

The Prurigo Strophulus in Brazzaville: Demonstration of Vectors and Study of Some Associated Bioecological Parameters

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Abstract.- Strophulus prurigo, chronic skin disease widespread in Africa in general and the Congo - Brazzaville in particular is studied here in a neighborhood of the city of Brazzaville located near a watercourse. Studies conducted at 100m and 500m from the river show a frequency of infestation which is highest near water. Two arthropods are reported to cause infections in prurigo strophulus: dipteran Simuliidae, *Simulium albivirgulatum* and an Ixodidae mite, *Ixodus ricinus* L. The notion of a genetic transmission of this disease is hypothetical. Suspicion of a hereditary origin of this infection is not confirmed here. Field of patients with prurigo does not seem to be atopic. The study of daily activity rhythms of *Simulium albivirgulatum* shows that this insect is well suited to urban areas with peaks of both diurnal and crepuscular activity, providing important human parasite pressure. The dermatological consequences are all the more important that individuals are less covered mainly in the limbs according to their clothing habits. In addition, our results indicate a predominance of women in the prevalence of this infection, regardless of the age groups considered.

Keywords: Prurigo strophulus, arthropods, humid tropics, watercourse, sex ratio, body cover, allergy, activity rhythm.

INTRODUCTION

Prurigo strophulus discovered in 1857 by Erasmus Wilson is a chronic skin disease in general and particularly in infants. It is itchy, and is due to abnormally prolonged hypersensitivity to insect bites (Larrègue and Maleville, 1986; Jorizzo *et al.*, 1981; Hanifin and Rajka, 1980; Saurat *et al.*, 1990; Viraben, 1996; Touraine and Revuz, 1997; Beneton and Saiag, 2000).

The condition is a reaction immunoallergic to arthropod bites. The vector of strophulus prurigo is an ectoparasite, an insect or a mite. In Europe, more than 30,000 species of mites are incriminated with this disease. In Africa, some studies have implicated both the arthropod bites and the social conditions of patients (Ahogo *et al.*, 2008). Distribution of lesions sometimes depends on the seasonal vector

(Ruiz and Tamayyo, 1973; Daneshpazhooh *et al.*, 2004).

Strophulus prurigo is a public health problem (Hyde and Montgomery, 1909; Touraine and Revuz, 1997; Sangare *et al.* 2001; Anonymous, 2005). Generally in Africa and specially in Congo. The rich fauna and flora are associated with significant biodiversity of biting insects and piercing-sucking mites but also warrant a thorough study of causative agents.

Treatment of prurigo strophulus is difficult and mostly symptomatic. The elimination of the carrier agent is ideal therapy for the patient.

Knowledge of the succession or overlapping ecological niches or habitats and/or micro-habitats of offending arthropods may provide further insights into the conditions of distribution thereof. Our study aims at finding the suspected vectors of prurigo strophulus in a district of Brazzaville, located near a watercourse. This is a bio-ecological study on the fluctuation of vectors and environmental ecoethological residents of the targeted area.

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MATERIALS AND METHODS

Laboratory equipment and chemicals

The equipments used were essentially a sweep net for collecting specimens of vector, a maximum-minimum thermometer and 25cl jars. Ethanol (70%) and formaldehyde (10%) were used for preservation of arthropods (Roth, 1980). Formaldehyde allows in particular to retain the colors of the collected specimens.

Watch glasses were used for observation of arthropods under binocular magnifying glass type Leica Zoom 2000 or under the microscope. Flexible and fine forceps were required for the careful handling of specimens and a stereomicroscope was used to carry out the detailed characterization of collected specimens.

Our study focused on arthropod vectors of disease mainly mites and insects, which were identified according to Caspari *et al.* (1961), Chinery (1984) and Baker (1999).

Medical approach

Appropriate survey forms were developed to identify patients from the study area. The services of consultants of Department of Dermatology, Hospital University (CHU) in Brazzaville were available to advise the patients. A digital camera type Sony Cyber shot 3.2 mega pixels was used to photograph the injuries related to the studied disease. Consulted patients received appropriate treatment and monitoring.

Study sites

The city of Brazzaville, located at 4 ° 4 'south latitude and 15 ° 2' East longitude, divided into 9 districts including the fourth, Mougali, was chosen as the venue for our study. This district is watered by a river, the Maduku tsiékélé, through most of the city.

Both sides of the riverbank are thickly populated. There is in this area straddling between water and the banks, a sparse vegetation *viz.*, Poaceae *Panicum maximum*, *Hypparhenia diplandra*, *Loudestia arundinace* and *Voshia cuspidata* and residual pollution from the accumulation of garbage.

We have delineated two areas, starting from the river to the neighborhood, at varying distances from the river. One is 100m and the other 500m far from the river, Seven blocks located in the study area were monitored and the number of infected patients and those not infected was carefully recorded.

Data collection was based on the interrogative method from a predetermined survey form. The questionnaire was exclusively reserved for parents. The study involved 100 patients -50 of them lived 100m from the river, and the other 50 at 500m thereof. A dermatologic consultation was scheduled for all patients with lesions.

To study the activity rhythm of arthropods, sampling was carried out by mowing in homes on one hand and in the grass surroundings on the other. For this, collections were done every two hours, from 6:00 AM to 6:00 PM, according to the method used by Vouidibio (1985) and Matoko and N'sounga (2001) for *Drosophila*. In a second approach, the arthropods were harvested only once a day always at the same time, to avoid depletion of wildlife during the experiment.

Data analysis

Species diversity was determined by the Schannon-Weaver index (H') and species distribution was evaluated by calculating the equitability (E) (Vessereau, 1963).

RESULTS

Frequency of prurigo strophulus

Seventy cases of prurigo strophulus were observed during the study period on 100 identified patients (Table I). Forty three patients lived in the area at 100 meters far from watercourses and 27 patients lived in the area at 500m. Age classes ranging from 0 to 8 years were followed. The largest frequency of prurigo strophulus was found among children 6 to 8 year old, and located at 100m far from the stream, as shown in Table II.

Consequently, under our experimental conditions, the highest rates of prurigo infestation is found among the 4-6 year old children (Table II) and the same situation was observed in the densely populated streets (Table III).

Table I.- Distribution of young infected patients according to the age, cumulatively at 100m and 500m.

Age (Years)	Total number of children with signs of infestation in the study area	% of children infected	Total number of children observed
0-2	14	20	100
2-4	12	17.15	
4-6	21	30	
6-8	23	32.85	
Total	70	100	

Table II.- Number of male and female infected children close to the river (100 m) and away from water course (500 m).

Age (Years)	Close to the river		Away from water course	
	Males	Females	Males	Females
0-2	2	8	3	3
2-4	0	6	0	6
4-6	2	9	3	7
6-8	6	10	6	1
Total	10	33	10	17

River : without S, singular

Table III.- Distribution prurigo strophulus patients in different streets 100 m and 500 m away from the river.

Street names	100 m away from river		500 away from river	
	Infected	Infestation rate (%)	Infected	Infestation rate (%)
Mayama	10	23.26	12	44.44
Franceville	7	16.28	4	14.82
Djambala	1	2.32	3	11.11
Gamboma	3	6.97	2	7.41
Moudzombo	11	25.58	5	18.52
Zanaga	6	13.95	1	3.70
Lekana	5	11.63	-	-
Total	43	100	27	100

Importance of the social status of parents

The distribution of patients according to social status of parents is reported in Table IV. The results obtained on all patients show that the number of patients with prurigo strophulus is higher among children living in houses occupied by families with limited incomes. Furthermore, the highest rates of

patients with prurigo strophulus were found in secondary sector worker families, rather than in the tertiary sector.

This pattern is also observed regardless of the remoteness of the river houses (Table IV). Indeed, patients whose parents were traders or officials were systematically less infested by prurigo strophulus (either at 100m or 500m far from the rivers), than those from the secondary sector. Social status seems to be one of the determining factors in the variation of prurigo strophulus incidence.

Importance of personal protection or clothing habits

Comparing frequency of prurigo strophulus based on clothing habits in the two situations of distance from the river, the results show that this infection is much less in occurrence in the patients wearing protective clothes. Indeed, 79.07% of patients were wearing less clothes against 20.93% of patients always wearing full clothes (Table V). In addition, 69.77% of patients wearing noncovering clothes were female, while 9.30% of patients were male (Table V). Either near the river (100m) or even further (500m) thereof, the rate of most patients with prurigo strophulus was higher in patients not wearing protective clothes and therefore, whose body protection was low (Table V). In fact, male patients, according to their social habits, are used to wear more protective clothes such as pants, for example. So they were logically more protected against the bites of arthropods than the young female patients.

Importance of history of allergy on the occurrence of prurigo strophulus

The distribution of patients according to personal and family history of allergy-related clinical signs are reported in Table VI. The results show that regardless of the street locations and of the remoteness of the river, the rate of personal allergy was always higher than the rate of family allergy. However, under our experimental conditions, we can still notice that personal rates of allergy are overall lower at 500m far from the stream than at 100m. Patients in prurigo strophulus family presented less allergies.

Table IV. Distribution of patients with prurigo strophulus according to social status of parents living 100 m and 500 m away from the river.

Streets	100 m away from river				500 m away from river			
	Worker (%)	Commercial (%)	Official (%)	Unemployed person (%)	Worker (%)	Commercial (%)	Official (%)	Unemployed person (%)
Mayama	33.33(1)	15 (3)	22.22 (2)	36.36 (4)	75 (3)	0	50(7)	66.67 (2)
Franceville	0	15 (3)	11.11(1)	27.27 (3)	0	16.67 (1)	21.43 (3)	0 ()
Djambala	0	0	11.11 (1)	0	25 (1)	0	7.14 (1)	33.33 (1)
Gamboma	33.33(1)	10 (2)	0	0	0	33.33 (2)	0	0
Moudzombo	0	25 (5)	44.44 (4)	18.18 (2)	0	33.33 (2)	21.43 (3)	0
Zanaga	0	20 (4)	0	18.18 (2)	0	16.67 (1)	0	0
Lékana	33.33(1)	15 (3)	11.11 (1)	0	-	-	-	-
Total	3	20	9	11	4	6	14	3

() : Number of listed patients

Table V.- Effect of body protection of prurigo strophulus patients in area closed and far away from the river.

Sex	100 m away from river			500 m away from river		
	Covering clothes	Noncovering clothes	Total	Covering clothes	Noncovering clothes	Total
Male	6	4	1	5	5	10
Female	3	30	33	3	14	17
Total (%)	20.93	79.07	100	29.63	70.37	100

() : Number of listed patients

Demonstration of causative agents of prurigo strophulus in the study area

Two types of arthropods were found and identified during this study. This is an insect and a mite. The insect was identified as *Simulium albivirgatum* Wanson and Hevrard 1944, belonging to the order Diptera, suborder Nematocera. It is essentially characterized by its biotope always near rivers or outside human dwellings. This insect belongs to the superfamily Chironomoidea and family Simuliidae. It is gray in colour, and the females have rather long legs, two membranous wings slightly ribbed segments dominated by abdominal tergites with five dark bands. This insect like all *Simulium* is characterized by a hunchback before chest, bending its head down. Short antennae are mounted on a head bearing palps with sting.

The mite was identified as *Ixodus ricinus* Linnaeus 1758, adapted to many environments and parasitic to many warm-blooded mammals. This is an arachnid family Ixodidae with no eyes, and bears the palpi longer than they are wide. The female is 3 to 3.6-mm long but its size can be up to 11mm and

the male is between 2.4 to 2.8 mm. There is a groove above-the anus and a hard dorsal shield covers the abdomen (Baker, 1999)

These arthropods were found in proximity to the river Maduku tsiékélé (100m) and also in a relatively greater distant (500m). Seven blocks for the first situation (100m) were chosen for monitoring the abundance of these arthropods and the same streets were studied also for the second location at 500m.

Location at 100m from the river

Table VII shows that *S. albivirgatum* was most prevalent and its rate reached 100% in the majority of delimited streets. No individual of the species *I. ricinus* was found in five of the surveyed streets. The number of different species obtained was enough significant. A total of 2551 individuals were collected.

Location at 500m from the river

A total of 1595 individuals was collected. *S. albivirgatum* was found in all the streets, while *I. ricinus* was recorded only in 3 of lined streets (Table VII).

Table VI.- Number of prurigo strophulus patients with and without family history living close to river and away from river.

Streets	100 m away from river			500 m away from river		
	Personal allergy (%)	Family allergy (%)	Total	Personal allergy (%)	Family allergy (%)	Total
Mayama	70(7)	30(3)	10	100(12)	0	12
Franceville	85.71(6)	14.29(1)	7	75(3)	25(1)	4
Djambala	100(1)	0	1	66.67(2)	33.33(1)	3
Gamboma	100(3)	0	3	100(2)	0	2
Moudzombo	81.82(9)	18.18(2)	11	60(3)	40(2)	5
Zanaga	100(6)	0	6	100(1)	0	1
Lékana	100(5)	0	5	-	-	-

() : Number of listed patients

Table VII.- Relative abundance of both species viz., *Simulium albivirgatum* and *Ixodus ricinus* close to and away from the river.

Streets	100 m away from river			500 m away from river		
	<i>Simulium albivirgatum</i> (%)	<i>Ixodus ricinus</i> (%)	Total	<i>Simulium albivirgatum</i> (%)	<i>Ixodus ricinus</i> (%)	Total
Mayama	40.76	59.24	709	32.23	67.77	391
Franceville	100	0	349	52.25	47.75	222
Djambala	100	0	271	100	0	136
Gamboma	100	0	269	100	0	245
Moudzombo	71.34	28.66	478	54.07	45.93	381
Zanaga	100	0	120	100	0	220
Lékana	100	0	355	-	-	-

The relative abundance of H' of the two species is quite large regardless of the remoteness of the river, the values are between 0.60 and 1.06 depending on the streets. The evenness of the two E species that expresses the stand structure of arthropods studied appeared more variable at 100m of the stream rather than 500m (Tables VII, VIII) because the differences range from 2.53 in the first case, to 0.67 in the second case.

Monitoring of changes in daily activity rhythms of S. albivirgatum

Seasonal average temperature during the study period was 28.3°C. As shown in Figure 1, female of *S. albivirgatum* were active between 6 and 12 O'clock, even up to 1600 hours in the evening, with peak activity between 6:00 AM and 10:00 AM in the morning twilight and a peak between 1400 hours and 1600 hours. In males, an increase in activity was observed in the morning,

between 6am and 12am and between 1400 hours and 1800 hours.

Table VIII.- Population structure of arthropods at 100 m and 500 m far from the stream.

Street names	100 m away from river		500 away from river	
	H'	E	H'	E
Mayama	0.55	1.83	0.60	2
Franceville	0.85	2.83	0.85	2.83
Djambala	0.96	3.2	0.81	2.7
Gamboma	0.96	3.2	1.06	3.53
Moudzombo	0.72	2.4	0.62	2.06
Zanaga	1.31	4.36	0.86	2.86
Lekana	0.8	2.9	-	-
Total	6.15	20.72	4.8	15.98

E, equitability; H', Schannon-Weaver index.

i) "stand structure" or "population structure" is an ecological parameter of population integrating relative abundance and species distribution

ii) H': means specific diversity or relative abundance of population

E: species distribution

S. albivirgatum is a diurnal species, either 100m or 500m far from the river. Thus, either near or far from the river, it shows a morning peak and a peak at dusk, allowing this activity to spread more in human parasite.

Moreover, in all our observations, the activity of females appeared ever more important in its magnitude than in males. Only the street Mayama showed a significant increase in the level of male activity whose peak follows the females, between 1400 and 1800 h (Fig. 1). In all the other streets, the differences in pace of activity between males and females were evident.

DISCUSSION

Relatively common in tropical areas, prurigo strophulus is characterized by the presence of relatively large papules with a dark crust and abrasions on skin. The major characteristics of this symptom is pruritus (itching), sometimes very intense (Beneton and Saiag, 2000)

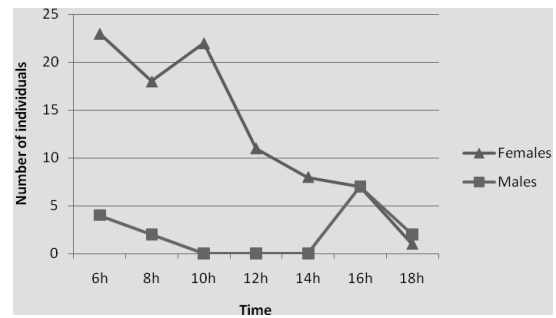
There are more prurigo patients living 100m from the river rather than those living 500m away. The blood-sucking vectors of prurigo strophulus seem to have a preference for more humid areas, particularly because of watercourse and/or floating weeds which promote development of their larvae.

Strophulus prurigo is a dermatosis that sometimes occurs during a contact allergenic or on genetically predisposed land (Hojyo-Tomoka *et al.*, 1995, 1997; Bazex and Dupré, 2000; Arrese *et al.*, 2001).

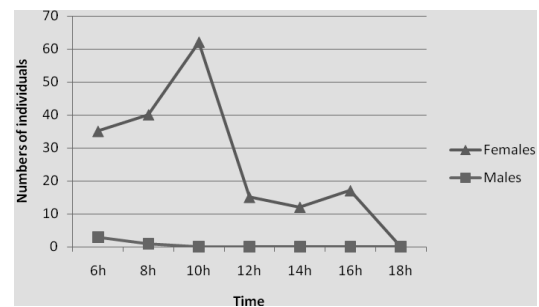
In our study the rate of allergy was always personal, under our experimental conditions, greater than the rate of allergy family. Nunes *et al.* (1978) have reported higher frequency of allergy among non-atopic patients. It does not seem to be a familial predisposition. This dermatitis can occur after contact with an individual allergen-specific history, after an exaggerated production of IgE.

The period of the wet season is favorable for larval development of vectors due to the possibilities of water stagnation, that makes the proliferation of vectors of disease agents easier (Ahogo *et al.*, 2008). In temperate zones, for example, the seasonality of the disease was found during the months of autumn and spring (Caspari *et*

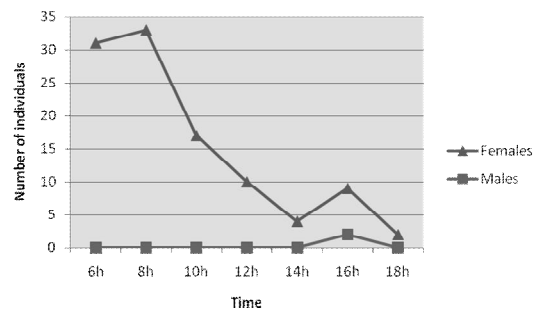
al., 1961; Saurat *et al.*, 2004), transition periods before the winter season in the first case and the summer season in the second case.



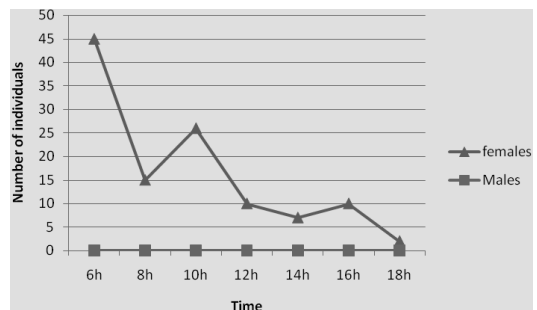
A



B



C



D

Fig. 1 Rhythm of daily activity of *Simulium albivirgatum* in Mayama street (A), Gamboma street (B), Franceville street (C) and Lékana street (D).

In tropical areas, the rainy season provides most favourable breeding sites. It is during these periods that organisms thrive, regulate their life cycles in order to adapt to future climate conditions more stringently (Caspari *et al.*, 1961).

Our study reveals that 70% of patients suffered prurigo strophulus. However, this study also shows that wearing clothes can reduce the rate of infected patients, and this applies both near the river and in an area much further away. The risk of patient exposure to hematophagous arthropod bites including many species of vertebrates as humans, can thus be mitigated.

The results obtained during this study also show that social status is a prime contributor to prurigo strophulus. Indeed, as shown by Ahogo *et al.* (2008), most patients coming from families with low incomes, and potentially exposed to arthropod bites, may cause the transmission of prurigo strophulus.

S. albivirgulatum and *I. ricinus* are two cosmopolitan species, well adapted to domestic and urban areas. The high density of population in the area is understandable. They are vectors of many diseases such as onchocerciasis for the former (Fain *et al.*, 1981) and *Babesia bovis* or relapsing fever for the latter (Baker, 1999; Gray *et al.* 2002).

Daily activity patterns of both *S. albivirgulatum* let us understand the strategy of occupying its niche through the registration of its activity peaks in early morning and twilight (Blondel, 1995). This allows an almost permanent parasite pressure on patients whose localization behavior and dress may increase the risk of disease. The differences in the pace of daily activity between males and females are shown by the variation of curve profiles. This shows that each one occupies a different gender dimension of its niche in terms of its benefits.

However, females show more activity than males. They are only sucking and thus they occupy the ground more thoroughly than males whose food resources are less varied and require less wealth. It is probably a strategy consisting of sharing resources that can better reduce competition for food.

The temperatures stimulated the optimum activity of the females in the early hours of the

morning period of fairly low temperature. Rising temperatures during the day contributes to the lowering of the activities observed in females of *S. albivirgulatum* in particular. Both arthropods studied have a different spatial distribution in the urban environment and have developed a strategic adaptation to be able to better parasitize their hosts late in the morning, according to their need for food resources, under the influence of optimal climatic conditions.

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