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Research article

Medicinal and ethnoveterinary remedies of hunters in Trinidad

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Abstract

Background: Ethnomedicines are used by hunters for themselves and their hunting dogs in Trinidad. Plants are used for snakebites, scorpion stings, for injuries and mange of dogs and to facilitate hunting success.

Results: Plants used include *Piper hispidum*, *Pithecelobium unguis-cati*, *Bauhinia excisa*, *Bauhinia cumanensis*, *Cecropia peltata*, *Aframomum melegueta*, *Aristolochia rugosa*, *Aristolochia trilobata*, *Jatropha curcas*, *Jatropha gossypifolia*, *Nicotiana tabacum*, *Vernonia scorpioides*, *Petiveria alliacea*, *Renealmia alpinia*, *Justicia secunda*, *Phyllanthus urinaria*,*Phyllanthus niruri*,*Momordica charantia*, *Xiphidium caeruleum*, *Ottonia ovata*, *Lepianthes peltata*, *Capsicum frutescens*, *Costus scaber*, *Dendropanax arboreus*, *Siparuma guianensis*, *Syngonium podophyllum*, *Monstera dubia*, *Solanum* species, *Eclipta prostrata*, *Spiranthes acaulis*, *Croton gossypifolius*, *Barleria lupulina*, *Cola nitida*, *Acrocomia ierensis* (tentative ID).

Conclusion: Plant use is based on odour, and plant morphological characteristics and is embedded in a complex cultural context based on indigenous Amerindian beliefs. It is suggested that the medicinal plants exerted a physiological action on the hunter or his dog. Some of the plants mentioned contain chemicals that may explain the ethnomedicinal and ethnoveterinary use. For instance some of the plants influence the immune system or are effective against internal and external parasites. Plant baths may contribute to the health and well being of the hunting dogs.

Background

The aim of this paper is to evaluate the ethnoveterinary remedies used by certain hunters in Trinidad. Plants are used to treat snakebites and scorpion stings and for hunting success. During the research some hunters claimed that their dogs either started hunting or hunted better after they had treated them in various ways with medicinal plants. This study has evolved out of an interest in a non-experimental evaluation of Trinidad and Tobago's ethnopharmacopoeia. This evaluation establishes whether the plant use is based on empirically verifiable principles or whether symbolic aspects of healing are more important [1]. Hunters are principally interested in the following game animals: agouti (*Dasyprocta agouti*), matte (*Tupinambis negropunctatus*), tatou (*Dasypus novemcinctus*), deer (*Mazama americana trinitatis*), lappe (*Agouti paca*), manicou (*Didelphis marsupialis insularis*), wild hog/quenk (*Tayassu tajacu*). The hunting season lasts from October 1st to February 28/29, then there is a closed season for the rest of the year. There is no comprehensive published information available on the number of hunting dogs in the country.

Hunting dogs are typically foxhounds, 13 inch and 9 inch beagles, coonhounds (all original stock imported) and mixed breeds. These dogs are usually scent and not sight hounds.

Methods

Data collection

The research area is located in Guayaguayare on private land belonging to a State-owned oil company. This area also has a protected animal reserve where in theory no hunting is allowed. From 1997 – 1999, the authors conducted research with one group of seven hunters based in south Trinidad on this private land (not in the protected animal reserve). One of these hunters was Indo-Trinidadian, the others were Afro-Trinidadian or of mixed race. This research included participant observation [2], which involved taking part in five hunts over the three years (going into the forest, observing the chase and capture, sharing a meal and sharing of take home game). One veterinarian[1] served as the linkage and provided entrance to this group and facilitated the participation in the hunting activities. Hunts started thirty minutes after this veterinarian arrived with the first author and either one or both of the two female veterinarians, typically between 9 a.m and 11 a.m. Hunts ended when at least one agouti was caught. The earliest occasion being 14.00 hrs. After the return to the camp, cooking would take place. Stories would continue until 20.00 to 22.00 hrs. The ethnoveterinary remedies were written up into a handout. The authors joined in two social occasions in which each hunter in turn sat with the first author and added details to information already documented in the handout and confirmed his remedies. These social occasions lasted from 11.00 a.m. to 21.00 hrs.

Unstructured interviews were also held with four individual hunters in North Trinidad (Paramin) and two in Central Trinidad (Talparo) and four in Mayaro (South Trinidad). The interviews were an hour long in Paramin and Mayaro. Three eight hour days were spent talking to the Talparo informants while they worked on a cocoa and coffee farm. Paramin and Talparo retain Hispanic traditions either from the original Spanish colonists or from continuous small-scale immigration from Venezuela [3]. Many of the original Spanish colonists intermarried with Trinidad's original Amerinidian inhabitants. Two of the four hunters in Mayaro were Afro-Trinidadians the other two were of mixed race. The following information was collected from all respondents, the popular name, uses, part(s) used, mode of preparation and application. The ethnoveterinary handout was given to two hunters. These two hunters then used the documented information to provide 50% of the plants. A third hunter provided the plants that he used to bathe dogs for quenk hunting. The author collected the other 40% percent of the documented plants from the informants in Mayaro, Talparo and Paramin, and on one occasion when the hunting camp was being dismantled by three of the hunters for the closed season. The use of the plants was only reported, not observed. One plant bath was shown already prepared in Mayaro. All the plants were identified at the University of the West Indies Herbarium, but no voucher specimens were deposited.

Results

Environmental hazards

The following section outlines environmental hazards to hunters (and researchers) which may explain some of their bush medicine remedies. One research hazard was the presence of a mite infestation *Trombicula* species, in the area. These mites are called 'bête rouge' locally because of the orange colour of the larval cluster seen on the skin. The mites affect game animals like agouti and can attack man since they attach themselves to all mammals and vertebrates. The author can confirm that depending on the sensitivity of the individual a larval infection produces slight or extreme irritation. Lesions may persist after the larvae have left to begin their adult stage however the dermatitis disappears. The adult mites are free living on vegetation and are found in fruit- growing areas on chalky soil [4].

Yellow fever outbreaks in the past have affected howler monkeys (*Alouatte seniculus insularis*) and can spread to any mammals, since these monkeys are susceptible to sylvan forms of the human disease [5]. Another occupational and research hazard is the presence of constricting and venomous snakes. 'Belle chemin' (*Liophis melanotus nesos*) is a constrictor. The 'huile' (*Boa murina*) eats all vertebrates. There are two families of venomous snakes. Within the Elapidae family in Trinidad there are two poisonous coral snakes (*Micrurus lemniscatus*, *Micrurus circinalis*) which rarely bite dogs or humans since they are small, rare, and have retracted fangs [7]. *Micrurus* venom has moderate effects on blood coagulation and tissue integrity however victims rarely survive because the potent neurotoxin in the venom causes a postsynaptic blockade of neuromuscular transmission [6]. The neurotoxin can cause cranial nerve paralysis leading to neurotoxic facies or respiratory paralysis and death [6].

Some harmless snakes in the Colubridae family like *Leptodeira annulata ashmeadi*, *Leptophis ahaetulla coeruleodorsus*, *Clelia clelia clelia*, *Helicops angulatus*, *Liophis* species, *Oxybelis aeneus*, *Pseudoboa neuwiedii*, *Thamnodynastes* species, and *Tripanurgos compressus*, *Erythrolamprus* species,*Siphlophis cervinus*, *Oxyrhopus petola petola*, may bite and cause a reaction or mild envenomation [7]. The last three are called false

corals since they mimic true coral snakes for protection. Bites from false corals are more common than those of true corals [6].

Snakes in the Viperidae family are locally called 'mapepire'. These pit vipers have long, hollow fangs. The mapepire 'z'ananna' or 'bushmaster' (*Lachesis muta muta*) and 'mapepire balsain' or 'fer-de-lance' (*Bothrops atrox atrox*) are large and poisonous. *Lachesis muta* can inject a large dose of venom in a single bite [8]. These snakes have front fangs and bitten areas show severe swelling and necrosis of tissue due to haemorrhagic, myotoxic, necrotizing, defibrinogenating, coagulant, caseinolytic, proteolytic, oedema-inducing, coagulant and neurotoxic venom activities [8].

Hunting dogs may be stung by scorpions of the Buthidae family (*Tityus trinitatis*). The effects of the sting can be severe. *Tityus trinitatis* accounts for 90% of the scorpion population, but there are six other species which are all venomous [9,10]. Signs would be swelling, pain and limping in dogs. There are approximately 175 stings by *Tityus trinitatis* and eight human deaths annually [11]. In humans acute symptoms are convulsions, nausea, vomiting, drowsiness, sweating, dyspnoea and localised burning [10]. Of all scorpion sting victims, 80% developed acute pancreatitis and in 38% of these cases there was no abdominal pain [10].

Conventional treatment in Trinidad for snakebites and scorpion stings in dogs makes use of steroids, antibiotics and the ananase enzyme (from the pineapple *Ananas comosus*) and needs to take place within 2 hours of the bite. Conventional treatment would include analgesics and antiinflammatory drugs [11]. The snake bite site typically is a necrotic area, the skin sloughs off due to the proteases in the venom and the area looks dark and bruised [12]. The ananase enzyme reduces the inflammatory response; and helps the breakdown of necrotic tissue. It is felt that dogs bitten on the head have a better chance of survival since there is less vascular absorption of the venom.

Hunters' ethnoveterinary medicines

Several plants are used in an attempt to improve hunting success. For this purpose the odour and other physical characteristics of the plant are very important. Plant use for hunting success has been divided into four categories. The first is called "steaming" and these plants are usually administered in baths and are considered mental and/or physical stimulants. Steaming is also carried out with one type of insect (an unidentified solitary wasp that hunts spiders). Both the wasp and its spider prey are put into rum with guinea pepper (*Aframomum melegueta*) on a Friday. This solution is then given to the dog, or included in the bath water, and it was claimed to have a stimulant effect on the dog.

The second category comprises plants placed in the dog's nose. Here it is expected that this action will act as a nasal and chest decongestant and the dog will subsequently have a better sense of smell and improve its ability to follow a scent.

The third category is based partly on the Doctrine of Signatures in which a plant characteristic is considered to have a desirable quality or to have a physical property that resembles the desired game. This desirable quality is claimed to be transferred to the dog after the plant is used in a bath. The plants used in this category are also chosen in recognition of animal behaviour. For example one respondent claimed that after the hole of an agouti was dug out *Piper marginatum* was found in the hole and it was claimed that it was being used as a bed. Therefore hunting dogs bathed with this plant would recognise the smell of the agouti, which would carry traces of the strong smell of *Piper marginatum*.

The fourth category is called "cross". In this situation the hunters complain that the dog goes in the opposite direction from the game. The dog is faced upstream and bathed in a river and rubbed with the crushed leaves of seven different plants (sometimes the plants used have no other distinguishing characteristic). The dog is then turned to face downstream. One respondent claimed that when dogs are "crossed" and seem to be "climbing trees" they are really chasing spirits in the forest.

One hunter who hunts quenks claimed that dogs are trained to hunt small game first. For example the dog is bathed with congo lala (*Eclipta prostrata*) and it will start hunting matte (*Tupinambis negropunctatus*), then it is bathed with caraaili leaf (*Momordica charantia*) and barbadine leaf (*Passiflora quadrangularis*) so that it will hunt larger game. Eventually the dog is bathed with the plants for quenks.

Plants are also used for emergencies such as snakebites. Plants used for snakebites are typically made into tinctures with alcohol or sweet oil (olive oil) and kept in 150 ml flasks called 'snake bottles'. Snakes bottles contain one or more plants and/ or insects. These tinctures are also used against scorpion stings (*Tityus trinitatis*). Plants used in snake medicines are often collected during Lent or specifically on Good Friday. In normal years this period corresponds to the Dry season and the concentration of plant chemicals may differ from other times of the year. Tref (*Aristolochia trilobata*) has to be rewarded with silver coins as a symbolic payment before removing some of its parts, or the respondents claim that the entire

Table 1: Plants used for successful hunting (steaming, "crossed", dog's nose)

Scientific name	Common name	Use
Zingiberaceae *Aframomum melegueta*	Guinea pepper	Dry seeds are ground to a powder, and sprinkled on the dog's food
Aristolochiaceae *Aristolochia rugosa*	Mat root	Considered "hot". Used to bathe lazy dogs (also crossed dogs)
Solanaceae *Capsicum frutescens*	Bird pepper	Put juice of 2 small fruit in dog's nose so it can find trail or to improve its ability to follow a scent
Cecropiaceae *Cecropia peltata*	Bois canôt	Dry leaf is put in water with red Physic nut (*Jatropha gossypifolia*). The water is left in the open for nine days until larvae are seen. The water is then used to bathe the dog
Euphorbiaceae *Croton gossypifolius*	Blood bush/ Bois sang	Bathe dog with leaves of bois sang and kojo root plant and mardi gras leaves and berries if the dog is not performing as well as in the past
Not yet identified	Turpentine bush	Bathe dogs with crushed leaves
Euphorbiaceae *Jatropha curcas*, *Jatropha gossypifolia*	White/Red Physic Nut	Three leaves each of white and red bushes are crushed and put into bath water. The water is then used to bathe the dog
Piperaceae *Lepianthes peltata*	Sun bush	Use crushed leaves to bathe dog for "cross"
Solanaceae *Nicotiana tabacum*	Tobacco	Cleans dog's nose to improve its ability to follow a scent
Piperaceae *Ottonia ovata*	Pot bush	Crush a piece of stem and leaves or roots and put it in the dog's nose or wash the dog's nose with decoction
Phytolaccaceae *Petiveria alliacea*	Kojo root	Bathe dogs with ground root so they are more alert
Euphorbiaceae *Phyllanthus urinaria*	Seed under leaf	Plant tops used to bathe dogs for "cross"
Piperaceae *Piper hispidum*	Candle bush	Leaves are used to bathe dogs
Asteraceae *Vernonia scorpioides*	Ruckshun	Bathe dogs with leaves so that they are more alert

plant or clump of plants will die. This payment was supposed to be placed in the hole from which the root was dug. The only explanation given for the payment was that the plant was not a "simple plant". Several of the plants have one local name for several closely related species. For example Candlestick is the name of *Piper hispidum*, *Piper marginatum* (species collected), *Piper amalgo* and *Piper dilatatum*. Monkey step refers to either *Bauhinia exisa* or the more commonly found *Bauhinia cumanensis*. All closely related species will be dealt with in the ethnomedicinal literature review.

The plants used to influence success in hunting are presented below in Tables 1 and 2. The plants used for snakebites, mange and other skin conditions, and injuries are listed below the tables. Tables 1 and 2 to be put here.

Plants used for snakebites

If dogs are bitten by snakes, the injury is usually on the nostrils, forehead or front shoulder. For snakebites of hunters and their dogs a piece of the woody flexible vine called monkey ladder (*Bauhinia cumanensis* or*Bauhinia excisa*, Fabaceae) is pounded and put on the bite. It is claimed that this stops the flesh around the bitten area from dropping off. Alternatively a tincture is made with a piece of the vine and kept in a snake bottle. Tinctures are also made with single or multiple ingredients and plant parts. A typical tincture would contain one or more of the following plants: mat root (*Aristolochia rugosa*), cat's claw (*Pithocellobium unguis-cati*), tobacco (*Nicotiana tabacum*), snake bush (*Barleria lupulina*), obie seed (*Cola nitida*), and wild gri gri root (*Acrocomia ierensis*, tentative ID). Some snake bottles also contain the caterpillars (*Battus polydamus*, Papilionidae) [13] that eat tref leaves (*Aristolochia trilobata*). The leaf juice of *Eclipta prostrata* is used for scorpion stings. Emergency snake medicines are obtained by chewing a three-inch piece of the root of bois canôt (*Cecropia peltata*) taken from the east part of the tree and administering this chewed-root solution to the dog. Alternatively four or five berries of mardi gras (*Renealmia alpinia*), are crushed with the juice of wild cane (*Costus scaber*) and the dog is given two spoonfuls of the resulting solution. All the respondents claimed that their snake medicines were effective against bites/stings of mapepire. One respondent who used mardi gras (*Renealmia alpinia*) for his dog claimed that the dog's throat became swollen after the snake bite. After he gave the dog the medicine it stood up and it was completely recovered hours later.

Plants used for mange and other skin conditions

The leaves and vine stem of wild caraaili (*Momordica charantia*) are crushed in water and used to bathe dogs with mange. The pulp of the fruit of the cannonball tree (*Couroupita guianensis*) is rubbed on the infected skin of mangy dogs. A frothy solution is obtained by crushing the leaves of syrio (*Sambucus simpsonii*) in water. This is used to rub dogs with mange. It is claimed that when the dog licks its skin, this medicine will also work inter-

Table 2: Plants used for successful hunting (Doctrine of Signatures)

Scientific name	Common name	Useful plant quality	Use
Araliaceae *Dendropanax arboreus*	Fei jein		Combine with leaves of the plants below to bathe dogs "steam" to catch quenks
Araceae *Monstera dubia*	Sei jein		Ditto
Monimiaceae *Siparuma guianensis*	Dead man's bush		Ditto
Solanaceae *Solanum* species	Devil pepper		Ditto
Araceae *Syngonium podophyllum*	Matapal-kit		Combine with leaves of the plants above to bathe dogs "steam" to catch quenks
Cucurbitaceae *Momordica charantia*	Caraaili	Used to bathe dogs so that it will catch agouti	
Piperaceae *Piper marginatum*	Agouti bush / Lani bois	Plant used so the dogs will catch Agouti	Leaves used to bathe dogs. Some hunters combine the lani bois with leaves of guatacare (*Eschweilera subglandulosa* Lecythidaceae)
Mimosaceae *Pithecelobium unguis-cati*	Cat's claw	The vine clings to any tree with "claws", therefore the dog will closely pursue Agouti	5 – 7 shoots of the whole vine are pounded and put into water and this is used to bathe the dog
Zingiberaceae *Renealmia alpinia*	Mardi gras	Berries on plant attract lice, which get trapped in the leaves and die. Dog will closely pursue the game	Plant berries and leaves are used to bathe the dog
Poaceae *Saccharum officinarum*	Sugar cane	Deer eat these leaves	Leaves are used to bathe dog so it will track deer
Orchidaceae *Spiranthes acaulis*	Lappe bush	Plant has markings similar to lappe so the dog will track lappe	Vine is used to bathe the dog
Araceae *Xanthosoma brasiliense*, *Xanthosoma undipes*	Hog tannia	The leaf has needles similar to the bristle-like hairs on the back and neck of the wild hog/quenk. The quenks also eat these tubers.	The root (or tannia) is ground and sprinkled on the dog's food
Haemodoraceae *Xiphidium caeruleum*	Walk fast	Ethnomedical belief is that use of the plant helps children walk	Leaves used to keep dogs walking straight

nally. Dogs with rashes are bathed with St. John's bush (*Justicia secunda*, Acanthaceae). It is claimed that this plant imparts a red colour to the bath water.

Plants used for injuries

Dogs may get trauma damage during the hunt but may have insufficient contact with game animals to pick up any diseases directly from them. Mardi gras (*Renealmia alpinia*) is used to bathe dogs who have strained a limb. Leaves of physic nut (*Jatropha curcas/gossypifolia*) are boiled and the decoction used to clean sores. Other injuries that hunting dogs are susceptible to would be nail breakage, lameness and shoulder injuries, injuries caused by running into an object or the dog may be kicked by a deer.

Dosages

Dosages were imprecise but hunters claimed to know what would happen with some cases of overdosing. For example an overdose of ruckshun (*Vernonia scorpioides*) would over-excite the dog to the point where it would even bark at snakes. If a dog is given a tincture made with puncheon rum (80% proof), it is claimed that the dog may become temporarily crazy. Based on experiences like these, some hunters have switched from alcohol to olive oil for their tincture solution. Additionally alcohol tends to evaporate. Lipophilic compounds are not extracted in alcohol that would be extracted by olive oil.

One respondent claimed that pot bush (*Ottonia ovata*) gave his dog a headache (it shook its head continuously and there is no sign of anything in its ear), and it made two respondent's tongues numb. This respondent then put Vicks™ in his dog's nose as an alternative. Another used vinegar as an alternative to the 'scratchy' pot. Another respondent claimed that dogs had a stronger constitution than humans and should be given the equivalent of twice the human dose per body weight.

Discussion

The following sections examine the plant used by hunters in a holistic manner, however, it is difficult to judge hunting success. Cultural factors are examined first and

then the 'efficacy' of all the plants used is evaluated using a non-experimental method.

Amerindian conceptualisations of nature

The following section attempts to reframe the ethnomedicinal data in terms of bioscientific concepts and methods; or to establish whether symbolic aspects of healing (social support, belief systems) are of greater relevance [1,14]. The symbolic aspects of the plant use are very similar to those of the South American Amerindians and modern hunters may be unknowingly using the traditions of the original Amerindian inhabitants of Trinidad and Tobago. These Amerindian traditions are related to those previously practiced in South America. For example the claim that dogs that are "crossed" are chasing spirits in the forest rather than prey may be related to the belief of theTacana in Bolivia that malevolent spirits dwell in canopy trees such as *Dipteryx odorata* and *Ceiba samauma*[15]. The Caribs in Dominica used leaf baths against bad luck [16]. From the Venezuelan/Spanish or Amerindian tradition comes the belief in plants called "turals" in Venezuela and in Spanish-speaking Trinidad. These plants bring good fortune and have silver coins planted at their roots [3,13]. The belief that plants can bring luck may explain their use for hunting dogs. These beliefs may have originated in the Amazon where baths are a frequent way to utilise traditional remedies [17]. Absorption routes of active compounds are the respiratory tract (volatile substances carried by water vapour) and the skin [17]. It is also practical to use baths if the intention is to disguise the smell of the hunting dog so that the game animal does not recognise it [18].

The use of hallucinogenic and other plants to improve hunting success is documented in the literature [19,16]. Waorani in the Ecuadorian Amazon feel that the characteristics of one entity or object may pass to another [19]. These beliefs may lie behind the use of plants for hunting success. Various rituals were performed by the Amerindians in Guyana before a hunt [20]. These rituals included plants called 'beenas', which acted as charms to entice any object or desire wanted, including making the capture of game certain. Each beena usually had a specific purpose. Beenas were used for dogs, which were made to swallow specific pieces of roots and leaves for specific game animals [20].

Beenas were used because there was an ancient almost forgotten belief that plants possessed associated spirits [21]. In addition to the plant use of the Guyanese Amerindians, ants and other insects were made to bite the nostrils of the hunting dog. Plant leaves and other plant parts including peppers were then rubbed into the wounds on the noses of the dogs [20]. This was done on the assumption that the power of scent in dogs was improved by these practices since the nasal mucous membranes were cleaned, the perceptions were sharpened, and the dog would keep its nose to the ground when hunting [20,21]. There seemed to be a mental connection of success in acquisition of game with pain previously inflicted on the hunter and his dog [20]. The nervous system of the dogs was irritated to such an extent that it was responsive to even the slightest external stimulus and therefore more likely to be successful in hunting [21]. There was also the belief that inflicting pain was a means of preparing to meet without flinching any pain or danger that could arise during the chase [20]. This preparation was not ill-advised since *Lachesis muta muta* often lives in the burrows of lappe and tatou [22]. Each hunting dog was trained to hunt one sort of game [20].

The use of the solitary wasp in the "steaming" process can also be linked to Amerindian traditions. Firstly, the Amazonian belief that the characteristics of one entity or object may pass to another [19], could explain the use of a wasp that hunts successfully in baths or decoctions to make dogs better hunters. Additionally there are records of a specific ant that was given to dogs by Guyanese Amerindians in order to make them good hunters [21]. Amerindians also named their hunting dogs after ants and a wasp called "warribisi" that caught prey. *Costus* species is called poivre ginet in Dominica, while *Aframomum melegueta* is called guinea pepper in most of the Caribbean. It is not known if the original Amerindian practice was for both plants to be used for hunting dogs.

Plants are given symbolic payments if they are considered to have supernatural owners who require such payment [23]. The payment is placed on the ground near the plant before it is picked and can be recovered later by the person who picked it [23]. Much of the plant use is based on the Doctrine of Signatures which claims that plant morphology suggests the medicinal use for a plant. One example is the use of leaves from various species of *Aristolochia* to treat snakebites [24,21]. The triangular head of a *Bothrops* viper is similar in size and shape to many *Aristolochia* species leaves [24]. The serpentine coloration of the flowers of the *Aristolochia* vines also suggests the use as tourniquets to prevent the spread of snake venom and the use of the leaves in anti-snakebite potions [25]. The Doctrine of Signatures is also seen in the plants used as "beenas" or "turals" which are supposed to have patterns on their leaves resembling different forest animals [3]. The beena for lappe had typical white markings similar to those of the lappe, while the beena for quenk had a leaf with a small secondary leaf under the surface that resembled either the scent gland of the quenk or its nostril tip [20]. Medicinal plants are collected on Good Friday in Almería, Spain [26].

Hunting success

The characteristics that dogs need for hunting success are scent-accuracy, speed, enthusiasm and stamina. However, several of the hunting dogs observed by the authors were in poor condition. Medicinal properties in the plants used for baths may help alleviate any subclinical infections these dogs might have due to their poor condition.

Agouti feed by day on fallen fruits [5]. During the hunts they were observed to be running within particular territories when chased but had a habit of running and doubling back or crossing water to disguise their scent. Dogs pursuing this game have to have their wits about them, be fit, and be persistent. The hunters chose smaller dogs as "agouti dogs" so that they could follow agoutis through dense bush to their hiding places. The hunters reported that deer ran straight for miles until they lost their pursuers. Deer hunters were reported to spend days searching for their lost dogs. Deer dogs were chosen for endurance. Deer are also solitary and nocturnal and enter water when chased [5]. They are also adapted to swampy areas and are good at camouflage [5]. All these characteristics are considered by the hunters when choosing deer dogs. Lappe, tatou and manicou are nocturnal, living in hollow fallen trees during the day and they forage at night [5]. Dogs pursing this game would ideally have good night vision, a good sense of smell and cannot be afraid to dive into hollow logs or into water, since lappe often enter their burrows from under water [5]. Lappe have four longitudinal rows of white spots [5]. Hunters claim that the plants used to bathe dogs so that they will hunt lappe have similar markings. Hunters also claimed that dogs hunting tatou may have to dig to unearth their prey.

Wild hog/quenk can be very aggressive, especially in a group of five or six [5]. They live in swampy parts of the forest and will cross water during the day [5]. The bristles on the mid-dorsal line from crown to rump of the quenk raise when the animal is excited and the musk glands emit a musky odour [5]. Quenks eat succulent tubers and fallen fruits and nuts [5]. The bravery dogs need to hunt quenk has been documented [27]. Of an original pack of nine 'native curs' trained in quenk and lappe hunting, two received deep flesh wounds inflicted by the tusks of two quenks during a hunt. Four others were bitten by a *Lachesis muta muta* that one dog pulled out of a hollow tree [27]. Two of the bitten dogs ran off before they could be treated and died within fifteen minutes. The two other dogs bitten by 'his snakeship' (7 ft, 10 ins) on the neck and paw were held and treated with the local folk medicine of roots, barks and seeds in a tincture with rum [27]. These two were carried home and recovered in three days. The author did not indicate if the three uninjured dogs of the nine were the 'bravest', 'least brave' or the most 'alert', 'agile' or 'lucky'.

Olfactory considerations

There is literature establishing that native Amerindians participated in hunts with Creole hunters [27]. This may explain not only the symbolic aspects of the plant use by modern hunters discussed above but also the olfactory considerations discussed in this section. Both sections show parallels between the practices of current Trinidad hunters and the indigenous knowledge of native South American groups.

The Mixe in Mexico consider that the odour and taste of a plant are important criteria in deciding what plants to use for an illness [1]. The Waorani in Amazonian Ecuador consider that plants with strong, or repulsive odours will force symptoms to flee from the body and this belief guides their use of *Renealmia alpinia* and a *Philodendron* for snakebites [28]. The Warao in eastern Venezuela consider 'bad air' to be pathogenic and 'good' or perfumed air to be therapeutic [29].

The acute sense of smell in dogs is due to a large area of olfactory epithelium [18]. Smells have the advantage of remaining in the environment for a long time and are a useful means of communication in dense vegetation where verbal and visual communication is impaired. When hunters bathe dogs with strongly smelling members of the *Piper* species they may be imitating animal behaviour or trying to mask the individual body odour of their dogs so that they remain un-detected by game animals. Dogs show a form of behaviour called rolling/rubbing in strongly smelling objects [30]. The intention of the dog may be to eliminate or dilute the odour since this type of rolling is frequently associated with sneezing and running [30]. In other cases the dog may roll in an odour that is considered unpleasant by humans. There are two plausible explanations for this last behaviour. One is that the dog is attempting to take on the odour like a perfume, the other is that the odour is too strong to cover with a urine mark so the dog tries to cover it with its entire body surface [30].

There are indications that South American Amerindians were aware of animal behaviour in relation to smells. For example, the bristles on the mid-dorsal line from crown to rump of the quenk elevate when the animal is excited and the musk glands emit a musky odour [5]. Quenks maintain odour homogeneity within the herd. Each animal rubs the lower portion of its jaw on a gland in the other's mid-dorsum. If a veterinarian removes a quenk from the herd for treatment, it will be killed when it is replaced, since it will no longer have this herd odour (Dr. Gabriel Brown, Department of Clinical Sciences, Univer-

sity of the West Indies, pers. comm. 2000). If hunters bathe dogs with a plant that quenks eat the temporary smell dogs obtain from this bath may be similar to the smell of a quenk that feeds on this plant.

Roucouyennes (Caribs) rubbed their dogs with *Hibiscus abelmoschus* with the expectation that its pungent smell would prevent jaguars from biting their dogs [21]. Tukanoan tribes in South America also believed that deer had an inoffensive body odour that was linked to their diet of "pure" foods such as fresh sprouts, young green leaves and sweet fruits [31]. Tukanoan tribes also believed that people and animals have smells related to the food that they eat and the environment that they lived in [31]. This association of animal smells with their environment is perhaps what the informant was referring to in his reference to an agouti and the smell of its *Piper marginatum* "bed". There is evidence that some of the plants used by hunters are eaten by deer and possibly by other game animals (these are *Costus* species, *Eschweilera* species, *Piper* species and *Pithecellobium* species [32]. Tukanoan tribes also recognise the complex pheromonal system of chemical communication that deer and other animals use. For example they claimed that when white-tailed deer are frightened suddenly from close by, they run off and repeatedly break wind. These tribes interpret this behaviour as an attempt to mask the odour trail left by the deer's interdigital glands and thus mislead predators and hunting dogs [31].

Poisons

Caterpillars may accumulate chemical compounds from the plants that they feed on, which may explain their usefulness as part of a remedy. Some hairy caterpillars have urticating hairs, which can cause severe skin reactions and pain [9]. It is not known what effect if any the caterpillar venom has on the snake bit remedy. Any effect of the plants claimed to be efficacious against scorpion stings may be due to symptomatic relief – analgesic, antiinflammatory, antipruritic effects, in addition to other biological activities [11].

While proteases, phospholipase A_2 and nucleotidases are responsible for the haemorrhagic lesions induced by *Bothrops jararaca* venom, most crotalid myotoxins are phospholipases and some exhibit proteolytic activities [12]. Crotalid snakes have a wide geographical distribution, this may contribute to differences in their venom composition [8]. Differences in venom composition may play a role in the effectiveness of the medicinal plants used for snakebites. Unfortunately no research on the venoms of Trinidad's snakes was discovered so the following review is of the closely related South American and Caribbean snakes and scorpions. Phospholipase A_2 was purified from *Lachesis muta* venom in Brazil, the venom also showed procoagulant and proteolytic activities [33]. High proteolytic activity was found in venom of *Lachesis muta* and no platelet pro-aggregating activity, low inhibitory effect on platelet aggregation and low procoagulant, proteolytic and phospholipase activity for *Botrops atrox* in Brazil [34].

Studies in South America detail the pain and oedema at the bite site and manifestations of autonomic nervous system stimulation (vomiting, diarrhoea, sweating, hypersalivation, bradycardia) that may be attributed to serine protease in *Lachesis muta* venom which causes hypotension by releasing kinins from plasma kininogen [8]. There are also cases of bleeding distant from the bite site such as gingival haemorrhage, epistaxis, haemoptysis, haematuria, uterine bleeding, soft tissue haematomas and very infrequently intrathoracic or intrabdominal bleeding [35]. Complications in the bitten limb can include secondary infections by Gram-negative organisms and acute renal failure among others [8]. There is a bothrojacarin-like 27 kDa protein in *Bothrops* species venom [36]. Bothrojacarin forms a non-covalent complex with thrombin, blocking its ability to induce platelet aggregation and fibrinogen clotting [8,36]. Haemostatic effects in *Lachesis muta* venom are attributable to an alpha-fibrin(ogen)ase and haemorrhagic metalloproteinases (LHF-1 and LHF-II) which have alpha-fibrin(ogen)ase activity [8].

The severity of envenoming depends on the species and length of the snake, the toxicity of the venom and the amount inoculated [37]. Also important are physical activity after the bite and the physical characteristics of the victim [37]. The severity of bites from *Bothrops laceolatus* in Martinique is increased due to the primary bacterial infection from bacteria present in the oral cavity of the snake (*Aeromonas hydrophila*, *Morganella morganii*, *Proteus vulgaris* and *Clostridium* species) [37]. This means that antibiotic treatment is sometimes necessary [32].

Scorpion venom when injected exerts a strong inflammatory response [11]. Many plant species used against stings contain compounds with antiinflammatory properties, flavonoids (rutin, hesperidin, quercetin), coumarins (bergapten), coumestans (wedelolactone), triterpenes, sterols and saponins [38,11]. The mechanism of action of the flavonoids is based on the inhibition of enzymatic steps in the arachidonic acid cascade [38]. Plant compounds that are immunostimulants at very low doses are some alkaloids, quinones, isobutylamides, phenolcarboxylic acid esters and terpenoids [39]. Other plant compounds with immunostimulatory effects are sesquiterpene lactones [40]. Many polysaccharides and glycoproteins enhance the unspecific immune system by

activating the phagocytotic activity of granulocytes and macrophages, or by inducing cytokine production or influencing complement factors [39].

Some compounds from plants used for general inflammation also inhibit enzymes (like phospholipase A_2) from snake and scorpion venom [40,11,42]. Some of these plant compounds are hypolaetin-8-glucoside and related flavanoids. Stimulation of the immune system might also contribute to reducing the effects of snakebites and improvement in recovery from envemomization by contributing to a more rapid removal of the venom [11]. Chlorogenic acid acts as an antidote by binding to proteins through hydrophobic interactions and hydrogen bonds [41]. It presents anticomplementary action at the classical pathway [41]. Analgesic properties like those provided by tropane alkaloids would also lessen the pain of the bite, as would compounds that act as sedatives and tranquilisers [40].

Several pharmacological properties of plants reputed to be snakebite antidotes include antimyotoxic, antihaemorrhagic, analgesic, and antiedematogenic, blockage of cutaneous and intraperitoneal capillary permeability activity caused by the venom and protection from its lethality [38]. A more direct anti-venom activity would involve complexation of the compounds with venom constituents thus rendering them unable to act on receptors; or to act by competitive blocking of the receptors [11]. Phenolic compounds especially complex polyphenols like some tannins can bind with proteins [42]. Alternatively, the catecholamines released as a result of venom-receptor interaction may be antagonised or metabolised more quickly [11].

Plant extracts (*Mucuna pruriens* var. utilis) that produce a dose-related increase in the clotting time of blood induced by carpet viper venom (*Echis carinatus*) would be useful against bites from *Bothrops* species that cause haemorrhage at the point of injection due to the inhibition of the clotting mechanism [40]. Antivenom compounds so far isolated from plants include protocatechuic acid, a catechin-gallo-catechin tannin, caffeic acid derivatives (chlorogenic acid, cynarin), coumarins (bergapten), flavonoids (rutin, isoscutellarein, kaempferol, quercetin, hesperidin), ar-turmerone, alkaloids (aristolochic acid), triterpenoids, triterpenes, coumestans (wedelolactone), sterols (sitosterol, stigmasterol, beta-amyrin), triterpenoid glycosides, alkaloids (allantoin) and lignoflavonoids [43,40,44,42]. Many relevant compounds are widely distributed nitrogen-free, low molecular weight compounds (except aristolochic acid, an untypical non-basic, nitro-derivative) [38]. The structural similarities of certain plant chemicals found in plants used for snakebites are an isoflavone skeleton, acidic nature and dioxygenated functionality [44].

One study found total inhibition of *Bothrops asper* haemorrhage with the ethanolic, ethyl acetate and aqueous extracts of plants containing catequines, flavones, anthocyanines and condensated tannins. These compounds may have played a role in the inhibitory effect observed, probably owing to the chelation of the zinc required for the catalytic activity of venom's haemorrhagic metalloproteinases [45]. Reduction in the intensity of the effects of envenomation could also be achieved by a neutralisation of the venom peptides, polypeptides, proteins and enzymes [38,11]. There are plants used for snakebite that act by inhibiting the proteolytic activities of the venom and antagonising crotoxin-induced haemolysis, myotoxic and haemorrhagic activities of crotalid venoms [46].

Tityus trinitatis toxic fraction was recognised by the antiserum of the Venezuelan scorpion *Tityus discrepans* (which has a β-type toxin) [47]. The onset of symptoms from the time of evenomation is generally between five and thirty minutes. Local evidence of a sting is often minimal or absent but several patients report severe pain or a burning sensation with intense pruritis and local or general hyperesthesia [11]. Symptoms may last from seven days to several weeks. Redness, inflammation and local oedema at the sting site are evident [11].

In Trinidad the following clinical features have been seen: tachypnea, restlessness, vomiting, increased salivation, cerebral oedema, pulmonary oedema, hypovolemic shock and convulsions, with myocarditis and pancreatitis being major complications [48]. Scorpion venoms may cause these symptoms through release of catecholamines from the sympathetic nervous system [11]. The venom exerts its effects primarily to the cardiovascular and respiratory systems, but there is also stimulation of both the sympathetic and parasympathetic peripheral activities [11]. The venom is a complex mixture of phospholipase A_2, low molecular weight proteins, acetylcholinesterase, hyaluronidase, toxic polypeptides, amino acids, serotonin and neurotoxins [11,48]. Two fatal cases suggested toxic myocarditis [48].

Review of the known biological effects of the plants and their constituents

This section reviews available literature on the plants identified in this study and compares their Trinidad and Tobago ethnoveterinary use to the folk-medicinal use in other countries (mainly Latin America and the Caribbean). All folk-medicinal uses are human uses unless otherwise specified. Plants used to achieve hunting success including those chosen according to the Doctrine of

Signatures will be treated here as medicinal plants since supernatural emic can occasionally suggest etic efficacy [49]. For each species or genus a summary of chemical constituents will be given, in addition to active compounds if known. This type of ethnopharmacological review and evaluation is documented in the literature [1]. The plants below are listed in alphabetical order.

Acrocomia ierensis (tentative ID). No research was found on the compounds in the root.

Aframomum melegueta has been previously recorded as a stimulant [50]. Caribs of Dominica used *Aframomum granum-paradisi* leaves on their bodies while they were bathing and the plant was also given to their hunting dogs [16]. Seeds were put into rum as a 'chauffe' to excite dogs [16]. *Aframomum granum-paradisi* contains alkaloids (piperine), essential oils and resins [54].

Aristolochia rugosa and *Aristolochia trilobata* are recorded in a list of plants used worldwide and in the West Indies, Venezuela, South and Central America against snakebites and scorpion stings [51,52,24,43,40,53]. Caribs in Guatemala use *Aristolochia trilobata* root and tuber decoctions for stomach pains and use leaf tinctures for diarrhoea [55]. Aristolochic acid inhibits inflammation induced by immune complexes, and nonimmunological agents (carrageenan or croton oil) [56]. Aristolochic acid inhibits the activity of snake venom phospholipase (PLA_2) by forming a 1:1 complex with the enzyme [56,40,38]. Since phospholipase enzymes play a significant part in the cascade leading to the inflammatory and pain response, their inhibition could lead to relief of problems from scorpion envenomation [11].

Barleria lupulina is well known in Thai folk medicine as an antiinflammatory, and is used against snakebites and varicella zoster virus lesions and showed activity against five clinical isolates of herpes simplex virus type 2 [57]. Compounds found in the leaves of *Barleria lupulina* are barlerin, acetylbarlerin, shanzhiside methyl ester, acetylshanzhiside methyl ester, ipolamiidoside and iridoid glucosides [58]. An antibiotic and immunostimulant protein was reported from the plant and other species and patented [57].

Bauhinia excisa vine decoction has been used for snakebites and pain and the root decoction is used for scorpion stings in Trinidad [52].

Indigenous Mayans and inhabitants of Eastern Nicaragua use *Caspicum frutescens* for fever, respiratory problems and infections [59,53]. Capsaicinoids are powerful skin irritants [54]. Capsaicin is a vanillylamide with hyperemic and anaesthetic properties [39,61]. It causes vasodilatation, enhanced permeability and has antiinflammatory and neurotransmitter activation properties [61]. Capsicum species have inhibitory effects on *Bacillus* species, *Clostridium* species and *Streptococcus pyogenes*[59].

Capsaicin's use in the treatment of chronic pain is due to an analgesic effect that is explained by capsaicin's action of depletion of stores of substance P from primary sensory neurons as a consequence of the reduced production of prostaglandin [39,60]. Capsaicin's antiphlogistic activity is due to the "counter-irritant effect"; which means that a local irritant effect exerts an additional more remote antiinflammatory effect [60]. This is explained by a liberation of corticoids under the influence of certain cutivisceral reflexes [60]. The counter-irritant effect on the gastric mucosa also occurs because capsaicin stimulates production of the cytoprotective prostaglandin E_2[60]. Capsaicin produces analgesic and antiinflammatory effects because it inhibits both 5-lipoxygenase and cycoloxygenase [39]. A 10 g human ingestion of red pepper stimulated carbohydrate oxidation [62]. This may explain why the Chocó Indians used it to give their hunting dogs more "energy" [25].

Cecropia peltata leaves boiled in water are used in a bath for rheumatism in Guatemala [63]*Cecropia peltata* leaves are used for aches, abscesses, coughs, pains, fever, pertussis, skin lesions and digestive problems in Eastern Nicaragua, Jamaica and Cuba [53,64]. *Cecropia peltata* leaves are used for snakebites in Trinidad [52,65]. Free fatty acids including stearic, arachidic, behenic, lignoceric and cerotic acids were isolated from *Cecropia* species. Leaves of *Cecropia peltata* contain leucocyanidin [54].

Cola nitida nuts contain a heart stimulant (kolanin), caffeine, strychine, theobromine and quinine and are associated with increased blood pressure [71].

Costus species is called Poivre Ginet in Dominica and was used to bathe hunting dogs by the Caribs [66]. *Costus scaber* (syn. *Costus cylindricus*) showed some activity against *Bacillus subtilis*[67]. *Costus lasius* is used by traditional healers for snakebites in the northwest region of Colombia. An ethanolic extract of *Costus lasius* (leaves, branches and stem) partially neutralised *Bothrops atrox* venom when it was injected i.p. into mice (18–20 g) [68]. *Costus speciosus* contains diosgenin, and beta-glucosidase which converts a furostanol glycoside (protogracillin) to a spirostanol glycoside (gracillin) [69,70].

Couroupita guianensis (Lecythidaceae) fruit pulp contains sugar, gum, and malic, citric and tartaric acids.

'When ripe the fruit pulp exceeds in foul odour all that is abominable in nature' [76].

Dendropanax arboreus is used for snakebites and externally for foot inflammation in Columbia and is also used by the Tacana in the Bolivian Amazon [72,15]. Leaves of *Dendropanax arboreus* showed cytotoxic activity. The active compound is an acetylenic compound [73]. Other compounds in the leaf extract are dehydrofalcarinol, a diynene, falcarindiol, dehydrofalcarindiol, and two new polyacetylenes (dendroarboreols) [74].

The *in vitro* myotoxicity of the crotalid venoms venoms (*Bothrops jararaca*, *Bothrops jararacussu* and *Lachesis muta*) and myotoxins (bothropstoxin, bothropasin and crotoxin) was neutralised by simultaneous exposure of isolated skeletal muscles to an aqueous extract of *Eclipta prostrata* or to wedelolactone, stigmaterol and sitosterol. Stigmaterol and sitosterol were less effective than wedelolactone, but interacted synergistically with it [12]. These effects were interpreted as consequences of anti-proteolytic and antiphospholipase A_2 activities of *Eclipta prostrata* and its constituents [12]. These three plant compounds have anti-inflammatory properties and are recognised anti-venom compounds [43,40,44,42,38,11].

Ethanolic extracts of the aerial parts of *Eclipta prostrata* (Asteraceae) neutralised the lethal activity of the venom of South American rattlesnake (*Crotalus durissus terrificus*), as well as the myotoxic and haemorrhagic effects of *B. jararaca*, *B. jararacussu* and *Lachesis muta* snake venoms when mixed *in vitro* before i.p. injection into adult Swiss mice [75,12]. Three plant compounds, wedelolactone, sitosterol and stigmasterol were able to neutralise lethal doses of the venom. Aqueous extracts of the plant inhibited the release of creatine kinase from isolated rat muscle exposed to the crude venom [75]. Wedelolactone reduced the myotoxic effect of crude venoms *Crotalus viridis viridis* (western rattlesnake) and *Agkistrodon contortrix laticinctus* (copperhead) and two phospholipase A_2 myotoxins, CVV myotoxin and ACL myotoxin, isolated from them [46]. Empirical use of *Eclipta prostrata* alcoholic extracts to treat crotalid envenomation are supported by these studies [12].

Eschweilera subglandulosa is a tree with smooth leathery leaves about 8 inches long [76]. The fruit is well liked by agouti [5]. This fact may explain its use, since after a bath the smell of its leaves may stay on the hunting dog.

Jatropha curcas latex is applied to external wounds in Perú and Indonesia [77,78]. The leaf bath is used for rash, bewitchment and poultices for sores in Trinidad [52]. *Jatropha curcas* leaf and bark contain glycosides, tannins, phytosterols, flavonoids and steroidal sapogenins [79,80]. The latex contains proteolytic enzymes and provides significant cicatrizant activity (wound healing) [78]. The sap inhibits growth of *Candida albicans* and *Staphylococcus aureus*[81].

The leaf decoction of *Jatropha gossypifolia* is used for bathing wounds [83]. The stem sap stops bleeding and itching of cuts and scratches [84,85]. The leaf bath is used for sores, sprains, rash and bewitchment in Latin America and the Caribbean [52,86]. Poultices are used for sores and pain in Trinidad [52]. These uses are similar to the ethnoveterinary use. *Jatropha gossypifolia* leaf contains histamine, apigenin, vitexin, isovitexin and tannins. The bark contains the alkaloid jatrophine and a lignan (jatrodien) is found in its stems [81,88]. The latex of *Jatropha gossypifolia* yielded two cyclic octapeptides (cyclogossine A and B) [85,89].

The use of *Justicia secunda* for rashes has been previously recorded [52]. Different species have yielded steroids, lignans, betaine, triterpenoids, coumarins, dihydrocoumarin, umbelliferone and 3-(2-hydroxyphenyl) propionic acid alkaloids and flavonoids [90–92]. Coumarins and flavonoids have anti-inflammatory properties [38,11]. Wounds on Wistar rats treated with organic and aqueous extracts of *Justicia pectoralis* showed intermediate swelling in comparison to wounds treated with coumarin isolated from the plant extract (least swelling) and the controls [93]. This study supported local usage for wound-healing properties.

Throughout tropical Central and South America, leaves of *Lepianthes peltata* Miq. (Piperaceae) (syn. *Pothomorphe peltata* Miq.) are used as antiinflammatory, antipyretic, hepatoprotective and diuretic infusions and to treat external ulcers and local infections [94]. A cataplasm of the leaves of *Lepianthes peltata* is used by the Cuna and Chocó Indians for various external ailments and is rubbed on the body to exterminate lice [25,95,81]. In South America leaves are used for inflammatory disorders and are warmed and rubbed with coconut (*Cocos nucifera*) or castor oil (*Ricinus communis*) and applied to any painful or swollen joints and inner body parts [94,54,96–98,65,99].

Lepianthes peltata plants contain alkaloids, carotenoids, anethol, chavicine, piperine and lignans [94]. *S. aureus* was partially inhibited by *Lepianthes peltata*. *Lepianthes peltata* methanolic extract had antioxidant activity attributed to the catechol derivative (4-nerolidylcatechol) [97]. Plants showed a significant analgesic effect lasting for 30 minutes [81]. The anti-inflammatory effectiveness of the methanol leaf extract supports this traditional use of *Lepianthes peltata*[94]. The plant's analgesic, antiinflammatory and antibacterial effects

may help clear up any health problems of the dog that prevent it from successfully tracking a game animal.

Momordica charantia is widely used in the Caribbean for various ailments [84,66]. Leaves rubbed in coconut oil (*Cocos nucifera*) are used for scabies and skin rashes in Eastern Nicaragua, the Caribbean and in the Philippines [100,101,110]. Aqueous and ethanolic extracts of *Momordica charantia* inhibit the growth of *Escherichia coli*, *Sacrina lutea*, *Staphylococcus aureus*, *Pseudomonas aeruginos*, *Bacillus subtilis*, *Proteus* species and *Staphylococcus albus*. Preliminary work showed activity against *Salmonella paratyphi* and *Shigella dysenterae*[87].

The Tacana of Bolivia use the heated leaves of *Monstera* sect. *marcgraviospsis* species for boils and a leaf poultice of *Monstera subpinnata* for leg pain, as a vesicant and to cauterize wounds [15,103]. *Monstera* species accumulate derivatives of caffeic acid [102]. *Monstera pertusa* stem fragments were carried in the Antilles as a charm to ward off poisonous snakes, and is applied with cotton to snakebite wounds [103].

Crushed leaves of *Nicotiana tabacum* are applied to wounds in Guatemala [63]. The steam vapour was a general cure-all in Latin America and the Caribbean [16,104]. Historically, powdered tobacco was burnt on the blade of a paddle as a propitiatory offering to the local boa snake (*Constrictor orophias*) [16]. The plant contains nicotine, malic and citric acids, phenolic acids (chlorogenic, quinic, nicotinic), flavonoids (rutoside), coumarins and enzymes [81]. Presumably the nicotine in the dog's nose would act as a stimulant.

Ottonia ovata contains an isobutylamide, piperovatine and a piperovatine derivative [105,106]. Piperovatine promotes the flow of saliva and anaesthetises the tongue [106].

Passiflora quadrangularis leaf decoction is used by the Garífuna of Eastern Nicaragua for fevers, rashes and sores [50]. The leaf and branch decoction is used in Columbia in external baths for snakebites [139]. An extract of branches and leaves had moderate neutralizing ability against the haemorrhagic effect of *Bothrops atrox* venom in Columbia [35]. The plant contains passiflorene, nor-epinephrine, 5-hydroxytryptamine and flavonoids [107,50].

In Belize the crushed leaf of *Petiveria alliacea* is put on the dog's nose to improve its ability to follow a scent [109]. Kojoroot or Kudjuruk (*Petiveria alliacea*) is considered a charm and a medicine for aches, pain, snakebites and respiratory conditions in Dominica, Bolivia, Columbia, Peru and Eastern Nicaragua [16,96,53,108]. The plant can stimulate the phagocytosis activity of the reticulo-endothelelial system and has antibacterial effects [61,108]. The plant contains isoarborinol, isoarborinol-cinnamate and sulphide compounds, which give it a smell of onions or garlic [86,50]. The strong garlic smell may suggest the various uses of the plant (Doctrine of Signatures), however this aspect was not noted in the meticulous data compiled on Middle America [86]. It is difficult to assess which medicinal properties of the plant could help in making dogs more alert.

Phyllanthus urinaria plant was used by Caribs with other plants in a bath against bad luck (called 'piai') [66]. Pharmacological activities of various compounds in some species of *Phyllanthus* include analgesic, antiinflammatory, antilipoxigenase, antiallergic, nitrosamina blocker, aldose reductase inhibitor, antiviral, mitochondrial ATPase inhibitor, phosphodiesterase inhibitor and cyclooxigenase inhibitor [111]. Other activities are hepatoprotective, phosphorilase and tirosine kinase inhibitor, phospholipase A_2 inhibitor and increased the survival of hepatocellular carcinoma harbouring animals [54,111,113,112]. The compound with hepatoprotective activity is triacontanol [114]. Several compounds found in *Phyllanthus* species, like flavonoids (quercetin, rutin), tannins (geraniin, furosin), benzenoids (ethyl gallate, methyl gallate) and phytosterols showed antinociceptive effects in mice or multiple mechanisms of action [111,115]. The flavonoids also have anti-inflammatory properties [38,11]. The hydroalcoholic extracts of four *Phyllanthus* species were 2 – 6 fold more active in causing antinociception than aspirin depending on the route of administration and the pain model used [115]. *Phyllanthus amarus* has antioxidant properties, reverses chromosomal alterations induced by genotoxic agents and has anticancer activity [112]. Active compounds may be flavonoids (quercetin, astragalin), ellagitannins (amarinic acid), hydrolysable tannins (phyllanthisiin D) [112]. The multiple plant compounds found in *Phyllanthus* species might help clear up any physiological condition that results in dogs having difficulty following game animals.

Piper auritum, and *Piper tuberculatum*, are used against dermatological illnesses in Mexico [61]. In Puerto Rico and the Caribbean chewed leaves of *Piper amalgo* are put on bleeding cuts [100,66]. Caribs of Dominica considered *Piper* species to be charms [16]. Hunting dogs were rubbed with *Piper* species plant leaves when bathed in order to make them "good" in the chase [16]. *Piper auritum* leaf juice is applied topically to remove ticks and head lice in El Salvador and Ecuador respectively [92]. In Guatemala, Panama and Columbia the juice of crushed leaves of *Piper* species or the decoc-

tion of roots are drunk or used in baths for snakebites or rubbed onto the body as a snake repellent [63,95,139]. In Eastern Nicaragua and Jamaica *Piper hispidum* is used in remedies for colds, fever, stomach aches and for aches and pains [116,53]. In Trinidad, Puerto Rico and other Caribbean countries *Piper amalgo* leaf infusions are used as ritual baths or baths to perfume the body [52,16].

The chloroform extracts of branches of *Piper auritum* and *Piper guineense* inhibit growth of *Candida albicans*, *Cladosporium cucumerinum* and the pathogenic fungus *Basidiobolus haptosporus*[92,117]. These results indicate a possible use of this plant extract in the treatment of subcutaneous phycomycosis in humans and animals [117]. *Piper* species contain lignans, benzoic acid derivatives, flavonoids including the dihydrochalcones (asebogenin) and the alkaloid piplartine-dimer A [61,118]. Asebogenin may have antiplasmodial activity [118]. The piperamides (cepharadione A and B) from *Piper auritum* possess antifungal and anaesthetic properties [61]. Dogs may be bathed with various *Piper* species to remove external parasites.

Pithecelobium unguis-cati is used as a febrifuge and for malaria in Guatemala and the Peruvian Amazon [119,120]. Hunters wrongly claimed that *Pithecellobium unguis-cati* was parasitic. It has claw-like tendrils that allow the species to climb other plants [66].

The Mosetene Indians in Bolivia use the crushed *Renealmia alpinia* plant mixed with water and rub this preparation over the dog's body to improve its hunting ability [108]. In Trinidad a leaf poultice or bath or root decoction is used on swellings, sprains, sores, wounds and for stomach pains and malnutrition [52,54,65]. The purple-red juice from the *Renealmia alpinia* berries is used to treat eye diseases. *Renealmia alpinia* plant contains diterpenes and proanthocyanins [65,121]. Decoctions or external baths of *Renealmia alpinia* rhizome are used by traditional healers for snakebites in the northwest region of Colombia and in Amazonian Ecuador [28,139]. An ethanolic extract of *Renealmia alpinia* rhizomes demonstrated moderate to full neutralising capacity of *Bothrops atrox* venom within 48 hours when it was i.p. injected into mice [68]. The neutralisation was attributed to antiphospholipase A_2 activity.

Saccharum officinarum is used medicinally in Eastern Nicaragua and in the Caribbean for infections, chills, fever, rashes and sores [122,53]. Chlorogenic acid, ferulic acid and p-cumaric acid have been found in the plant [128,129].

Sambucus species were recorded in Egyptian papyri as being of ancient use [104]. Flower decoctions of *Sambucus* species are used for open sores and in baths as emollients; and leaves are used in poultices on bruises, wounds and sores in France, Spain, Turkey, Madeira and Porto Santo [123–125]. Plant compounds found in *Sambucus simpsonii* flower are caffeic acid, chlorogenic acid, mucilage, potassium nitrate and rutoside [50]. Some of these plant compounds have anti-inflammatory properties.

Siparuma guianensis wood contains oxoaporphine alkaloids (liriodenine and cassamedine) [128]. The leaves contain an essential oil consisting of furanosesquiterpenes (mainly cruzerenones), myristicin (8%) and cruzerene (0.4%) [128]. Some alkaloids are immunostimulants at very low doses [39].

Solanum americanum leaf decoction is used for fevers by the Mosetene Indians in Bolivia [108]. *Solanum* species is used in Guatemala and by the Pilagá in Argentina to treat boils, dermatitis, as a cicatrizant and analgesic [130]. *Solanum torvum* and *Solanum mammosum* leaf juices are rubbed onto afflicted areas for athlete's foot in Belize [109]. *Solanum nigrescens* leaf decoction was suggested as an effective treatment for vaginal candidiasis [55,108]. *Solanum americanum* leaf extracts were active against *Microsporum* species, *Epidermophyton floccosum*, *Trichophyton* species and *Cryptococcus neoformans* and showed intraperitoneal subacute toxicity in mice [127,131,108].

Vernonia scorpioides (syn. *Cyrtocymura cincta*) is used in Trinidad as an aphrodisiac and against witchcraft [52]. *Vernonia* species are used worldwide to stop bleeding, allay inflammation and in the treatment of stomach aches, asthma, intestinal parasites and for protection against snakebites [51,132–134,82,92,135]. The use of *Vernonia scorpioides* for mange has been recorded [50]. *Vernonia scorpioides* aerial parts and flowers and leaves of *Vernonia megaphylla* (syn. *Eirmocephala megaphylla*) contain sesquiterpene lactones, glaucolides and piptocarphols. The fungicidal activity of *Vernonia scorpioides* against *Penicillium citrinum* and *Aspergillus alutaceus* has been attributed to the sequiterpene lactones in the stalks and leaves [135]. Sesquiterpene lactones have immunostimulatory effects [40]. *Vernonia scorpioides* roots contain costunolide and eudesmanes [136,92,137].

A *Xanthosoma* species has been tentatively identified in an Aztec herbal [103]. A *Xanthosoma* species called "chou poivre" was rubbed on the body by the Caribs in Dominica as a charm before going to war [103]. Another species called "chou froidure" was used as an infusion for chills [103]. *Xanthosoma auriculatum* leaf sap is used in Brazil for severe wounds and skin diseases [103]. *Xan-*

thosoma brasiliense and *Xanthosoma undipes* probably contain irritating compounds that irritate mucous membranes [138,129]. *Xanthosoma brasiliense* belongs to the Araceae family, which generally contain glycoflavones, flavonols and proanthocyanidins.

Xiphidium caeruleum leaves were rubbed on the feet and knees of children in Trinidad and Tobago that were learning to walk [52]. Walkfast or corrimiento (Spanish *correr:* to run) is used to help hunting dogs in Trinidad run fast and "brighten them up" [3]. In Panama and Columbia *Xiphidium caeruleum* ground stem infusion or decoction is drunk as an antiemetic and the leaf infusion is used externally for skin disorders [107,129]. Xiphidione and other 9-phenylphenalenone pigments are found in *Xiphidium caeruleum*[107,129].

Conclusion

It is suggested that the medicinal plants exert a physiological action on the hunter or his dog. Plant use is based on odour and plant morphological characteristics. Plant use is embedded in a complex cultural context based on the ancient beliefs of indigenous Amerindians [1]. Columbian healers also use ethanolic extracts of plants for snakebites, prepare snakebite remedies in the week before Easter and choose plants according to the Doctrine of Signatures [139]. The cultural basis of the plant use does not mean that the plants have no effect. Some of the plants mentioned contain chemicals that may explain the ethnomedicinal and ethnoveterinary use. For instance some of the plants influence the immune system or like *Lepianthes* are effective against internal and external parasites. Plant baths with species such as *Lepianthes* and *Phyllanthus* that have compounds showing analgesic, antiinflammatory and antibacterial effects may contribute to the health and well being of the hunting dogs. The multiple plant compounds found in *Phyllanthus* species merit further investigation. Plant species that show potential efficacy against skin conditions are *Momordica*, *Piper*, *Solanum* and *Vernonia*. *Jatropha* and *Justicia* species contain compounds with potential in wound healing. *Eclipta prostrata* and its constituents (wedelolactone, stigmaterol and sitosterol) showed good potential against crotalid venoms. The carcinogenic risk cited in the literature on aristolochic acid [61] needs to be evaluated versus its potential benefit as an emergency medicine for snake and scorpion bites.

Competing interests

None declared.

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