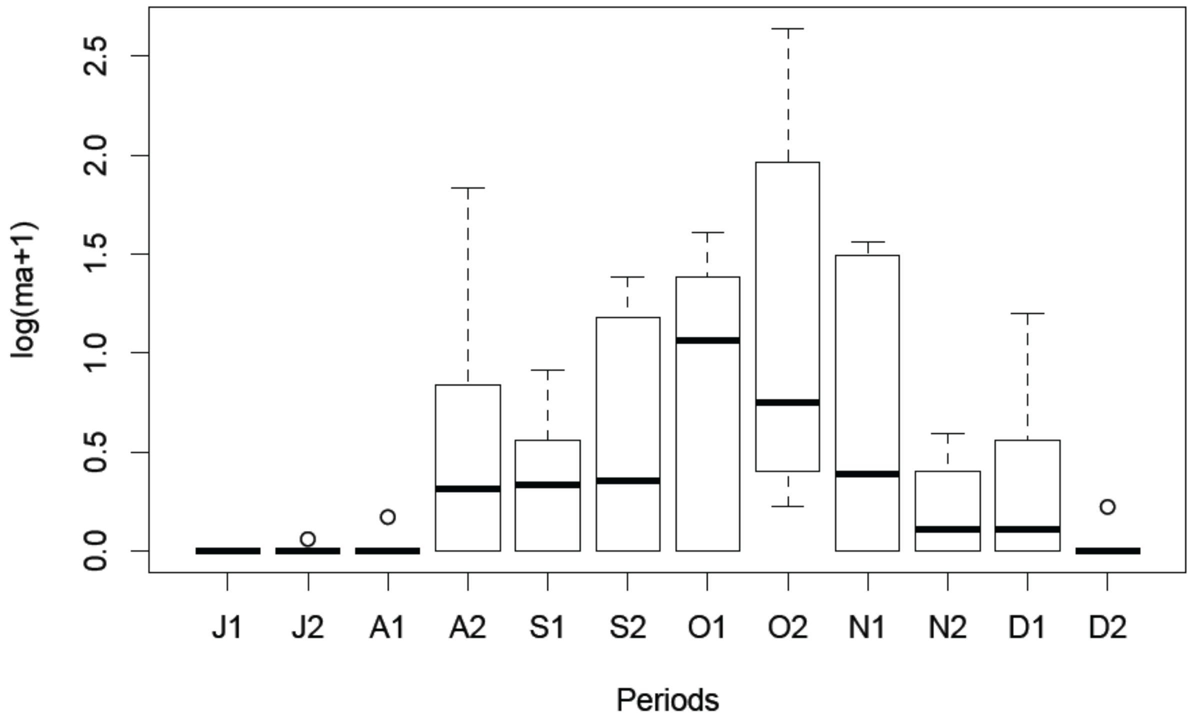

Figure 2: Variations of the Human Biting rate for the species of the *An. gambiae* complex in the study area from July to December 2011
(1= second week of the month; 2=fourth week of the month)

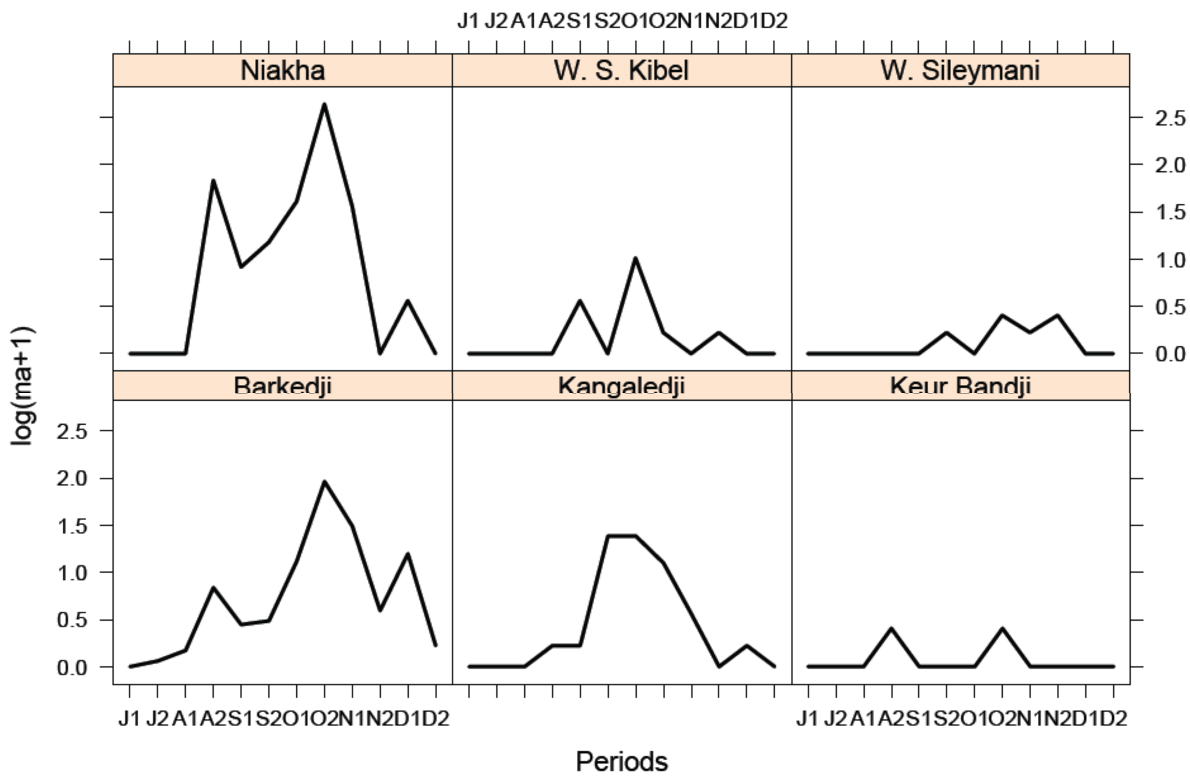

Figure 3: Temporal variations of the Human Biting rate for the species of the *An. gambiae* complex in each of the studied villages from July to December 2011

Parity rates

Within the study area, the mean parity rate was estimated to 35.8% (CI95%=28.8-43.6). No significant difference was observed between the 6 villages (c2= 0.5634, df = 3, p= 0.9). Fisher exact test, p=0.17).

Host-seeking behaviour

Overall, 32.3% of *An. gambiae* females were collected indoors. The endophagous rates (figure 4) were statistically different between the 6 villages (c2=38.8, df=5, p<0.0001). Furthermore, when pairwise comparisons were made between villages, the differences were significantly different only between Barkedji and Niakha (c2= 25.01, df=1, p<0.001) and between Barkedji and W.S.Kibel (c2=9., df=1, p=0.002).

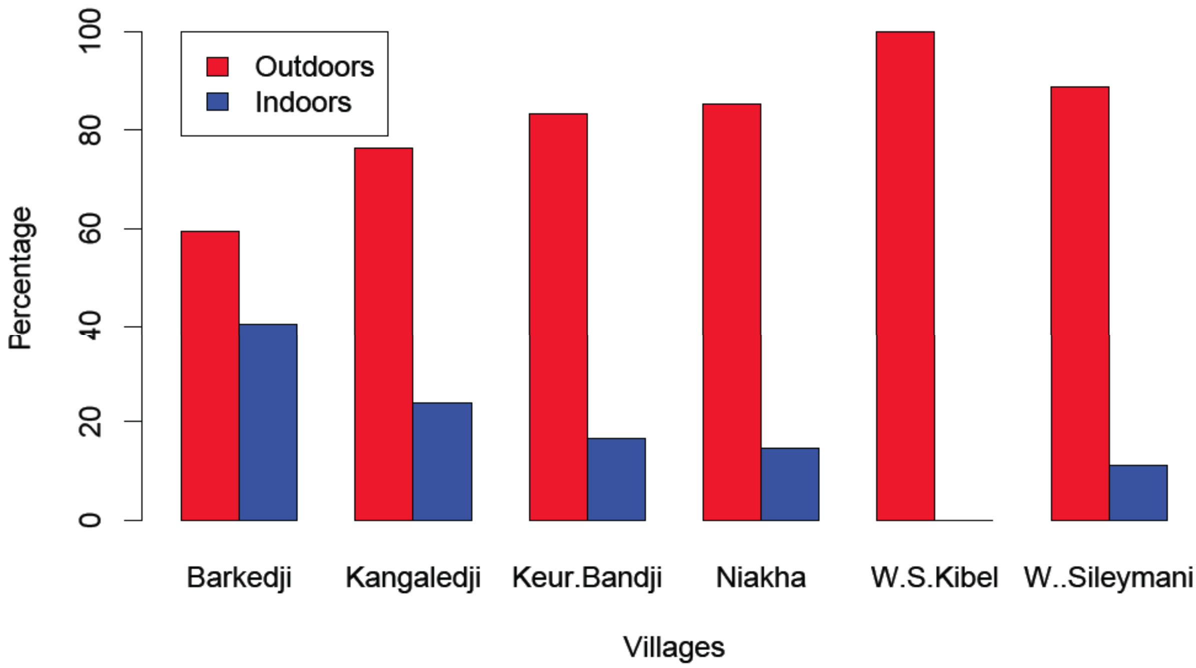

Figure 4: Variations of the endophagous and exophagous rates between the 6 villages from July to December 2011

A total of 1012 bloodmeals from *An. gambiae* resting females collected in the three of the six villages (Barkedji, Keur Bandji and Wouro Samba Kibel) were tested by ELISA to determine the source. The females have taken their bloodmeals from Human, Bovine, Ovine, Chicken and Equine hosts. The mean anthropophilic rates were significantly different between the three villages (c2=7.4, d.f. = 2, p=0.024) as well as Barkedji and Keur Bandji (c2= 7.4, d.f. = 1, p=0.007).

RVF vectors

The entomological studies on RVF vectors were conducted in order to study the RVF vectors spatial distribution around the main ground pools in the study area and the attractiveness of the main vertebrate hosts namely human, sheep and goat. The selected ground pools included Niakha, Kangaledji, Ngao, Fourdou and Beli Boda.

The RVF vectors were collected every fortnight from July to December using CDC light traps with CO_2 placed around ground pools and net-baited traps with human, goat and sheep as hosts. After collections, mosquitoes were frozen and subsequently identified on a chill table using mosquitoes morphological keys. They were sorted into monospecific pools and stored in liquid nitrogen (-180°C) for transportation to the laboratory, where they were kept at –80°C until their testing for virus detection.

Results

Mosquito collections

A total of 18 556 mosquitoes belonging to 6 genera and 35 species were collected. *Cx. poicilipes* and *Ae. vexans* were the dominant species and represented respectively 34.4% and 49.6% of the mosquitoes collected.

Population dynamics

For *Ae. vexans* the mean number of specimens per trap per night (STN) was 120.7 during the period of survey. This mean was higher in July at the beginning of the rainy season (respectively 266.4 and 955 STN during the second and the fourth week of July). This density decreased from August to October and no specimen was collected afterwards in November and December (figure 5).

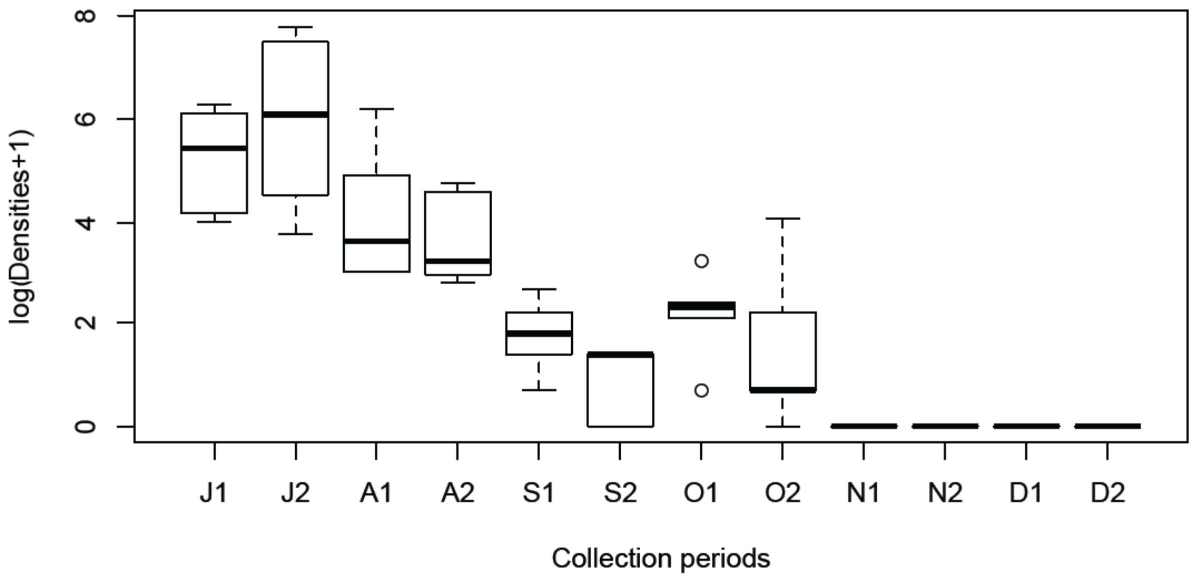

Figure 5: Variations of *Ae. vexans* densities in the four ground pools studied from July to December 2011

For *Cx. poicilipes*, the variations were quite different. The mean number of STN was 76 STN. The mean number of STN of *Cx. poicilipes* collected at the beginning of the survey was 1.2 and 0.2 respectively during the second and the fourth week of July. The densities increased afterwards reaching 589.4 at the beginning of October then decreased to 35 STN in late November and no mosquito was collected in December (figure 6).

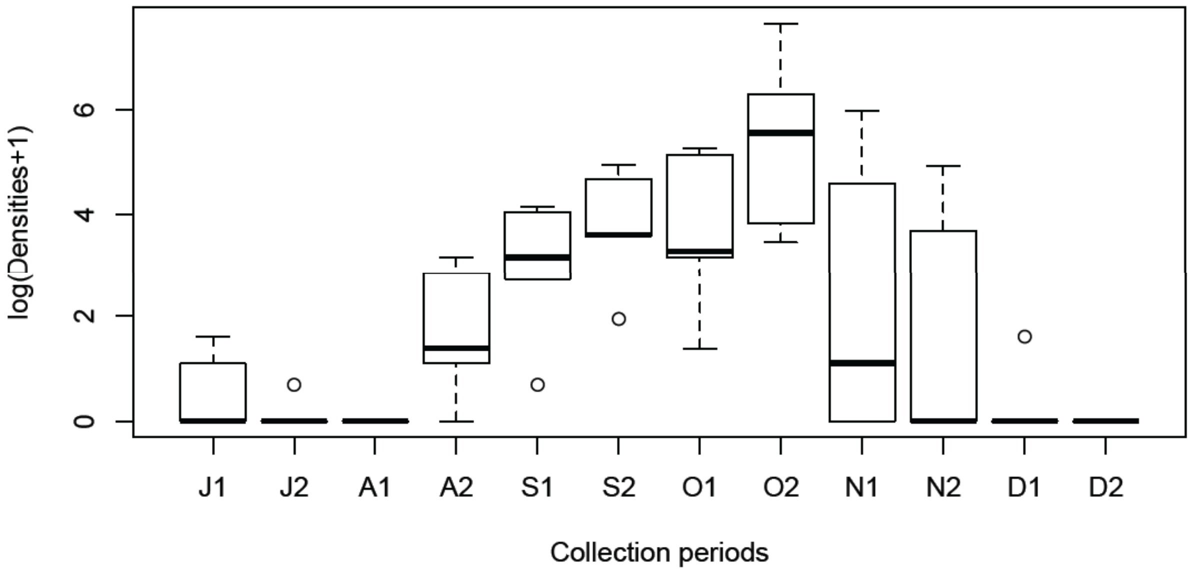

Figure 6: Variations of *Cx. poicilipes* densities in the four ground pools studied from July to December 2011

When comparing the population dynamics of the two species in the 5 ponds, the dynamic of *Ae. vexans* was similar to the general trend observed. Overall, the densities were higher in Kangaledji and Ngao ponds, the peak of densities was earlier in these two ponds (Figure 7).

For *Cx. poicilipes*, the population dynamics profile was also similar to the general trend observed. The peak of densities was observed at the middle towards the end of the rainy season. The Niakha and Kangaledji ponds showed the highest densities (Figure 7).

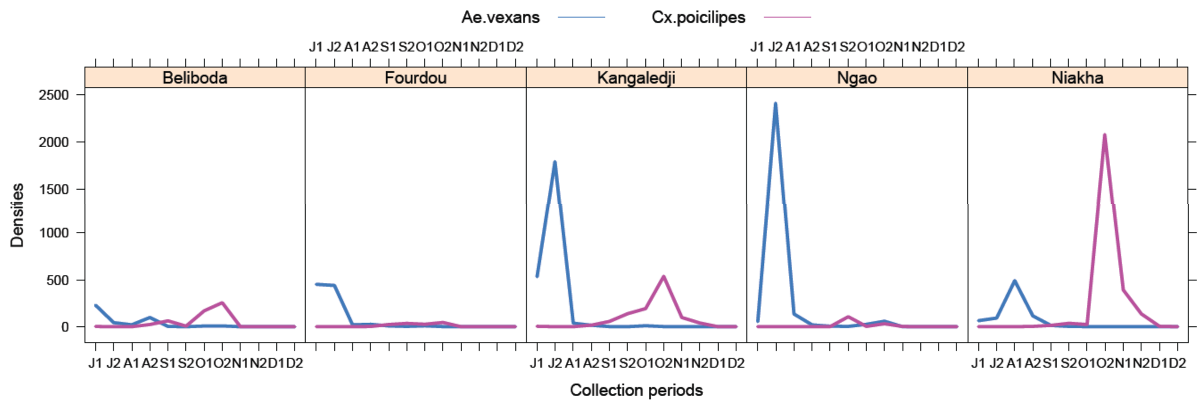

Figure 7: Temporal variations of *Ae. vexans* and *Cx. poicilipes* in each of the 5 ground pools studied from July to December 2011

Host attractiveness

The attractiveness for human, sheep and goat to the two main vectors were studied near the Niakha, Kangaledji and Fourdou ground ponds using net-baited trap (figure 8 and figure 9). Our findings have shown that for *Cx. poicilipes*, whatever the ponds considered, the CDC light traps caught more mosquitoes than the net-baited traps. Sheep and goat seem to be the main attractive hosts.

As for *Cx. poicilipes*, the main hosts for *Ae. vexans* was goat and Sheep.

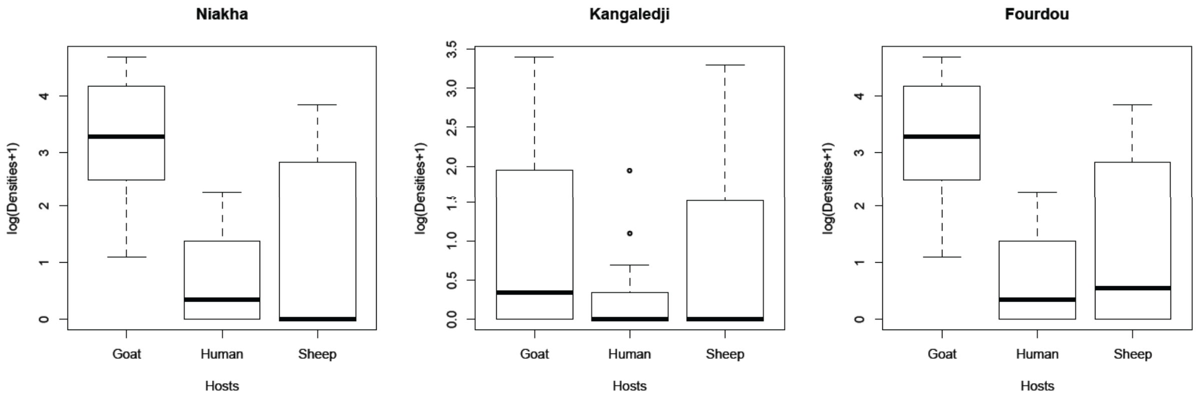

Figure 8: Comparative hosts attractiveness of *Ae. vexans* in the 3 ground pools from July to December 2011

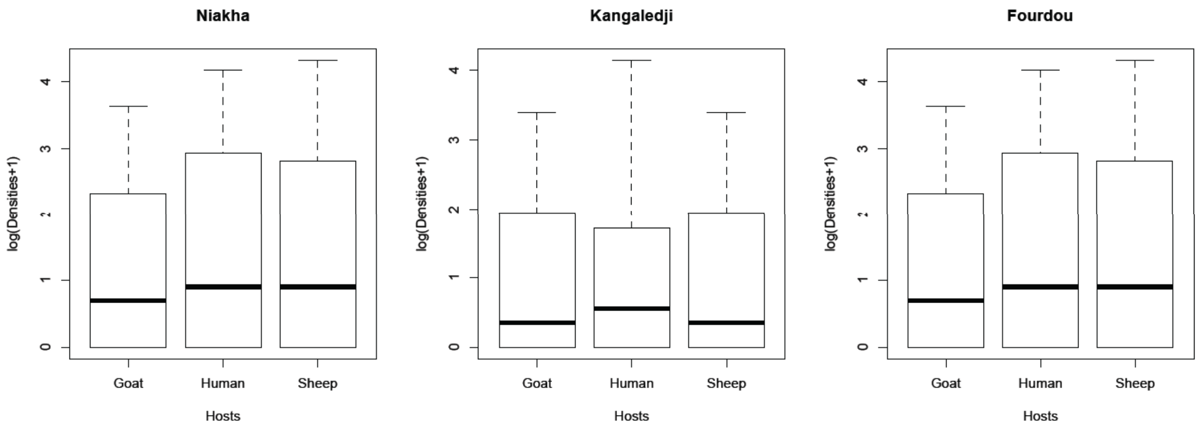

Figure 9: Comparative hosts attractiveness of *Cx. poicilipes* in the 3 ground pools from July to December 2011

The mosquito densities of *Ae. vexans* in each of the three net-baited traps were significantly different in Niakha and Fourdou ground pools (respectively $F_{2,33}=8.24$, $p= 0.001251$ and $F_{2,33}=8.2334$ $p=0.00125$) whereas in Kangaledji ground pool the densities were comparable.

For *Cx. poicilipes*, no significant difference was observed whatever the ground pool considered.