Heterogeneity in the risk of sleeping sickness in coffee and cocoa commercial plantations in Ivory Coast

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SHORT COMMUNICATION

Since 1945 in the forest area of Ivory Coast, human sleeping sickness due to Trypanosoma brucei gambiense (Dutton) has been continuously associated with the development of coffee and cocoa plantations. However, the studies in progress in the Département des Sciences Humaines Appliquées à la Santé of the Institut Pierre Richet show that the disease distribution is highly heterogeneous. Thus, sleeping sickness has always been sporadic in regions like Gagnoa, where agricultural forest development was achieved by large-scale commercial methods. By contrast, in the region of Daloa for instance, where there are small-holder plantations, the prevalence of the disease has always been high. These significant differences suggest that land use has a direct impact on sleeping sickness prevalence and incidence (Hervouët, 1992).

Zoukougbeu, which is an active focus of sleeping sickness, is located at 30 km on the western side of Daloa, between 6°05′ and 7° North, and between 6°50′ and 7°10′ West. Between April and June, there is a major rainy season, followed by a short dry season in July. The minor rainy season occurs in September and November and the long dry season occurs from December to March. The ombrophilic forest has mostly disappeared but remains in the centre western region. Coffee and cocoa small-holder plantations mainly prevail but there are also some commercial plantations where no sleeping sickness case has ever been detected.

In contrast with the rest of the area, the northern part of the Zoukougbeu focus is characterized by the presence of large agricultural developments all in one block. This is the case with the Tonykro plantation (130 ha) where coffee and cocoa plantations represent 19% and 16% of the whole area, respectively (Fig. 1). These plantations are located along the two main tracks of the area, although the forest reserves and the wastelands are found close to the inland valleys. At the cross-tracks, there is a settlement occupied by ten seasonal workers. The next Siluekro plantation covers 80 ha, with 19.5% of coffee plantations and 18% of cocoa plantations. The remains of the development comprises orange and kola trees together with wastelands. There is no forest reserve. Ten seasonal workers also live in this settlement. By contrast with Tonykro, many tracks cross the Siluekro plantation, used for agricultural activities and also for the movements of people living in the adjacent settlements.

Entomological surveys of two commercial plantations evaluated the epidemiological risk of sleeping sickness. Tsetse (Diptera: Glossinidae) were caught in November 1997, at the end of the short wet season, with 28 Vavoua traps (Laveissière & Grébaut, 1990): 15 in the Tonykro plantation and 13 in the Siluekro plantation (Table 1; Fig. 1). The placement of the traps was determined to evaluate the human-vector contact with regard to the spatial and temporal distribution of the agricultural activities. Thus, sites regularly frequented by humans (type 1) were distinguished from sites frequented before the catches (type 2), sites frequented during the catches (type 3) and sites not yet frequented (type 4) (Table 1). The environment of the traps was also noted.

The traps were operated 4 days continuously at each site. Tsetse were removed daily between 14.00 and 18.00 hours. They were identified and then counted according to their origin (Diallo et al., 1997). The epidemiological risk index was calculated using the method of Laveissière et al. (1994).

All the tsetse caught were G. p. palpalis with an average 0.3 fly/trap/day. In the Tonykro plantation, the averaged ADT was 0.2 fly/trap/day, although it was significantly higher in the Siluekro plantation with 0.4 fly/trap/day (t = 25.6; d.f. = 56; \[t/2\] = 2.005). The relative densities varied substantially according to the location of the traps (Fig. 1).

In the Tonykro plantation, the tsetse were more abundant near the track going to Belle-ville. The presence of the
workers near trap no. AA6 did not seem to attract the flies. In the Siluekro plantation, the flies were also more abundant close to the tracks. They were found at trap no. AB0 where coffee and cocoa were harvested during sampling. In the areas frequented by the workers before sampling, the flies were found only close to trap no. AC7. The rate of teneral females was 4.8%, suggesting that the sites of sampling were not reproduction sites. This was confirmed by the statistically higher abundance of the females ($\chi^2=6.5; \text{d.f.}=1; P=0.01$). As no human blood-meal was identified, human-vector contact seemed to be low and the epidemiological risk of transmission could be considered as nil in the two plantations.

Our results support the hypothesis that land use has an impact on the distribution of sleeping sickness. The commercial plantations did not appear as risk areas. The human-vector contact was low, although the entomological survey was done during the harvest period which usually brings many people to the plantations.

The circulation of the workers in the plantations did not seem to affect the presence of the tsetse; the relative density of the tsetse was high especially in the regularly visited sites such as tracks or water holes (type 1). However, differences were observed between the plantations which may be associated with the opening of space. Thus, the Tonykro plantation may be considered as a socially closed space; only agriculture providing regular human presence. The Siluekro plantation is a more socially open space; the tracks are used by both the workers and outsiders, increasing the human presence in the space.

In contrast, when population and settlement densities induce a high human mobility, as in the small-holder plantations area, the sleeping sickness risk is increased (Koné et al., 1998). Thus, in both the Nouroulaye and the Bahigbeu II areas, which

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were identified as risk areas, epidemiological risk indices were 9.93 and 8.62, respectively.

The risk of sleeping sickness development seems to be reduced since the activities are undiversified and the human displacements are only governed by agricultural developments. Consequently, the expression of the disease appears to be linked to the land use and it is then understandable that some regions may escape sleeping sickness.

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References


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