A BRIEF REPORT ON A LARGE MOUNTAIN-TOP COMMUNITY OF *DIOSCOREA PRAEHENSILIS* IN THE TROPICAL RAINFOREST OF SOUTHEASTERN CAMEROON

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ABSTRACT Wild yam tubers have been considered to be key food to resolving the question of whether hunter-gatherers could live independently of agriculture in a tropical rainforest, or what made it possible. Above all *Dioscorea praehensilis* is known as the most reliable staple food in Africa. In February 2000, the author found a large community of *D. praehensilis* on the upper part of a small mountain in southeastern Cameroon. Using the belt-transect method, the author estimated the density of stems and the productivity of edible tubers at 147 per hectare and 118 kg per hectare, respectively. These values are much higher than found in other studies. This mountain is one of several areas which local Baka hunter-gatherers recognize as rich in *D. praehensilis*. Such places would have made it possible for old hunter-gatherers who had never lived in the forest interior to have done so.

Key Words: Baka hunter-gatherers; Wild yam; *Dioscorea praehensilis*; Tropical rainforest; The yam question.

INTRODUCTION

Since the late 1980s, the question whether human beings can live independently of agriculture in tropical rainforests, known as the Yam question (Headland, 1987), has been argued. However, the prehistoric sites excavated in east D. R. Congo in the late 1990s has brought the argument a new development. Mercader (2003) excavated ten rock shelters in the Ituri Forest and found Late Stone Age (LSA) to Iron Age assemblages there. Their phytolith analysis verified that these sites were in forested areas from 18,800 to 900 B.P., when hunter-gatherers continued to use these rock shelters. Then, Mercader & Martí (2003) also excavated some Middle Stone Age (MSA) and LSA sites in Cameroon and Equatorial Guinea and reported that these sites had been in a forest environment. These findings could contradict the hypothesis that human beings have never lived in tropical rainforests without agricultural products, which was proposed by Headland (1987) and Bailey et al. (1989). However, all the questions have not been driven away. We have not answered the question of Hart and Hart yet, that is, it is unlikely that hunter-gatherers would have gone out of their way to live independently in the forest interior, when many of the food species they exploit are more abundant toward the savanna border (Hart & Hart, 1986). Although we need to resolve the questions of what made it possible or how they lived there, archaeological and ecological data about

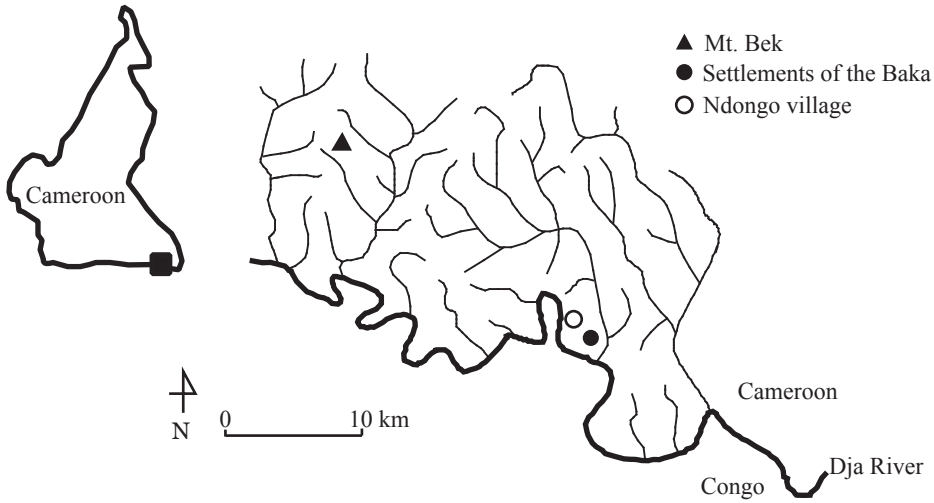

Fig. 1. Research Area.

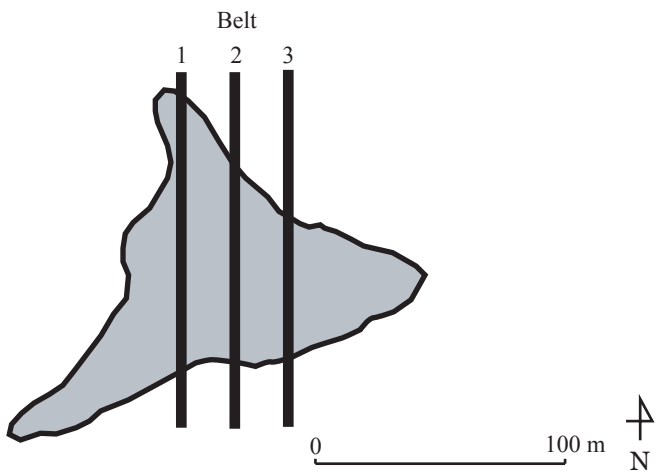

Fig. 2. The Top of Mt. Bek and Direction of Research Belts.

Paleolithic forest dwellers, their habitats and their subsistence systems is still scarce.

Since 1995, in order to examine whether wild yams are the most reliable candidate as the staple food supporting a pure foraging life in tropical rainforests, the author has conducted transect surveys of the density and productivity of wild yams and yam-like plants in six research sites in the southeastern part of Cameroon, assisted by the Baka hunter-gatherers. He reported the high potentiality of these plants as a reliable staple food (Sato, 2001). In these surveys, however, the high density and high productivity of

Dioscoreophyllum cumminsii (Menispermaceae) and such perennial wild yams as *Dioscorea burkilliana* and *Dioscorea minutiflora* were estimated to be plentiful while *Dioscorea praehensilis* which was the most important wild food for the Baka hunter-gatherers was not much observed. During the surveys, most Baka assistants said frequently to the author that these research sites were not very rich in "safa," the Baka name of *D. praehensilis*, but a lot of "safa" could be found in more remote forests where they built temporary hunting camps. The former surveys were conducted in the forests relatively close to the villages of farmers or the Baka hunter-gatherers. All research sites were within a day trip's distance, 1 to 10 km from the nearest village. In February 2000, the author visited Mount Bek which the Baka assistants recommended as a land rich in wild yams and he found a surprisingly large community of *D. praehensilis* on the top of the mountain. In this brief report the author describes the density of wild yams, especially of *D. praehensilis*, and estimates its productivity.

AREA AND METHODS

Mt. Bek, about 600 m above sea level, is located on latitude 2.20° N and longitude 14.73° E in southeastern Cameroon (Fig. 1). Since it takes two days on foot from the nearest village, the Ndongo Village, farmers have never visited it to make fields. The great artificial change of its vegetation, therefore, would have not occurred, but the small changes which the Baka hunter-gatherers have caused by digging out wild yams or collecting honey would be an exception. Although the vertical drop between Mt. Bek and the Ndongo Village is small, about 300 m, the topology is very undulate because of many hills and streams. The vegetation around Mt. Bek is a semideciduous forest (Letouzy, 1985) including several marshlands.

Basically the author adopted the same research method as in his former researches. He counted all but seedlings of standing stems of wild yams within a narrow transect belt (4 m×500 m). He had three straight belts in all which lined east and west at 25 m intervals. As shown in Fig. 2, these three belts strode over the flat top of Mt. Bek, triangular in shape with an area of about 7000 m^2, east-west 100 m and north-south 140 m. Counting stems and determining yam species, the author was assisted by four Baka men who had an intimate knowledge of the forest. In consideration of environmental factors influencing yam density, he divided the belts into 5 m long sections and classified the vegetation on each section into two types, "manja" and "bi", and the landform into two types, the slope and the top of the mountain. In the Baka language, "manja" means a clean forest without shrub or liana obstructing the view, and "bi," a thicket consisting of dense shrubs or lianas. The author used this classification used by the Baka assistants. In order to estimate the productivity of wild yams, he also weighed all the edible portions of standing stems found in the sample sections 4 m wide × 25 m long selected every 100 m from the starting point of each belt.

RESULTS

I. Wild Yam Species and their Density

Six species of wild yam were observed (Table 1). Among them, *D. praehensilis* was most densely distributed, followed by *D. minutiflora* and *D. burkilliana*.

II. Environmental Factors of Wild Yam Density

As shown in Tables 2 and 3, the density of the whole yam species was significantly higher in "bi" and on the top than in "manja" and on the slope respectively. The whole yam density was 407.1 per hectare in "bi" and 106.3 per hectare in "manja," and 602.3 per hectare on the top and 185.5 per hectare on the slope. Except for three species, *D. semperflorens*, *D. smilacifolia* and "njakaka" (an unidentified species) which were seldom observed, however, the relationship between the yam density and the environmental factors varied from species to species. Concerning the vegetation type, *D. praehensilis* and *D. minutiflora* had significantly higher density in "bi" than in "manja" while there was no significant difference between the two types in the density of *D. burkilliana*. Concerning the landform type, only *D. praehensilis* had significantly higher density on the top than on the slope. The density of *D. praehensilis* was 568.2 per hectare on the top of Mt. Bek. This high density, 5 or 6 stems per 10 m^2, was similar to that in a field.

III. Wild Yam Productivity

Twenty-one stems of *D. praehensilis* were observed in the 25 m sample sections. The average weight of their edible tubers was 803 g per stem (95% confidence interval: 0 to 1866 g), ranging from none to 10.7 kg per a stem. Although eleven stems of *D. minutiflora* were counted, there were no edible tubers. Among seven stems of *D. burkilliana* observed, one had 116 g of edible tuber, but the remaining six had none. The average weight was 20 g per stem (95% confidence interval: 0 to 69 g). No stems of other yam species were observed in the sample sections. Based on the average tuber's weight per stem

Table 1. Number and Density of Standing Stems of Wild Yams Observed in Three Transect Belts (0.60 ha).

Scientific name	Vernacular	Number	Density (N/ha)
Dioscorea praehensilis	"safa"	88	146.3
D. minutiflora	"kuku"	29	48.3
D. burkilliana	"keke"	24	40.0
D. semperflorens	"suma"	3	5.0
D. sp.	"njakaka"	3	5.0
D. smilacifolia	"baloko"	1	1.7
Total		148	246.7

and the density, the productivity of *D. praehensilis* could be estimated at 118 kg per hectare though its possible value ranges from 0 to 274 kg. That of *D. burkilliana* could be estimated at 1 kg per hectare with the range from 0 to 2.8 kg as well.

Table 2. The Composition of Number of Standing Stems of Yams in 5 m long Sections by Vegetation Type.

Yam species / Vegetation type	Type of sections by the number of yam standing stems							Number of stems	Area (ha)	Density (N/ha)
	0	1	2	3	4	5	6			
Dioscorea praehensilis										
manja) ***	135	12	1	1	1			21	0.32	65.6
bi	105	20	5	6	2	1	1	67	0.28	239.3
D. minutiflora										
manja) ***	159	1						1	0.32	3.1
bi	123	9	5	3				28	0.28	100.0
D. burkilliana										
manja	150	10						10	0.32	31.3
bi	128	10	2					20	0.28	50.0
D. semperflorens										
manja	160								0.32	0
bi	138	1	1					3	0.28	10.7
D. sp.										
manja	150			1				2	0.32	6.3
bi	139	1						1	0.28	3.6
D. smilacifolia										
manja	160								0.32	0
bi	139	1						1	0.28	3.6
Whole yam species										
manja) ***	133	23	2	1	1			34	0.32	106.3
bi	77	34	14	11	2	1	1	114	0.28	407.1

*** $p<0.001$ in Wilcoxon's test.

Table 3. The Composition of Number of Standing Stems of Yams in 5 m long Sections by Landform Type.

Yam species / Landform type	Type of sections by the number of yam standing stems							Number of stems	Area (ha)	Density (N/ha)
	0	1	2	3	4	5	6			
Dioscorea praehensilis										
slope) ***	225	26	3	2				38	0.512	65.6
top	25	6	3	5	3	1	1	50	0.088	568.2
D. minutiflora										
slope	238	10	5	3				29	0.512	3.1
top	123								0.088	0
D. burkilliana										
slope	237	17	2					21	0.512	41.0
top	41	3						3	0.088	34.1
D. semperflorens										
slope	254	1	1					3	0.512	5.9
top	44								0.088	0
D. sp.										
slope	254	1	1					3	0.512	5.9
top	44								0.088	0
D. smilacifolia										
slope	255	1						1	0.512	2.0
top	1								0.088	0
Whole yam species										
slope	188	48	13	7				95	0.512	185.5
top	22	9	3	5	3	1	1	53	0.088	602.3

*** $p<0.001$ in Wilcoxon's test.

DISCUSSION

I. Environmental Factors on Yam Density

The findings of this survey differed widely from previous surveys in the density of *Dioscoreophyllum cumminsii* and *D. praehensilis*. Although in former surveys, *Dioscoreophyllum cumminsii* was observed in all six research sites and had considerably higher density, 30 to 165 standing stems per hectare, none was observed in this survey. One site where the density of *Dioscoreophyllum cumminsii* was exceptionally low in the former survey was within the forest which was about 6 km away from the nearest village and was not very disturbed by human activities. The other five sites where it was densely distributed were near villages and within the fallows or forests from which timber had been cut in the past. On the one hand, Mt. Bek has kept nearly unspoiled because the main human group visiting it was the Baka hunter-gatherers who engaged in foraging activities, not in farming. This suggests that human activities such as making fields or cutting timber could promote the spatial distribution of *Dioscoreophyllum cumminsii* in the tropical rainforest of southeastern Cameroon. Both the tasty tubers and sweet fruit of this yam-like plant are used as food by forest dwellers. Human beings may contribute to the high density of this plant in the forests near villages not only by providing sunlight-rich forests by clearing, but also by playing the role of seed-dispersants.

Our short-term research of an experimental pure foraging life confirmed that *D. praehensilis* could be the most important food as an energy source for the Baka hunter-gatherers leading a foraging life within the deep forest (Sato, unpublished data). In the former belt-transect surveys, nevertheless, its density was very low in all research sites. This suggests that *D. praehensilis* may not be distributed ubiquitously, but unevenly in the tropical forests of southeastern Cameroon. Mt. Bek is likely to be one of the places where *D. praehensilis* is distributed most densely. The Baka people living in the Ndongo area mention frequently that they could get a stack of "safa" tubers from Mt. Bek. This survey proved their assertion true. Why is *D. praehensilis* distributed so densely on Mt. Bek? One of the reasons could be because the forest on Mt. Bek is rich in sunlight. In general, wild yams prefer sunlight-rich environments to sunlight-poor ones: artificial secondary forests to primary forests (Hart & Hart, 1986; Hladik et al., 1984) or "bi" to "manja" (Sato, 2001). According to Hladik et al. (1984) who conducted the botanical surveys of African wild yams in Gabon and southeastern Cameroon, *D. praehensilis* also followed this pattern. The top and upper slopes of Mt. Bek, which is not so high but prominent on the flat lowland, are sunnier than the lowland forest. Sunny forests on upper mountain slopes are likely to provide *D. praehensilis* with good conditions for growing. This premise gains strong support from the fact that almost all the places where the Baka people recognize to be abundant in "safa" are mountainous areas like Mt. Bek. In this survey the flat top of Mt. Bek had the higher density of *D.*

praehensilis than the slopes. This can be also attributed to the difference in the richness of sunlight between the top and the slopes.

We also need to consider the human factor as it appears certain that the wild yam tubers on Mt. Bek have been used by some human groups for a long time. During this survey we collected a few items of earthenware debris from the surface of the top of Mt. Bek (after that, in December 2003 when we conducted an anthropological field survey, we collected more debris scattered in the same area on Mt. Bek). Our Baka assistants knew neither who had been the earthenware's users nor when it had been used. Because of the narrow top and the steep slopes of Mt. Bek, its users would not have had the intention of clearing crop fields there, but they may have stayed temporarily for some other activities. Whether they were farmers or hunter-gatherers, they must have depended on the wild yams on Mt. Bek at that time. Why then have not the wild yam resources been depleted in spite of such long-term exploitation? It is probable that gathering pressure was low because Mt. Bek was mountainous and in a remote area from neighboring villages. There is another possible explanation: that is, the way of sustainable use of wild yam tubers. When the current Baka hunter-gatherers dig out "safa" tubers in the forest, they often intentionally deposit the upper small part of the "safa" tuber in the ground and expect germination from it. Dounias (1993) called such a way of collecting "safa" by the Baka hunter-gatherers "paracultivation". If the early visitors to Mt. Bek were ancestors of Baka hunter-gatherers, their way of sustainable use of "safa" is likely to have contributed to the preservation of its richness.

II. Productivity of *D. praehensilis*

The productivity of *D. praehensilis* on Mt. Bek was estimated at 118 kg per hectare, however, the confidence in this value is low due to the small number of samples. Although there is a question regarding confidence, this value is much larger than ones in preceding studies: 2.39 kg/ha including all edible wild tubers in Central Africa (Bahuchet et al., 1991) and 3.0 kg/ha including only wild yams' tubers in southeastern Cameroon (Hladik et al., 1984). In addition, the uncommonly high density of *D. praehensilis* on Mt. Bek suggests the potential for high productivity. It was as if the top of Mt. Bek which bristled with the stems of *D. praehensilis* had been a cultivated field. Hart & Hart (1986) were right to question whether the hunter-gatherers could lead a life independent of agriculture in the forest interior poorer in edible food resources than the savanna border. If their food resources were distributed sparsely, they wouldn't have taken the trouble to go into the forest interior. However, if there were many places like Mt. Bek dense with starch food resources in the forest, hunter-gatherers would desire to live there. In the future we should investigate the biomass of *D. praehensilis* in such places similar to Mt. Bek and how many such places there are in the tropical rainforest of southeastern Cameroon.

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