Social structure and SIV_{agm} prevalence in two groups of green monkeys, *Cercopithecus aethiops sabaeus*, in Senegal

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The aim of this study was to analyze demographic structure and SIV prevalence in two groups of green monkeys (*Cercopithecus aethiops sabaeus*), the virological status of certain individuals being known. These elements are necessary for *in natura* modeling of the propogation of identified retroviruses.

The study was conducted as part of the project entitled "Ecology of simian retroviruses", under the auspices of the Large AIDS Project of ORSTOM, the French Institute of Scientific Research for Cooperative Development, in collaboration with the Pasteur Institute at Dakar and the Directorate of National Parks of Senegal.

Material and methods

Groups 'P' and 'G' of the green monkey population in the Fathala Forest and adjacent mangroves (Saloum Delta, Senegal) were studied. P is located near the village of Bakadadji. G lives near to the primatological station of ORSTOM. Captures were done using nets baited with peanuts. The animals were anesthetized with Ketamine or Diazepam. Blood samples (2-4 ml) were collected in heparin tubes from the femoral vein. Whenever possible, the monkeys were tatooed and the adults marked using collars or miniature radio transmitters. The monkeys were released at the place of capture after about 1 hour (Galat-Luong et al., 1991).

A sample comprising 18 individuals was also collected at Toubacouta, about 15 km north of the Fathala Forest (Durand et al., 1990). Serological analyses used either ELAVIA and LAV BLOTT DIAGNOSTICS PASTEUR™, at the Pasteur Institute in Dakar, or INNO-LIA HIV-1/HIV-2 Ab (IMMUNOGENETICS™), at the retrovirus and parasitology laboratory of ORSTOM in Montpellier.

Age-and-sex classes were defined as follows. Adult males, >5 yrs; adult females, >4 yrs; subadult males, 4-5 yrs, subadult females, 3-4 yrs; infants I, <6 months; infant II, 6-18 months; juveniles, between infants II and subadults.

Table 1. Demographic structure of groups P and G.

Age-and-sex class	Group P		Group G
	1991 May	November	1992 March-April
Adult (or subadult) males	9	10	6
Adult females	12	14	9
Juveniles	9	12	14
Infants II	8	7	7
Infants I	7	2	1
Total	45	45	37

Results and discussion

The demographic structure and SIV prevalence of groups G and P are presented in Tables 1 and 2.

The methods used here - capture, marking, recapture, behavioural and demographic study of the groups - allows exploration of the natural circulation of SIV viruses within known groups of individually identified monkeys. The prevalence of SIV_{agm} is 46% for the studied population at Saloum. Among adults, the value is 81%, compared to 51% (82/162) in eastern Senegal (Durand et al., 1990, ms.). This difference is highly significant (χ^2=18.76, p<.001). It can be concluded that prevalence may vary from one region to another. The reasons for such variation must then be addressed. Might there be a temporal change, the sample from eastern Senegal dating from before 1986 while those from Saloum date from 1989 and 1992? This hypothesis is contradicted by the analysis carried out the ORSTOM-IPD blood laboratory (Durand et al., 1990, ms.), showing no increase in prevalence in 352 sera sampled from 1967 to 1986. Nevertheless, it will be tested further following new captures in groups being observed, and recaptures of already-sampled individuals.

There may be geographical variability. This hypothesis will be tested by sampling in different regions. In this case, can the differences be related to aspects of the monkeys' behaviour which might modify the possibility of transmission? This hypothesis will be tested by comparing the socioecology of the different populations of green monkeys studied.

Alternatively, might there be a variable characteristic of the retrovirus itself, influencing the likelihood of infection or pathogenesis? This hypothesis will be tested at the retrovirus and parasitology laboratory of ORSTOM in Montpellier.

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* Résumé en Français :
La séroprévalence SIV *(Simian Immunodeficiency virus)* de deux bandes de Singes verts, *Cercopithecus æthiops sabæus,* vivant dans leur milieu naturel (la forêt de Fathala et la mangrove limitrophe du Parc national du Delta du Saloum, Sénégal) a été calculée après vérification que la structure démographique de l'échantillon testé était bien représentative de celle des bandes dont il est extrait. La proportion de Singes verts infectés est de 45,3%. Elle passe de 21% chez les jeunes à 81% chez les adultes ce qui conforte l'hypothèse d'un mode de transmission hétérosexuel semblable à celui de l'Homme. La valeur non négligeable relevée chez les jeunes implique que les autres voies de transmission possibles ne doivent pas être exclues *a priori* des hypothèses à tester.

Table 2. Prevalence of SIV in groups P and G.

Age-and-sex class	Group P		Group G		Population Saloum P+G +Toubacouta, n=18
	SIV+ n	%	SIV+ n	%	SIV+ %
Adult males	5	71.4 (n=7)	1	33.3 (n=3)	61.5 (n=13)
Adult females	9	90.0 (n=10)	5	100 (n=5)	94.4 (n=18)
Immatures	5	21.7 (n=23)	2	22.2 (n=9)	20.5 (n=44)
Total	19	47.5	8	47.1	45.3

n, number of individuals sampled.

The effect may also be due to increased homogeneity of the sample, the studied animals being from two groups and a restricted area, with better representativity of the sample. The study aims to ensure that the demographic structure of the sample reflects that of the population; this was not done in eastern Senegal. The importance of the sampling procedure is thus emphasized.

The difference between immatures and adults is important; the difference in prevalence between the two age-groups (21% vs. 81%) is highly significant (χ^2=26.2, p<.001), and raises the suggestion of heterosexual transmission similar to that which occurs in humans. However, risk-laden social behaviours such as biting and ingestion of genital fluids during grooming have been observed, including during interspecific interactions (Galat-Luong, 1991). These other modes of transmission should not be excluded *a priori* from hypotheses to be tested.

The results provide some elements for constructing a model of SIV transmission in free-living monkeys. A computer simulation of transmission is currently being elaborated. This will allow us to study the speed of dispersion of a SIV virus within one group of monkeys and its dissemination between groups, taking into account behavioural characteristics (interindividual relations, sexuality, peripheralization of young males, etc.) and socioecological features (group size, social organization, territoriality, emigration-immigration, etc), and testing two hypothesized transmission modalities: sexual behaviour and biting. The model should be applicable to the dissemination of other directly transmitted viruses or parasites.

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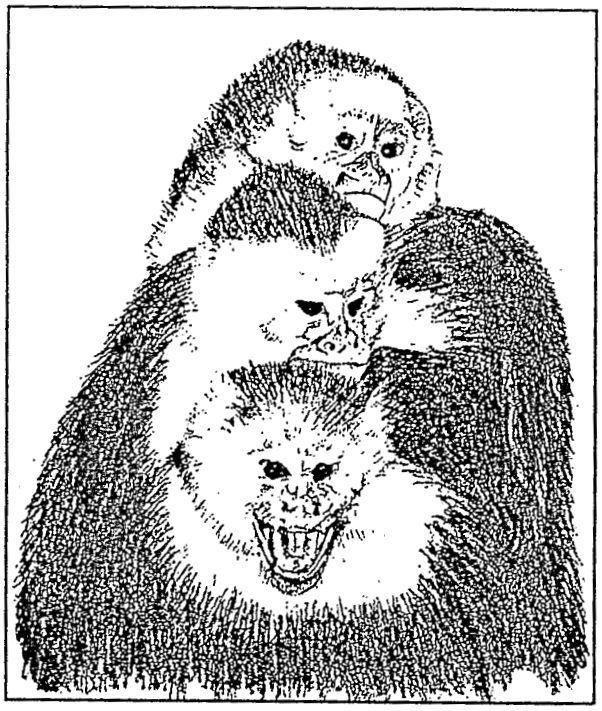

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