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Observations on the Illness and Consumption of a Possibly Medicinal Plant *Vernonia amygdalina* (DEL.), by a Wild Chimpanzee in the Mahale Mountains National Park, Tanzania

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ABSTRACT. Detailed observations on the consumption of *Vernonia amygdalina* (DEL.), a naturally occurring plant of known ethnomedicinal value, by an adult female chimpanzee (*Pan troglodytes schweinfurthii*) of M-group in the Mahale Mountains, Tanzania were made. Chewing the pith of several shoots, she sucked out and swallowed the astringent, bitter tasting juice; spitting out the fibrous remains. The female was followed during this period for 11 hr, over two consecutive days, and was recognized to be in irregular health at the time of consumption, exhibiting signs of lethargy, lack of appetite, and irregularity of bodily excretions. The low frequency and lack of seasonality in the usage of this plant suggest that it is sought after for reasons other than as a food source. These factors suggest that for chimpanzees, the consumption of this plant is primarily medicinal. The symptoms displayed by the female are the same as those experienced by people throughout tropical Africa who utilize this plant as a medicinal treatment for them. Interactions between the female and others suggest that they too were aware of her condition and coordinated their activities with the female and her infant.

Key Words: Chimpanzees; *Vernonia amygdalina*; Medicine.

INTRODUCTION

Observations on the consumption of certain plants containing medicinal properties have been reported for mammals (JANZEN, 1978), and in particular among primates (HAMILTON et al., 1978: *Papio ursinus*; PHILLIPS-CONROY, 1986: *Papio hamadryas*, *P. h.*×*P. anubis* hybrid; WRANGHAM & NISHIDA, 1983, TAKASAKI & HUNT, 1987: *Pan troglodytes schweinfurthii*). PHILLIPS-CONROY (1986) suggested that the leaves and nutritious, tasty berries of *Balanites aegyptiaca* (L.) DEL., were eaten by *P. hamadryas* and *P. h.*×*P. anubis* hybrid as a prophylactic agent against schistosomiasis. This plant was found to be a regular part of their diet along parts of the Awash river, Ethiopia, where schistosomiasis was most prevalent. For WRANGHAM and NISHIDA (1983), it was the peculiar feeding habits of *Aspilia* spp. at Gombe Stream and Mahale Mountains National Parks, Tanzania, which first drew their attention to the possible use of medicinal plants by chimpanzees. They argued that *Aspilia* spp. were not eaten for their caloric value, as the leaves of all of these species were swallowed slowly and without chewing. Subsequent chemical analysis (RODRIGUEZ et al., 1985) and another report on a different species eaten, (*Lippia plicata* BAKER, of known medicinal use) in a similar manner at Mahale (TAKASAKI & HUNT, 1987), strengthened their hypothesis.

PHILLIPS-CONROY (1986) points out the difficulty in distinguishing the relative nutritional and medicinal value of many primate plant foods with known active secondary compounds. The above reports cited medicinal use of the plants utilized, but provide little or no information about the physical state of the user before and after consumption. An ideal example of plant consumption primarily for medicinal value, would be one in which utilization is distinguishable from the daily dietary habits of the population and in which consumption is identifiable with sickness in the individuals concerned. This paper reports on yet another plant species of known ethnomedicinal value possibly utilized for its medicinal properties by chimpanzees at Mahale. Detailed observations on the change in health and behavior of one individual, before and after its consumption are presented. Based on these observations and other available material, the acquisition and possible use of medicinal plants in chimpanzees are discussed.

METHOD AND MATERIALS

The M-group of chimpanzees in Mahale Mountains National Park, Tanzania was studied by M.A.H. for two five-month periods (August–December) in 1985 and 1987. Adult males and females were selected as study subjects and focal animal sampling was conducted (ALTMANN, 1974) following individuals for as long as possible. All members of the group were individually identified (HIRAIWA-HASEGAWA et al., 1984). All plant species utilized by them, were identifiable by the local Kitongwe/Kiswahili vernacular and Latin names (NISHIDA & UEHARA, 1981, 1983). During November and December 1987, M.S., accompanied M.A.H. into the field, assisting in plant identification, tracking, and observation of the study

Fig. 1. *CH* and her 2.5-year-old male infant *CP*.

subjects. M.S. is trained by his grandfather in the traditional Tongwe use of local medicinal plants.

The adult female chimpanzee, *CH*, was born in K-group circa 1958 and transferred into M-group where she has remained since 1981 (NISHIDA, 1979; HIRAIWA-HASEGAWA & HASEGAWA, 1988). *CH* has one surviving dependent 2.5-year-old male infant, *CP* (Fig. 1).

The Plant Consumed

Vernonia amygdalina DEL. (Compositae), a shrub or tree reaching up to 8 m, occurs naturally throughout tropical Africa. It is also frequently planted around villages and sold at markets in West Africa for its many uses (DALZIEL, 1937; BURKILL 1985). Of direct relevance to this paper is the widespread medicinal use of *V. amygdalina* throughout tropical Africa against parasites and gastrointestinal disorders in people and their livestock. Table 1 gives a detailed description of some of these ethnomedicinal uses. One other species, *V. colorata* (WILLD.) DRAKE, very similar in appearance, is known by the same vernacular names and apparently is not distinguished from *V. amygdalina* by the people in tropical Africa where both are found (DALZIEL, 1937). The medicinal use of both species are the same (IRVINE, 1961; BURKILL, 1985).

In English, this plant is called 'bitter leaf' because of the astringent, bitter taste of its leaves, root, bark, and stems (WATT & BREYER-BRANDWIJK, 1962; BURKILL, 1985). A bitter principle,

Table 1. Some ethnomedicinal uses of *Vernonia amygdalina* in Africa.*

Disorder/illness	Parts utilized	Countries/comments
Parasites:		
Schistosomiasis	root, bark	Zimbabwe, Mozambique: mixed with *Vigna sinensis*
Malaria (fever)	root, stem-bark, leaves	E. Africa, Angola, Guinea, Nigeria, Ethiopia: a quinine substitute
Antihelmentic	root, leaves	E. Africa: treatment in children for trematodes used as a suppository
	root, seeds	Nigeria: enteritis, worms
	leaves	W. Africa: crushed in water and given to horses for worms, and there also reports of cattle grazing freely on it, especially in the evening
	leaves	Nigeria: for nursing infants, passed through mother's milk
Amoeba	root-bark	S. Africa: cold infusion used as substitute for ipecacuanha (ipecac) a source of emetine
Epidermal affections	leaves	Nigeria: treatment for ringworm, schistosome, and dermititis
Intestinal upsets:		
Constipation	leaf, sap	Nigeria, Tanzania, Ethiopia
Diarrhea	stem, root-bark	W. Africa
Unspecified	stem, root-bark, leaves	Angola, Nigeria, E. Africa
Miscellaneous:		
Scurvy	leaves	Sierra Leone, Nigeria, W. Cameroons; leaves sold in markets
"Heart weakness"	root	W. Africa: substance known as vernonin, a cardiotonic glycoside comparable to digitalin, a heart stimulant
Lack of appetite	leaf	W. Africa; leaves soaked and squeezed several times in cold water and boiled for use in soup
Coughing	leaf	Ghana, Nigeria, Tanzania
Rheumatism	stem, root-bark	Nigeria

*Sources taken from DALZIEL, 1937; WATT & BREYER-BRANDWIJK, 1962; KOKWARO, 1976; BURKILL, 1985.

vernonine, has been demonstrated and found to be 100% fatal when injected subcutaneously in mice at 10 g/kg body weight. It has also been found to have a hypotensive effect on dogs (IRVINE, 1961). M.A.H. conducted field experiments on the infusion's toxicity, using *Barbus semifer* minnows (3 g dried leaves/100 ml water) in a series of diluted test solutions. It was not possible to use shoots for the field bioassay because of problems with mold when drying the specimens. However, the chemical composition of the active substance found in the leaf is considered to be the same as that found in the pith. The solution was found to be fatal at 20% (% infusion of 500 ml water) within 6 hr.

NISHIDA and UEHARA (1981, 1983) included *V. amygdalina* in the natural diet of the chimpanzees of Mahale in both K- and M-groups. According to their 59-month survey between 1973 and 1981, the leaves, pith, and bark were utilized. There is no apparent seasonality in its use, as it was recorded year round. The relative frequency of utilization during this period is not given, but they cite 21 cases for which the feeding bout time was recorded (NISHIDA & UEHARA, 1983). UEHARA (unpubl. data), during 29 months of this survey (K-group only), recorded its use 26 times (15/21 cases given above) by 12 individuals. It was the pith that was utilized in all but two of these cases. In one of these cases the user, a male, was apparently recovering from an influenza-like sickness (see UEHARA & NYUNDO, 1983; UEHARA, unpubl. data). The four individuals, *CH*, *WD*, *GW*, and *WL* (all presently in M-group) were observed by UEHARA to have eaten this plant at least two or more times; *CH* was observed to do so seven times (UEHARA, unpubl. data). During M.A.H.'s ten-month study its consumption by chimpanzees in M-group was observed only once as described below. This plant is found in the woodland zone of the M-group's home range. According to WRANGHAM (1975), at Gombe, the pith of *V. colorata* is eaten. No indication however is given about the frequency of its use or the physical state of individuals observed consuming it.

OBSERVATIONS

On November 21–22, 1987, *CH* was observed for a total of 11 hr 8 min. The observations are split up into three periods for comparison of the change in *CH*'s activity patterns over time, and between *CH* and other adult females. The periods are defined as follows: day one (12:41–17:55; 267 min), day two/morning (9:07–12:49; 222 min), and day two/afternoon (13:06–16:05; 179 min). With the exception of an initial 28 min ad lib. observation between 12:41–13:22 on day one, all were made by focal animal sampling.

Figure 2 shows *CH*'s travel route during these two days of observation. The following is a condensed version of these observations.

DAY ONE (clear)

CH and *CP* are first seen at 12:41 (Fig. 2), in a mixed group with nine others (*LJ*, *KZ*, *JI*, *WD*, *MG*, *MA*, *WL*, *AS*, and *SF*). At 12:54 *CH* splits off from the group with the two other adult females and their three offspring, heading south away from the river, in the Hwasi valley, into the forest. At 13:05 we find *CH* resting in a tree and *CP* nearby. *WD*, her 8-month-old female infant *MG*, and adolescent son *MA* are with them. We follow *WD* as she and her offspring move off to forage at 13:22. At 13:56 we return following *WD* to *CH*, who is now sleeping in a day bed in the same tree as before (*CH* becomes the focal animal at this time).

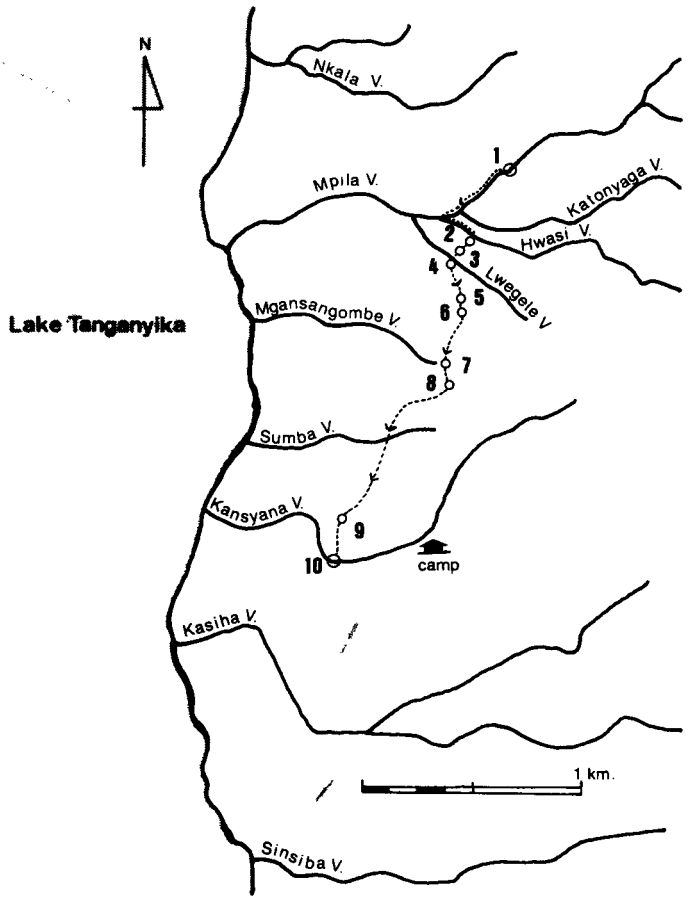

Fig. 2. Travel route of *CH* between November 21 and 22, 1987. 1: Nov. 21, 12:41; 2: 13:05; 3: 14:13; 4: 16:53–17:17; 5: 17:39–; 6: Nov. 22, 9:07; 7: 11:03–11:31; 8: 13:06; 9: 13:51; 10: 16:05.

At 14:02, *CH* climbs down and the group moves on south. While *WD*, *MG*, *MA*, and *CP* move ahead in the trees and on the ground foraging, *CH* slowly follows behind. *WD*, *MA*, and *CP* stop and feed on *P. purpureum*. At 14:13 *CH* goes directly to and sits down in front of a 2 m high shrub of *V. amygdalina* (Fig. 2, No. 3). She pulls down several young branches, approximately 2.5 cm in diameter at the base and 1 cm at the tip, to her lap and peels off the outer bark, leaves intact on the bark, exposing approximately 25 cm of pith from the tip down. This distal portion of the shoot is flexible and succulent (Fig. 3).

CH bites this portion off into several 5–7 cm portions, each time chewing them for several seconds. While doing so she makes a conspicuous sucking sound as she extracts and swallows the juice, spitting out the remaining fibers. Continuing in this manner, she processes several (not counted) shoot tips until 14:25.20. She pauses and begins moving her tongue around the inside of her mouth and teeth, opening and closing her lips slightly as if cleaning the inside. She makes no recognizable facial expression but her mouth seems to be affected by the substance she is eating. At 14:27.15 she shifts position and pulls down a dried stalk of *Pennisetum purpureum* SCHUMACK, and feeds on the larvae, eggs, and worker ants (*Crematogaster* sp.)

Fig. 3. Branch tips of *Vernonia amygdalina*.

found inside. At 14:30.54 she begins again to feed on *V. amygdalina* and until 14:35.07 she extracts the juice from four 15–25 cm long shoot tips.

During this time *CP* and *WD* sit nearby. *WD* is feeding on the tender pith of shoots of *P. purpureum*, and shows no interest in *V. amygdalina* although she is sitting on top of the bent over shrub to get at the grass. *CP* frequently shows interest in what *CH* eats by begging for the contents of her mouth. *CP* picks up pieces of the plant *CH* drops from her mouth and the discarded leaves and bark, putting them in his mouth for a few seconds but quickly discards them. *CP* continues to chew on the pith of small shoots of *P. purpureum* with *WD*. *CP* latter co-feeds with *CH* when she feeds on larvae, eggs, and worker ants (*Crematogaster* sp.).

After a brief rest, *CH* gets up and moves. The others follow behind. They occasionally forage on *Aframomum* sp. *CH* frequently stops to rest. At 15:01 *CH* and *WD* climb up a large tree. *WD* begins to feed on *Saba florida* (BENTH.) BULLOCK fruit and *CH* makes another day bed, resting until 15:30 when *WD* climbs down and sits on the ground below. *CH* leaves her bed and climbs part way down the tree. She stops and builds another day bed. *WD*, after a few minutes hesitation climbs back up into the tree and makes another bed next to *CH* at 15:33.

At 16:49 *CH* climbs out of her bed and urinates off the side. Viewed in bright light, her urine is unusually dark colored. *CH* slowly follows behind *WD*, *MA*, and *CP*. At 16:53 they cross the river in the Lwegele valley and *CH* takes a drink of water. They all forage on *Aframomum* sp. until 17:17 (Fig. 2, No. 4). *CH* slowly follows behind them, frequently stopping to rest. When *CH* reaches (17:29) the others, *WD* and *MA* have already begun to make their night beds. *CP* is waiting on the ground. *CH* attempts to defecate but appears to

Fig. 4. *CH* lying on a fallen tree to defecate.

be in pain when doing so. The discharge is slow but not firm. She climbs up and lays sideways on a fallen log and continues to defecate in small amounts (Fig. 4). At 17:36 *CH* climbs up into the closest tree attempting to defecate twice more, resting every meter or so. At 17:39 she begins to build a night bed and settles down at 17:44 (Fig. 2, No. 5). Observations are stopped at 17:55.

DAY TWO/MORNING (clear)

At 9:07 *CH* and *CP* are first seen, together with nine others in a mixed group (*DE*, *JI*, *WD*, *MG*, *MA*, *WL*, *AS*, *PT*, and *GW*) at a spot approximately 60 m from where they were left the night before (Fig. 2, No. 6). At 9:15 *CH* moves away and lays down at the edge of the group, leaving *CP* to play with two adolescents *AS* and *MA*, and a young adult female *PT*. At 9:59 *CP* follows *PT*, and *CH* slowly follows behind. Soon the whole group moves south-west.

At 10:00 *CH* splits off from the group leaving *CP* among them. She appears to be deficating normaly and urine color is back to normal. Until 10:38 *CH* remains separated from the group. *CH* frequently stops to rest or lie down. At 10:42 *CH* is seen for the first time today to eat. *CP* is now moving with her. *CH* briefly feeds on the fruits of *Garcinia huillensis* OLIV. and *Ficus urceolaris* WELW. ex HIERU. *CH*'s appetite appears to be coming back, although she frequently rests. Between 11:03–11:31 she forages on *P. angolensis* (WELW.) WARB. and *Ficus capensis* THUNB. (Fig. 2, No. 7). At this time *CH* and *CP* approach *DE*, *WD*, *MG*, *MA*, *GW*, and *PT*. They all lie down and rest for the next 72 min until 12:49 when they all suddenly stand up and move south.

DAY TWO/AFTERNOON (clear)

At 13:06 the group is relocated (Fig. 2, No. 8). *CH*, *CP*, and *GW* leave the group and continue south-west. Pausing only occasionally for the next 38 min, they cross the Sumba valley and climb down into the lower Kansyana valley (Fig. 2, No. 9). At 13:51 they begin to forage in the Kansyana valley along the river bed on *P. purpureum*. *Aframomum* sp., *F.*

ureolaris, *S. florida*, and *Crematogaster* sp. *CH* feeds steadily until the observations are terminated at 16:05.

DISCUSSION

CHANGES IN *CH*'S ACTIVITY PATTERNS

During these observations it appeared that *CH* was ill and that she gradually recovered. On day one, she appeared to be suffering from internal discomfort, lethargy, and a loss of appetite. This continued into the morning of day two. Later on in the morning, visible signs of a change were apparent. By that afternoon *CH* showed noticeable improvements in appetite and stamina.

In order to better evaluate the changes in *CH*'s behavior at these different stages, her activity was broken down into five basic patterns; lie in day bed or on ground, forage, travel, move-intermittent rest, and socialize. The results are given in Table 2. These results support the above conclusions.

On day one it was possible to directly compare her activity patterns with that of others in the same group. From 13:56 until 17:36 when *WD* began to build a bed for the night the two remained in close proximity. *CH* spent 51% of her time laying down and 28% foraging. The trend in *WD*'s behavior was reversed. She spent 54% of her time foraging and 35% resting in a day bed or on the ground.

For further comparison, activity patterns from focal observations of three adult females during similar time periods of the day in the same season, were calculated and given in Table 3. The variation that exists among individuals can partly be attributed to factors such as weather and group size; which indirectly affected day ranging patterns, feeding schedules, and opportunities for social contact (HUFFMAN, unpubl. data). These results further establish *CH*'s untypical behavior and change in health, suggesting marked recovery of appetite and strength sometime in the second day. The difference in the amount of time spent lying down and foraging between *CH* and these females is apparent.

INTERACTIONS BETWEEN *CH* AND OTHER CHIMPANZEES IN RELATION TO HER SICKNESS

Observations of interactions between *CH* and *CP* and a few other chimpanzees during this period, suggest that they were aware of her irregular health.

Table 2. Change in *CH* activity pattern during illness, with a comparison to that of *WD* for day one.*

Observation period		Lie in day bed or on ground	Forage[1)]	Travel[2)]	Move, intermittent rest[3)]	Socialize	Time (min)
Day One:							
	CH	(115) 51%	(63) 28%	(0) 0%	(41) 18%	(5) 2%	224
(afternoon)	*WD*	(77) 35%	(119) 54%	(18) 8%	(0) 0%	(5) 2%	219
Day Two:							
(morning)	*CH*	(138) 62%	(36) 16%	(0) 0%	(41) 19%	(3) 3%	222
(afternoon)	*CH*	(0) 0%	(141) 79%	(39) 21%	(0) 0%	(0) 0%	179

**CH*: 625 focal min; *WD*: 219 ad lib. min. 1) Feeding and moving from one food source to another, but not stopping to rest for more than 5 min without feeding; 2) moving quickly, taking few rests, and rarely pausing to sit and rest. Movement between locations of other activities (i.e., sleep, eating, socializing, etc.); 3) moving slowly, pausing to sit and rest for periods frequently equally as long as time spent walking; not intermixed with other activities.

Table 3. Activity patterns of three adult females, observed during similar time periods as observations made on *CH*.

Observation period and individual	Lie in day bed or on ground	Forage[1)]	Travel[2)]	Move, intermittent rest[3)]	Socialize	Time (min)
Morning:						
WD, Nov. 16 (9:51–12:51)	(0) 0%	(114) 63%	(0) 0%	(20) 11%	(46) 25%	180
GW, Oct. 26 (9:53–12:16)	(55) 38%	(44) 31%	(19) 13%	(25) 17%	(0) 0%	143
PU, Nov. 17 (9:30–12:38)	(14) 8%	(102) 56%	(0) 0%	(6) 3%	(61) 33%	183
Afternoon:						
WD, Nov. 16 (12:59–17:45)	(3) 1%	(117) 41%	(24) 8%	(49) 17%	(93) 33%	286
GW, Sept. 24 (13:00–17:17)	(0) 0%	(37) 22%	(4) 2%	(0) 0%	(126) 76%	167
PU, Nov. 17 (12:44–17:26)	(73) 27%	(177) 64%	(17) 6%	(8) 3%	(0) 0%	275

Watendele (*WD*); 466 focal min, *Gweklo* (*GW*); 310 focal min, *Pulin* (*PU*); 458 focal min. 1) Feeding and moving from one food source to another, but not stopping to rest for more than 5 min without feeding; 2) moving quickly, taking few rests, and rarely pausing to sit and rest. Movement between locations of other activities, (i.e., sleep, eating, socializing, etc.); 3) moving slowly, pausing to sit and rest for periods frequently equally as long as time spent walking; not intermixed with other activities.

On day one, *WD* remained with *CH* after they split off from the group. *WD* and her offspring left *CH* and *CP* alone for 34 min, but returned, as if expecting *CH* to still be there. For the rest of that day *WD* maintained a pace that allowed *CP* to move with them while *CH* followed slowly behind. In this way *WD* and *MA* acted as protectors of *CP*, as *CH* was not responding adequately to *CP* by letting him wander off on his own. *WD* could have easily left *CH* and joined other chimpanzees on several occasions. In one instance (15:30) the coordination of activities was obvious when *WD*, after initially climbing out of the tree, climbed back up into it after *CH* had refused to follow her down to the ground. *WD* build a day bed next to *CH* and they remained there for 76 min. *CH* was also partially responsible for maintaining this proximity by taking advantage of the time *WD* foraged in the same tree to build a bed and sleep (15:01).

On day two *GW* watched over *CP*, intervening when *CP* was abused by her older playmates, while *CH* slept. The group members allowed *CP* to move with them while *CH* stayed away to rest. At 13:06 *GW* moved away with *CH* when she separated from the group and watched over *CP* while *CH* feed on her own. During this period she made no attempts to forcefully draw *CP* away. Instead, she followed behind the two or stayed close ahead, following *CP* whenever he strayed too far from *CH*.

The consumption of *Vernonia amygdalina*, a plant of known medicinal properties (GITHENS, 1949; WATT & BREYER-BRANDWIJK, 1962; BURKILL, 1985), by a wild female chimpanzee was observed. Documented in detail for the first time, irregular health of the user at the time of consumption was confirmed.

From our experience in eating many of the food items of the M-group chimpanzees utilized during the research periods, we concluded that this plant was an exception to their (and our) normal taste preferences (HUFFMAN, unpubl. data). KALMUS (1970) notes the similarities in human and chimpanzee taste preferences, especially their aversion to strongly bitter tasting substances. We expected that the very bitter, astringent qualities of this plant should discourage chimpanzees from eating it. On the contrary, the adult female consumed in a liberal amount, the source of this bitterness in a highly concentrated form. The quickness with which *CH* began preparation, and consumption, as well as the time spent in the activity (1,006 sec.) shows that *CH* approached the plant with the intention of eating it. On the other hand, *WD* (known to have eaten this plant on several occasions), showing no apparent irregularities in

health at the time, paid no attention to this plant while foraging next to *CH*. The relatively low frequency with which this plant is consumed, despite an apparent lack of seasonality (NISHIDA & UEHARA, 1983), and year round availability, suggests that it is not sought after as a food source. These factors strongly suggest to us therefore that in chimpanzees, the consumption of *V. amygdalina* is primarily medicinal.

At this point information is limited and any further conclusions can only be speculative. However, suggestive evidence from a variety of sources and interesting similarities in the ethnomedicinal use of *V. amygdalina* and that by *CH*, have been recognized and raise important questions about the acquisition and use of medicinal plants by chimpanzees.

The strong bitter taste of *V. amygdalina* is an interesting factor in the use of this plant by chimpanzees. Among people of many cultures there appears to be an association made between bitterness and medicinal activity (GITHENS, 1949). Humans put up with the unpleasant bitter taste of many medicines, or disguise them, in order to benefit from the expected effects.

The Tongwe drink a cold water infusion of *V. amygdalina* extracted from 1–2 crushed leaves in 300–400 ml water for the relief of intestinal colic. It can take as long as 24 hr for the patient to feel better (M. SEIFU, pers. obs.; O. KABAJO, pers. comm.). It is not known whether *CH* had consumed *V. amygdalina* or other possibly medicinal plants on that day before we began to observe her. However, during our observations *CH* did not eat anything else different from her associates. The illness may have subsided in its own time, but it should be noted that approximately 23 hr had elapsed between observed consumption of this plant and *CH*'s remarkably obvious return to normal activity.

The continuation of the use of a given medicinal plant should be based on the experience of whether it produces satisfactory affects or not. It was noted above that the use of this plant has been recorded for several individuals, most of them more than once (UEHARA, unpubl. data). However, this does not explain how such plants are originally selected. Random experimentation does not seem likely, given the high degree of conservatism found in chimpanzee feeding habits (NISHIDA et al., 1983). A growing body of literature suggests that animals modify their diet on criteria other than just nutritional or caloric value, and that these modifications may partly be in response to specific hungers and long-delay learning (RICHTER, 1943; ROZIN & KALAT, 1971; ROZIN, 1977; REVUSKY, 1984). Such a mechanism would be beneficial to animals living in environments with a high risk exposure to disease (PHILLIPS-CONROY, 1986).

The correspondence recognized between disease and the initial selection of specific plants may in fact be partly a result of such physiologically based mechanisms. According to REWELL's (1969) description of intestinal infections in chimpanzees, it seems possible that *CH* may have been suffering from some such sickness. Avoiding any specific diagnosis however, the symptoms observed in *CH* (i.e., lethargy, loss of appetite, irregularities of bowel habit, and urine color) were comparable to those expected to be exhibited by humans suffering from some of the illnesses described in Table 1.

Of primary concern to us, are the observable social parameters of this phenomena. Not all individuals may be as equally sensitive to such cravings, thus the benefits of observational learning and cultural transmission, which allow many individuals through the experience of a few, to acquire new information (NISHIDA, 1987) should be of major importance. It has frequently been observed that chimpanzees show interest and concern for the injuries or sickness of others (see GOODALL, 1986). UEHARA and NYUNDO (1983) have reported a case of temporary adoption, in K-group, for at least six days by *GW* and *WL* of *CH*'s previous

infant *KB*, when *CH* was ill with a influenza-like sickness that had spread through the group. During our observations, the responses of a few individuals to *CH*'s 'untypical' behavior suggested that they were aware of her condition and coordinated their activities with *CH* and *CP*.

Given this interest and awareness, the use of medicinal plants may be acquired by others, through *observation and association* of its use in the *context of sickness*. Thus far, we have two good examples of observation and imitation of the use of this plant. One case described here of *CP* observing *CH*, and another recorded by NISHIDA (unpubl. data) in January 1986, of a 4-year-old female *AB* observing her 18-year-old brother *KZ*. *AB* too only tasted it for a few seconds. If this plant is used primarily in conjunction with sickness, this association should become all the more obvious to those individuals showing interest and concern. TAKAHATA et al. (1986) have demonstrated in chimpanzees how rapidly new feeding habits are acquired when the suitability of an item is noticed. Unlike other primates (e.g., ITANI, 1958: CAMBEFORT, 1981) adult chimpanzees are capable of initiating such new habits into the group (TAKAHATA et al., 1986).

In this respect, transmission of the medicinal use of plants in chimpanzees may differ from that of other non-human primates. Thus far, reports of the medicinal use of plants in other primates appears to be characterized by widespread use throughout the group as a part of their regular diet (HAMILTON et al., 1978; PHILLIPS-CONROY, 1986). However, further observations are necessary to confirm this.

CH has been observed to eat all three species of plants thus far suggested to be of medicinal value at Mahale (TAKASAKI & HUNT, 1987; UEHARA & NYUNDO, pers. comm.). This suggests that chimpanzees may be using a diverse variety of plants for medicinal purposes.

The above discussion raises many important questions about the acquisition of plant use by chimpanzees for possible medicinal use, and its possible distinction from that of other primates. Further detailed observations of individuals using these plants must be made before these hypothesis can be tested. It will be of importance to evaluate the physical state of the users. This is not an easy task, because the symptoms of illness may not be apparent by just a few minutes or even hours of observation. Given that chimpanzees appear to be using a variety of plants for this purpose, the illnesses themselves may vary in degree of severeness from a minor headache to severe cramps. The identification and laboratory analysis of constituents from *suspected* plant species utilized by chimpanzees, followed up by careful observation may prove to be an effective means of collecting information in the future.

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