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Ethnophysiology and herbal treatments of intestinal worms in Dominica, West Indies

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Abstract

In rural Dominican ethnophysiology worms reside in a human organ called the 'worm bag'. Unchecked, worms can cause illness by growing in size and number, spreading out of the worm bag and into other organs. In this study of 'bush medicine', we use a measure of cognitive salience in free-listing tasks, which reveals five plants commonly used to treat intestinal worms. These were *Ambrosia hispida* (Asteraceae), *Aristolochia trilobata* (Aristolochiaceae), *Chenopodium ambrosioides* (Chenopodiaceae), *Portulaca oleracea* (Portulacaceae), and *Artemisia absinthium* (Asteraceae). Bioactive compounds appear to be present in all of these plants. The cognitive salience of these plant remedies coupled with evidence of biochemical properties suggest that they provide efficacious treatments for controlling intestinal parasite loads. © 2002 Elsevier Science Ireland Ltd. All rights reserved.

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1. Introduction

1.1. Scope of the paper

One common goal of ethnopharmacology and ethnobotany is to understand how people–plant interactions influence the health of indigenous populations. Study of traditional healing systems is most fruitful when it examines local models of human anatomy and illness alongside bioscientific perspectives (e.g. Browner and Ortiz de Montellano, 1986; Browner et al., 1988). Similarly, researchers can better understand treatment systems by adopting quantitative measures in tandem with qualitative observations (e.g. Moerman, 1979, 1989; Trotter and Logan, 1986). In this paper, we combine emic (view based on native knowledge) and etic (scientifically grounded categories of an observer (Winthrop, 1991)) approaches to investigate local conceptions and botanical treatments of intestinal worms among rural Caribbean villagers.

Specifically, we offer three contributions. First, we provide an overview of a Caribbean ethnomedical

system. Here we illustrate how Dominicans' notions of intestinal worms relate to the local model of health. Second, we discuss the plants Dominicans use as worm treatments and describe why locals consider them efficacious in controlling intestinal parasites. Last, we illustrate the utility of an ethnoscientific technique—the salience index—for identifying patterns of plant use.

1.2. Ethnopharmacological methods: why salience matters

Indigenous people's selection and use of plants ultimately depends on 'cultural constructions of efficacy' (Etkin, 1990: 28). Documenting culturally useful plants is aided by quantitative methods to target the most efficacious species among local pharmacopoeias. One assumption is that the most efficacious species are well known to respondents. For example, Moerman (1979, 1989) determined that plant species with higher frequencies of use among culturally isolated Native American groups generally contain higher levels of secondary alkaloids than plants with lower frequencies of use. In a study of Mexican–American plant remedies, species reported by high proportions of respondents show greater bioactivity than those reported by lower proportions of respondents (Trotter and Logan, 1986).

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Phillips and Gentry (1993) constructed a use value statistic to assess the importance of a given species in an ethnobotanical inventory. Use value of a plant is the number of uses listed by a respondent summed and divided by the number of interview sessions in which the respondent provided information about the plant. Mean use value for each plant in the inventory is the sum of values for each plant listed by each respondent divided by the number of respondents.

Although the approaches mentioned above are useful, none of them takes into account the salience, or psychological prominence, of plants listed by respondents. One way to determine salience of medicinal plants is to calculate the salience of plant names respondents give during free-listing tasks. Free-listing is an efficient ethnographic tool used to determine the constituents of a semantic domain (Bernard, 1994; Weller and Romney, 1988). This method is used in a number of ethnobotanical and ethnomedical studies to identify traditional remedies (e.g. Crandon-Malamud, 1991; Hatfield, 1994; Trotter, 1981). Several analytical techniques can be applied to free-list data, such as list length (Brewer, 1995) and frequency of mentions of items (Bernard, 1994; Weller and Romney, 1988). Salience, however, is especially useful because it combines frequency of mention with the order of mention (Smith, 1993; Robbins and Nolan, 1997). Because respondents tend to mention the most culturally important items first in a list, and efficacious plants are usually listed more frequently (Trotter and Logan, 1986), salience is the appropriate method for revealing which medicinal plants deserve special attention in our research. Though Martin (1995) and Cotton (1996) emphasize the importance of the salience of plants in free-lists, few if any ethnopharmacological studies use salience to determine the likely efficacy of medicinal species. Here we demonstrate the potential of the method for ethnopharmacology.

1.3. *The study site*

The Commonwealth of Dominica is a small, rural island nation located between the French Departments of Guadeloupe to the North and Martinique to the South (15°N, 61°W). The island is relatively undeveloped as it is extremely mountainous and without substantial agricultural or tourist industries. Dominica's population of about 70 000 people is of mixed Island-Carib, African and European descent. Most Dominicans are bilingual in Creole-English and French-Patois, though Patois is the language of folk medicine.

The study site is a village on Dominica's East Coast (i.e., the Atlantic, windward coast). This village is nestled at the crux of two 1400-foot mountain ridges that slope steeply into the ocean. These ridges trap rain blown in from the ocean. Consequently, the site gets

between 100 and 150 inches of rain per year. The vegetation surrounding the village is mostly littoral forest with pockets of lower montane rain forest (Beard, 1949).

The village is primarily a subsistence agricultural community with a population of about 650 full and part-time residents. In addition to subsistence gardens at the village periphery, most land within the village is cultivated with fruit trees and other plantings. Many families also maintain small house-gardens for condiments (e.g. peppers) and herbs for cooking and medicine.

Outside economic opportunities are few. Average annual income is approximately \$5000 EC (\$1850 US). More than half of the households have electricity. None has running water.

Remote even by Dominican standards, the village is located about a 40-min drive from the main road, at the end of a mostly unpaved lane. No villager owns a car. However, regular motorized transports to Roseau, the capital, leave the village at 05:30 h on weekday mornings.

Residents have limited access to health care, in part because of their remote location. The village shares a small clinic with the neighboring village. According to locals, the clinic is normally out of medications such as analgesics and antibiotics, though it does offer some first aid, immunizations, and medicine when available. The nearest pharmacy is 2 h away. A doctor is available at the government health center, 45 min drive from the village. In cases of emergencies, residents can call an 'ambulance'—actually a pick-up truck—which is sent from the health center and carries the patient back in the truck-bed. Thus, for less urgent cases, villagers take care of themselves with remedies made from either foraged plants, or herbs grown around the house in small gardens and containers. Locals call this type of medicine 'bush medicine' because it is based on 'bush' (or herbal pharmacopoeia) and because it is the type of medicine used by people who live 'way out in the bush'.

2. Methods

Fieldwork for this project was conducted during five trips to the study site between 1993 and 1998. Ethnographic data on worm treatments were collected using informal key informant interviews (by M.B.Q. and R.J.Q.), a village health survey, and free-list tasks (M.B.Q.).

The informal interviews were conversational and involved asking a representative sample of village adults about their own experiences with worms. The health survey involved asking every village mother (including healers) a series of recall questions regarding the health of family members. Women were asked about the

general health history and condition of all household residents. They were asked to recall any illness or injuries their family members had suffered in the past week, past month, and past year. Each time a woman mentioned an illness event she was asked how the person got sick to probe for the perceived etiology of the illness. Women were next asked what, if anything, anyone did to treat the sick person. If someone at home treated the sick person (which was usually the case), the woman was asked to describe the treatment.

The free-list interview was conducted with a quota sample of 30 adult villagers. This is approximately one quarter of the adult population. The sample contained five women and five men from each of the three major village hamlets. In each hamlet, one woman interviewed was in her twenties, one in her thirties, one in her forties, one in her fifties, and one in her sixties or seventies. The men were represented in the same manner. The quota was thus stratified equally regarding age, sex, and village location.

For these interviews, we asked our respondents to list all the names of plants that are used for treating intestinal worms. Next, respondents were asked to describe which part of the plant is used, how each plant is prepared, the appropriate dosage, and the relative efficacy of the treatment. This process of 'successive free-listing' resulted in an exhaustive inventory of all local flora known by informants for the treatment of worms, and the corresponding mode of use for each plant.

We determined the mean list length for all respondents, the frequency of mention of each listed plant, and the average salience value of each plant. To calculate salience values, each listed plant was ranked according to its order of mention, or relative list position. Next, the ranks were summed by 30, namely, the total number of informants, which yielded a composite salience value for each plant (Smith, 1993). The resulting scores revealed which plants have the greatest cognitive and cultural significance as botanical worm treatments among our sample of respondents.

Key informants from the village (identified by their reputations as plant experts and their interest in this project) helped in the collection of voucher specimens of each species. The vouchers, as indicated in Table 1, are housed in the herbarium at the University of Missouri–Columbia.

A literature search was conducted to identify studies of (1) cross-cultural concepts and treatments of intestinal parasites; (2) pharmacological properties of the plant species Dominicans use as worm treatments; and (3) other populations' use of plant species used as vermifuges in Dominica. A comprehensive electronic search was performed in MEDLINE, AGRICOLA, and the Social Sciences Citation Index. Search terms were *keywords*: antihelminthic, intestinal parasites, vermi-

fuge, worms, and all species names in Table 1. The electronic search was supplemented by a review of the bibliographies of retrieved materials.

3. Results and discussion

3.1. Ethnophysiology of worms

The concept of internal balance is a focus of rural Dominican ethnophysiology. For optimal function, the body should (1) maintain equilibrium regarding intake of food and drink and elimination of waste, and (2) remain at a neutral, warm state of equilibrium regarding hot and cold.

A version of the hot/cold humoral theory exists in Dominica. Food, medicine, mental and physical states are classified according to culturally ascribed 'hot' or 'cold' categories. The hot/cold humoral system has been documented throughout the New World, particularly in Latin America (for an overview, see Foster, 1994).

In the Dominican humoral system, every living thing has its own inherent degree of 'hot' or 'cold'. For example, some plants have an intrinsically 'cold' quality. If a person ingests a 'cold' plant, as either food or medicine, the plant will internally cool his body. Other plants are 'hot'. Ingesting them will heat one's body. Dominicans' humoral beliefs differ from their Hispanic neighbors in that, to Dominicans, most plants and animals share the same humoral temperature as humans (Foster, 1994). Most living things thus have a 'neutral' humoral quality. Many illnesses are also 'neutral' in humoral terms because the bodily insult was created by a condition outside of the hot/cold dimension.

A worm infestation is an example of a humorally neutral condition. Dominicans allege that intestinal worms, like most other animals (including humans) share the neutral humoral status. This is one reason that humans make good hosts for the worms, as do their dogs, cats, and livestock.

Rural Dominicans describe the human body as having a 'worm bag', an organ specifically for worms. The worms that occupy the bag come from dirt. Infants are born with empty worm bags. They acquire their initial worms by ingesting invisible worm eggs when they suck and chew on their dirty hands or other dirty objects. By the time a baby is a year old, worm eggs have hatched in his worm bag. Even a person who takes regular worm treatments maintains a worm supply by inadvertently ingesting small amounts of dirt (when gardening, on food, etc.) throughout his life.

According to local ethnophysiology, after one swallows food or drink, the substance passes from the mouth to the throat, behind the lungs, through the 'throat pipe' and down into the 'belly'. The belly is not an organ, but the general term for the abdominal cavity; or as one

Table 1
Plants mentioned as worm treatments

Plant's Patois name	Species name	Times mentioned	% of informants	Saliense score	Voucher specimen
<i>Sime kontwa</i>	<i>C. ambrosioides</i>	30	100	0.912	MBQ23, MBQ122
<i>Twef</i>	<i>A. trilobata</i>	27	90	0.621	MBQ14
<i>Set vil</i>	<i>A. hispida</i>	22	73	0.44	MBQ37
<i>Kupiyé</i>	<i>P. oleracea</i>	18	60	0.266	MBQ74
<i>Lapsent</i>	<i>A. absinthium</i>	12	40	0.148	MBQ129
<i>Papay</i>	<i>C. papaya</i>	6	20	0.054	Sight record
<i>Ti bom</i>	unidentified vine	3	10	0.06	MBQ71
<i>Goamye wouj</i>	<i>B. simaruba</i>	3	10	0.036	MBQ56
<i>Gwenabafei</i>	<i>P. tenellus</i>	3	10	0.045	MBQ48

informant put it, "The belly is like a bag. It holds everything under your lungs until your ass." In the belly, the throat pipe channels the food into the stomach. The stomach is a bag that 'pounds up all what you eat' then, bit by bit, squeezes portions of the food into the 'worm bag'.

From a Dominican viewpoint, all humans should have some intestinal worms at all times. Humans and worms have a symbiotic relationship. Worms function in the digestive process to refine food, turning it into rich blood, much the way that earthworms convert composting material to rich soil. Rich blood that the worms expel passes through pores in the worm bag and into the belly. Blood collects at the bottom of the belly in a funnel-like organ and then filters through the liver. From the liver, good, clean blood goes to the heart, and waste goes to the bowel.

There are some villagers who resent all worms as continual menaces—parasites that, despite creating some blood, mostly rob the body of nutrition. Most locals, however, assert that worms are generally beneficial and only dangerous or painful if they grow or multiply beyond the capacity of their worm bag. Outside of the worm bag, they steal nutrients from the host and begin to feed on other organs, primarily the stomach and 'tripe' (intestines).

People attribute several symptoms to worm infestation. One symptom is excessive gas. Worms, like humans, produce gas as a by-product of digestion. This gas, like blood, passes through the porous worm bag walls and into the belly. Gas that collects in the belly can exit upward, through the 'throat pipe' (throat) or downward, through the anus, depending on which part of the belly it was nearer to begin with. If a resident is suffering from unusual flatulence, he suspects he has a plethora of worms simultaneously digesting his food.

'Gripes' or abdominal cramps are another symptom of worm infestation. Gripes result from too many worms stretching the worm bag, or worms outside of the worm bag feeding on other organs. Finally, seizures are sometimes attributed to extreme cases of worm

infestation. Villagers call such a seizure a 'fit' or 'fix' of worms.

Ingestion of certain substances causes an overabundance of worms. Villagers suggest that dairy products, in particular, cause worms to thrive. They point to two phenomena as evidence for this claim. First, adults frequently experience stomach discomfort after eating dairy products, probably due to high levels of lactose intolerance within the population. Second, worms most often trouble young children who ingest plenty of milk, and babies (under two) who drink milk almost exclusively. Some residents say that sweet foods augment worm growth resulting in 'fits' or 'fixes' of worms, which actually may be diabetic seizures. Finally, eating dirt can introduce more worms and cause existing worms to grow and multiply. Hence, young children are at highest risk for worm infestation because they ingest more milk and tend to put dirty, possibly wormy things in their mouths.

Locals explain that worm medicines work by either 'killing' the worms or making the worms 'sleep'. Dead and sleeping worms lose their jaws from their hosts' internal organs. Thus they can pass through the remainder of their host's digestive system.

The existing cross-cultural literature on the ethno-physiology of worms is relatively scant. The Warao of Venezuela (Wilbert, 1986), the Highland Maya of Mexico (Berlin and Berlin, 1996), and the Luo of Kenya (Geissler, 1998) recognize contaminated food or water as the primary source for intestinal worms, as do Dominicans. Geissler points out that this view may be derived or reinforced by exposure to Western biomedicine. Whereas dirt is the only perceived worm source for Dominicans, the Warao (Wilbert, 1986) and Highland Maya (Berlin and Berlin, 1996) also allow that worms may appear through sorcery or spontaneously. A Guatemalan K'ekchi Indian (Booth et al., 1993) and rural Hondurans (Kendall et al., 1983) suggest that worms can pass from a mother to her children in breast milk. The Luo of Kenya (Geissler, 1998), the Manica of Mozambique (Green et al., 1994) and rural Hondurans (Kendall et al., 1983) suggest that some people are born

with worms. Dominicans say that everyone (except newborns) always has some intestinal worms, and that worm presence alone does not indicate illness. Similar views are found among Jamaicans (Sobo, 1993), and several African (see Geissler, 1998) and Latin American peoples (Kendall et al., 1984). Kendall et al., (1983) describe a remarkably similar notion of worms to that of Dominicans. In rural Honduras (Kendall et al., 1983), worms are said to live in a worm bag, or *bolsa*, where they aid in digestion. Notions of human-worm symbiosis also occur in various African groups (Bierlich, 1995; Geissler, 1998; Green, 1997; Zondi and Kvalsvig, 1996). In some Latin American populations, a human's soul allegedly resides inside one intestinal worm—the mother worm (Kendall et al., 1984; Booth et al., 1993). People in these societies attempt to control the offspring worms while not harming the mother. The Ronga of Mozambique (Green, 1997) and the Kenyan Luo (Geissler, 1998) maintain that worms react negatively to 'bad' foods (which Geissler explains may be rotten, taboo, or cursed). The Dominican view that worms react to sweet food is mirrored by the Venezuelan Warao who associate worm attacks with eating brown sugar (Wilbert, 1986). The Warao further attribute adult tooth decay to worms. Dominican villagers assert that consumption of sweets can trigger the seizures or convulsions they call 'fixes of worms'. In a similar vein, Geissler (1998) found that Kenyan Luo attribute vomiting and convulsions (possibly caused by malaria) to notions of internal worm migrations.

3.2. Ethnopharmacology of worms

Residents of the study site have a number of plants at their disposal for treatment of worm infestation (Table 1). In this section, we review the most salient plant species, their local preparation, and what is known from the literature of their chemical properties, geographical distribution, and uses in other localities.

3.2.1. *Sime kontwá*

Sime kontwá (*Chenopodium ambrosioides* L., Chenopodiaceae) had the highest salience value in our study (Table 1). Every informant included it in his or her free-list, and most people (73%) mentioned *sime kontwá* first. Some English common names for this species are 'worm grass', 'Mexican tea', and 'fit weed' (Simpson, 1962). In the French-speaking Caribbean, it is called *herbe á vers*, or *simén contra*. Dominicans refer to it as *sime kontwá* in Patois and English. *Sime kontwá* is a pantropical (Nicholson, 1991), aromatic herb that occurs in the forest and in cultivated zones throughout the study area. However, residents often transplant bushes to their yard or house garden.

Villagers drink a 'bush tea' of *sime kontwá* fairly regularly. They make the infusion by breaking and

dropping a branch about 25 cm long (this typically contains about 15–20 leaves), complete with twigs, leaves and flowers, into approximately one l of boiling water. They boil the herb until the water has a chartreuse tint to it. This takes less than one min. Half of the mothers in our study gave a small cup of *sime kontwá* 'tea' to their children every morning (the amount of liquid depends on the body size of the child). Others prefer to give it once a week or so. More than half of the informants could not say exactly how often they drink an infusion of *sime kontwá*. They say they drink it from time to time, sometimes in the morning, sometimes to relax in the afternoon. If they feel a little stomach discomfort, or if they suspect that their worms are troubling them, they make themselves a cup of *sime kontwá* 'bush tea'. A number of people related that they drink *sime kontwá* 'tea' until the bush by their house is nearly branchless. Then they drink other 'bush teas' while their plant rejuvenates. People who drink the infusion regularly say that they never (or rarely) have worms in their stool because the drink 'keeps the worms down' constantly. People who only drink *sime kontwá* when they feel worm symptoms say that dead and 'sleeping' worms come out with their feces after one or two days.

Oil of chenopodium, which is distilled from *C. ambrosioides* is a pharmaceutical product used against tapeworms, roundworms, and hookworms. The active component, terpene ascaridole, makes up about 65% of the oil (Lewis and Elvin-Lewis, 1977). The whole plant (Kapadia et al., 1978) and the extracted oil of chenopodium (El-Mofty et al., 1992) are carcinogenic to animals.

This species, *C. ambrosioides*, is used to treat intestinal worms throughout the Caribbean (Honychurch, 1986). It is also a vermifuge in Mexico (Berlin and Berlin, 1996), Guatemala (Booth et al., 1993) and South America (Kainer and Duryea, 1992; Schultes and Raffauf, 1990).

3.2.2. *Twef*

The Patois *twef*, *Aristolochia trilobata* L. (Aristolochaceae), is the second highest ranked worm remedy in the community. Ninety-three percent of our informants mentioned *twef*, and 20% mentioned it first. This vine is native to Dominica (Nicholson, 1991) and grows in bushy coastal areas and secondary forests throughout the Caribbean and Southern Central America (Honychurch, 1986). It climbs up trees in the Littoral Forest around the study site. Villagers transplant the vines to their yards where they typically grow up the sides of homes and outhouses.

Villagers use *twef* for worms and to settle upset stomachs, in the form of a leaf infusion. Village rum shops also sell shots (or 'shoots') of 'twef rum' (a tincture of approximately four *twef* leaves soaked in a

fifth of cask rum). Many men in the village say they prefer to take their *twef* with rum. For the infusion, villagers boil about half a *twef* leaf per cup of water for a few minutes (until the water changes color), then let the leaves steep in the water while the tea cools. Adults drink one cup of the infusion. Children take less, according to their body size. Villagers say that one dose of *twef* (cup of the infusion or shot of the rum decoction) usually kills all the worms that are 'outside' of the worm bag, although people who suspect they have a particularly bad infestation may take a second dose on the following day. Worms are said to appear in the feces within one and a half days of the first dose. Children under 5 years rarely drink *twef* because parents prefer to give them something milder. Villagers say that one 'must add plenty of sugar' to this tea and let it cool for a long time. This way one can drink it quickly, 'like a shot of rum'. They say that even this way, *twef* tastes terrible. Indeed, *twef* 'bush tea' is so awful that parents force their children to drink it as a punishment for speaking rudely.

Several villagers noted that this worm remedy worked at least as well—in fact more quickly—than other worm remedies. However, they prefer not to use it because of its bitter taste. In addition, they say that something that tastes so bad and works so quickly is obviously very strong. They believe *twef* might make one weak if taken often.

Aristolochic acids in this species are renal toxins in animals and humans (Lajide et al., 1993). Aristolochic acids extracted from *Aristolochi albida* (a Nigerian species) shows 'extremely strong' feeding-deterrent and larval growth-inhibition activity in bioassays (Lajide et al., 1993). This lends credence to their potential efficacy against parasites. However, aristolochic acids are carcinogenic, causing stomach cancers, and atrophy in the lymph glands (DeSmet, 1992). For that reason, *Aristolochia* species are banned in European medicines because of the dangers associated with aristolochic acids (Zhu and Phillipson, 1996).

Nicaraguan Miskitu and Ulwa Indians use *A. trilobata* for digestive problems, as well as for bites, respiratory disorders, and as a general tonic (Coe and Anderson, 1999). On the island of Marie Galante, *twef* is used as an emetic in case of poisoning (Honychurch, 1986). In Trinidad, this vine is used for diabetes, hypertension, dysmenorrhea, as an abortifacient, and for snakebites (Wong, 1976). It is also used for snakebites in tropical South America (Millsbaugh, 1892). In fact, almost all of the species in this genus are used in the countries in which they grow as remedies for poisonous snakebites. There are no poisonous snakes in Dominica, however (Coborn, 1991).

3.2.3. *Set vil*

Set vil, or *Ambrosia hispida* Pursh (Asteraceae), is the third most salient worm treatment in the present study. Seventy-three percent of the informants mentioned it, but none mentioned it first. Common English names for *set vil* are 'worm wood', 'ragweed', and 'bay geranium'. This perennial herb is native to Florida, the West Indies and Central America (Hodge and Taylor, 1957), and is a fairly common weed in the village. It grows wild in sandy, disturbed areas and is common along sunny roads and trailsides.

Other than as a worm treatment, residents use *set vil* as a poultice for muscle strains, sprains and bruises. For this purpose, they crush the whole herb and mix it with water or, preferably, castor oil, to make a paste. For worms, villagers steep the leaves and inflorescence of one branch in 2–3 cups of boiled water to make a 'bush tea'. They drink this infusion once a day for 2–4 days, until they no longer 'feel cramps around the worm bag', or until they see worms in their feces.

Although, this species tested positive for alkaloids (Raffauf, 1996), little is known of its chemical properties. People in Marie Galante drink *set vil* tea for high blood pressure (Honychurch, 1986). Island Caribs (Hodge and Taylor, 1957) and Rastafarians (Caesar, 1997) elsewhere on Dominica also use this herb for worms.

3.2.4. *Kupiyé*

In the present study, *kupiyé* (*Portulaca oleracea* L., Portulacaceae) was the fourth most salient herbal treatment. Sixty percent of our informants mentioned it, but no one mentioned it first. *Kupiyé* (purslane or portulaca in common English) generally goes by the name *pussly* throughout the English speaking Caribbean (Honychurch, 1986; Wong, 1976; Ausprey and Thornton, 1953). Dominicans, however, use the French Patois name *kupiyé*. This creeping succulent herb grows as a weed worldwide. In the village, it typically grows under the edge of stilted houses, by paving stones and in and along stone retaining walls.

Dominicans eat *kupiyé* raw as salad or cooked in soups and stews. They also crush the plant to make a poultice for backaches and dysmenorrhea. More commonly, Dominicans steep a crushed handful of the plant in two or three cups of boiled water to make a tea for worms.

Our informants assert that this medicine works well as a vermifuge. After eating *kupiyé* or drinking *kupiyé* tea for two or three days, they claim that one begins to see worms in the feces. They do not believe that *kupiyé* is a very strong medicine; hence, they consider it a good treatment for babies with worms. Because *kupiyé* is a mild medicine, villagers suggest that it is safe to eat between other types of worm treatments to keep the worms in check or 'calm'.

Kupiyé is one of only seven species in the Portulacaceae that tests positive for alkaloids (Raffauf, 1996). Chemical analyses of purslane show that the methanol extract of the plant's non-root parts contain portulacate-A (a monoterpene glucoside) which exhibits moderate antimicrobial activity (Sakai et al., 1996). *Kupiyé* also has a high concentration of oxalate, which results in oxalate toxicity when it is fed to animals. Oxalate interferes with the absorption and metabolism of trace minerals (Mohamed and Hussein, 1994). In addition, *kupiyé* is a nutritious vegetable, high in omega-3 fatty acids, beta-carotene (Kesden et al., 1987) and potassium (Mohamed and Hussein, 1994).

The chemical properties of *kupiyé* may account for its use as a vermifuge in geographically distant regions. For example, this species was used to kill parasites in Ancient Greece (Kesden et al., 1987). Present day populations in Trinidad use it to treat intestinal worms (Wong, 1976), and the *kupiyé*'s seeds are used as a vermifuge in Java (Burkill, 1966).

3.2.5. *Lapsent*

Lapsent (*Artemisia absinthium* L., Asteraceae) showed marginal salience in this study. Twelve people (40%) mentioned the plant; however, they consistently mentioned it near the end of their free-lists. This plant goes by the common names 'wormwood' (English), and 'absinthe' (French). Dominicans use the Patois name '*lapsent*'. This introduced native Mediterranean perennial (Millsbaugh, 1892) does not thrive in the study site. As far as we are aware, there is only one *lapsent* plant in the village, growing in a container near one family's house garden.

Residents have access to this treatment only because a few individuals and village rum shop owners buy dried *lapsent* in Roseau, the capital. They soak the *lapsent* in rum. Some adults take a shot of *lapsent* tincture about once a month as a worm preventative.

People of this village report that *lapsent* is an excellent vermifuge, along the lines of *sime kontwá* and *twef*. They like to use *lapsent* because they enjoy its licorice-like flavor. However, *lapsent* is more difficult to obtain and reportedly works no better than native plants that grow in abundance around the village.

The plant is an effective vermifuge that was probably used by colonial Europeans in the Caribbean. That this herb is present in Dominica is not surprising. France was once the leading producer of absinthe liquor, and the last country to ban it in 1915 (Conrad, 1988). Dominica is a former French colony and lies between two French islands.

In Western Civilization, *A. absinthium* has been renowned as antihelmintic since ancient times. Conrad (1988) found that references to this plant appear in Egyptian papyri, early Syrian texts, and in the Bible. Early European texts refer to applying decoctions of *A.*

absinthium externally for fleas and other vermin, and to drinking the decoctions as a tonic and vermifuge (Conrad, 1988). The herb is now widely used as a vermifuge. For example, it is used among peoples of Argentina (Spegazzini and Najera, 1984), British Columbia (Turner et al., 1980), and Kashmir (Singh, 1994).

3.2.6. *Less salient treatments*

In addition to the five species mentioned above, Dominicans in the study population mentioned four other plants. These are *papay* (*Carica papaya* L., Caricaceae), mentioned by six people; *ti bom* (unidentified species), mentioned by three people; *goamiyé wouj* (*Bursea simaruba* Sargent, Burseraceae), mentioned by three people; and *gwenabafei* (*Phyllanthus tenellus* Roxburgh, Euphorbiaceae) also mentioned by three people.

Villagers stated that they chew the seeds of ripe *papay*, or papaya fruit, for worms. Laboratory screening found these seeds to exhibit antiamebic activity (Tona et al., 1998). They may be effective against other parasites.

The sap of the *bwa goamiyé wouj* (Patois), or 'worm gum tree' (English) has a smell reminiscent of turpentine. One elderly woman explained that soaking a 2 cm ball of congealed sap overnight in about 70 ml of cask rum, then drinking the rum first thing in the morning before eating or drinking anything else, will 'kill plenty of worms immediately'. Then, subsequent food and drink will help push the dead worms through the worm bag. People in Montserrat drink a similar tincture 'to ease stomach distress' (Brussell 1997).

The people who mentioned using *ti bom* and *gwenabafei* said that they made 'bush teas' with the herbs by steeping one handful of fresh plant (all parts but the roots) in two cupfuls of hot water.

4. Conclusions

The potential antihelmintic properties of salient Dominican worm treatments suggest a methodological approach for medical ethnobotanists interested in identifying bioactive plants. Researchers may find it expedient to identify long-term endemic maladies accompanied by well developed local conceptions of physiologic processes. These are culturally and environmentally prominent illnesses of a population—conditions for which local people need effective treatments.

Culturally significant plant species may be more efficacious than species collected randomly (Balick and Cox, 1996; Khafagi and Dewedar, 2000). Because of this, we suggest a two-step research technique. First, investigators should identify illnesses of community concern. Then, free-lists can be used to find salient medicinals. Salient treatments are those with the most

community consensus, and are therefore the plants with the most cultural significance.

In this study, the five most salient worm treatments all have chemical properties that may make them effective vermifuges. Two of these species, *A. trilobata* and *P. oleracea* (the second and fourth most salient species) have not been documented as worm medicines until now. We found no references to possible chemical anthelmintics in the third most salient plant, *A. hispida*. These lesser-studied treatments merit scientific consideration as vermifuges for two reasons. First, this population has a multi-generational history of reliance on these plants as worm treatments. Second, Dominicans regard *A. trilobata*, *A. hispida* and *P. oleracea* as equally effective as *C. ambrosioides* and *A. absinthium*, two of the most common vermifuges in the ethnobotanical record.

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