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KNOWLEDGE OF TRADITIONAL MEDICINES AND VETERINARY PRACTICES USED FOR REPRODUCTIVE HEALTH PROBLEMS

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ABSTRACT.—This paper explores links between women's health knowledge, cultural practices, and traditional veterinary medicine by focusing on nine plants used in both folk medicine and traditional veterinary medicine for reproductive health conditions. These taxa (*Spondias mombin* L., *Senna occidentalis* (L.) Link, *Petiveria alliacea* L., *Ruellia tuberosa* L., *Curcuma longa* L., *Abelmoschus esculentus* (L.) Moench., *Bambusa vulgaris* Schrad., *Oryza sativa* L., and *Stachytarpheta jamaicensis* (L.) Vahl.), identified in the course of ethnoveterinary research conducted in Trinidad and Tobago from 1995–2000, are a small part of the 180 plants recognized locally to have medicinal value. Non-experimental validation of the nine plants indicated that they show intermediate to high levels of validity and merit further investigation. This investigation could include further study into the efficacy of the methods of administration of the plants.

Key words: folk medicine, traditional veterinary medicine, Trinidad and Tobago, reproductive health.

RESUMEN.—Este artículo explora las relaciones entre el conocimiento sobre salud femenina, las prácticas culturales y la veterinaria popular referidas a problemas de salud reproductiva. Para ello se centra en nueve plantas utilizadas a la vez en medicina y veterinaria para tratar las condiciones sanitarias de la reproducción. Estos taxones (*Spondias mombin* L., *Senna occidentalis* (L.) Link, *Petiveria alliacea* L., *Ruellia tuberosa* L., *Curcuma longa* L., *Abelmoschus esculentus* (L.) Moench., *Bambusa vulgaris* Schrad., *Oryza sativa* L., y *Stachytarpheta jamaicensis* (L.) Vahl.), identificados durante un estudio etnoveterinario llevado a cabo en Trinidad y Tobago entre 1995–2000, son una pequeña parte de las 180 plantas reconocidas localmente como medicinales. La valoración no experimental de las nueve plantas indicó que muestran niveles intermedios a altos de validez y que merecen una investigación más profunda. Esta investigación podría incluir un estudio más profundo de la eficacia de las formas de administración de las plantas.

RÉSUMÉ.—Cet article explore les liens entre les connaissances gynécologiques, les pratiques culturelles, et la médecine vétérinaire ancienne, à travers l'exemple des neuf plantes suivantes: *Spondias mombin* L., *Senna occidentalis* (L.) Link, *Petiveria alliacea* L., *Ruellia tuberosa* L., *Curcuma longa* L., *Abelmoschus esculentus* (L.) Moench., *Bambusa vulgaris* Schrad., *Oryza sativa* L., et *Stachytarpheta jamaicensis* (L.) Vahl. Ces taxons sont utilisés traditionnellement dans les soins relatifs à la reproduction

pour les êtres humains et les animaux. Ces plantes, identifiées par une étude ethnovétérinaire menée à Trinidad et Tobago de 1995 à 2000, ne représentent qu'une modeste partie de la collection de 180 plantes médicinales utilisées par la population locale. La validation non expérimentale de ces neuf plantes indique une validité de niveau intermédiaire à élevée méritant une investigation plus poussée qui pourrait inclure une étude supplémentaire sur l'efficacité des méthodes d'administration.

INTRODUCTION

Research into traditional veterinary practices typically seeks practical options for the provision of livestock health care that can be of use to farmers with limited resources (McCorkle et al. 1996). Traditional veterinary medicine includes local descriptions of diseases and knowledge of how to treat or avoid them. Vaccinations and brandings have not been observed in Caribbean traditional veterinary medicine, but tools, technologies, and magico-religious beliefs are found. There is potential for locally available herbal medicines to be used in primary health care and agricultural development. In Trinidad and Tobago traditional veterinary practices and beliefs are based on Caribbean folk medicine, which incorporates knowledge from Africa, Europe, India, and South America (Longuefosse and Nossin 1996). Knowledge of folk remedies is transmitted orally from generation to generation, often from grandparents to the grandchildren who live with them or from elder female relatives to the young (Lans 1996; Longuefosse and Nossin 1996). Folk knowledge exists in (marginalized) parallel to western science but is often tried first, especially for minor conditions (Laguerre 1987; Lans 1996).

In this paper we focus on the non-experimental validation of nine plants used for reproductive health by women and for animals. This study is part of a larger one concerned with the documentation and non-experimental validation of traditional veterinary medicine in Trinidad and Tobago (Lans 1996, 2001). The first phase of the larger research project involved data collection carried out for five months in 1995 by Lans. This data collection was divided into four parts. A method called the school essay was used initially. This involved 242 students from nine secondary schools (age 12–15 years) who interviewed friends and neighbors on their use of folk medicine and then wrote essays that identified 28 respondents knowledgeable about traditional veterinary practices. Lans then held group and individual interviews with the 28 local experts, 30 veterinarians, 27 extension officers, 19 animal health assistants (AHAs), and 7 additional local experts that the AHAs identified. Five focus group workshops were then conducted with 55 of the non-veterinarians interviewed in order to validate and verify the data. An information seminar was also given at the veterinary school of the University of the West Indies.

In the second phase of the research, 1997–2000, Lans worked through previously existing social networks to build a purposive sample, which maximized the number of knowledgeable respondents. The respondents in the second phase included 23 people involved in the horse-racing industry, five involved in both horse racing and cockfighting, two involved in cockfighting who did not claim horse-racing involvement, one group of seven hunters, and ten individual hunters. Thir-

ty other respondents were interviewed who knew of folk remedies but did not admit to any knowledge of traditional veterinary remedies. The study results were divided into nine case studies: pigs, commercial poultry, gamecocks, ruminants, ruminants and reproductive health, pet dogs, hunting dogs, horses, and folk medicine. The case studies of pigs, commercial poultry, ruminants, pet dogs, and hunting dogs have been published.

In 1995, Lans noticed that male and female farmers were using certain plants to assist in the health care of their animals and it became evident that the knowledge of these plants came from the reproductive knowledge of female farmers or the female relatives of the male farmers (Lans 1996). The administration of the plant remedies was different for humans and animals. In order to examine this discrepancy as part of the non-experimental validation of the plants we felt it necessary to incorporate women's reproductive knowledge (and all its ramifications) into a study on animal health.

Several ethnobotanists now recognize that the parameters used to validate ethnomedicines cannot be derived only from the objective sciences, as sickness and health incorporate social, cultural, and psychological as well as biological phenomena (Weniger 1991). Our non-experimental validation methodology was adapted from the social sciences and from the ethnopharmacological literature (Browner et al. 1988; Heinrich et al. 1992). Heinrich et al. (1992) have claimed that ethnobotanical investigations have resulted in a large body of descriptive data, which should now be evaluated in order to select those plants that should be submitted to further investigation. Several scientists have begun the task of empirically evaluating indigenous medicine (Ankli et al. 1999). Like them, we do not assume that the number of users of the plants is a guide to their merit; instead the non-experimental validation of the plants determines which of the plants is likely to be effective and thus worthy of further investigation (Eigner and Scholz 1999; Elisabetsky and de Moraes 1990). Incorporating cultural details into the study of traditional veterinary medicines ensures that future scientific validation is not wasted on plants that are used only for cultural or religious reasons (Etkin 1993). This is important not only because of the waste of resources, but because negative results can destroy confidence in a field already struggling for recognition (Eigner and Scholz 1999).

Non-experimental validation of the traditional veterinary medicines was undertaken in recognition of the fact that western science has become the benchmark by which other cultures' knowledge is evaluated (Watson-Verran and Turnbull 1995). Many anthropologists and social scientists claim that scientists should not decide whether indigenous beliefs and practices are or are not scientific, as this has colonialist overtones (Hastrup and Elsass 1990), or that indigenous knowledge systems represent the cultural dimension of development and cannot be reduced to the empirical knowledge that they contain (Warren et al. 1995). These anthropological reservations have some merit, yet validation of traditional veterinary medicines is important. Many local people no longer treat themselves or their animals with folk medicines because they have not been validated by any recognized "scientific" body, yet some of these medicines may indeed be efficacious.

Non-experimental Validation.—The traditional validation process used in the development of synthetic drugs can be described as drug discovery, drug design, and pre-clinical and clinical studies (Schuster 2001). The process requires screening an average of 10,000 active compounds to find a single compound that successfully makes its way through validation to drug approval and then prescriptions and sales; this process is time consuming and too expensive for most developing countries (Elisabetsky and de Moraes 1990). Well-controlled clinical trials are used to evaluate the efficacy and side effects of herbal medicines before they are accepted for use in allopathic medicine. This process of randomized, double blind, multicentered trials with standardized extracts is protracted and expensive (Bodeker and Chaudhury 2001). Non-experimental validation seeks to reduce the time and expense of evaluating medicinal plants by providing a preliminary review of the plants. This review indicates whether the plants merit the time and expense of the traditional investigation described above.

The first step of the non-experimental validation involved a review of a variety of published literature to gain an understanding of Caribbean, Asian, African, and Latin American concepts of reproductive health, especially those related to the use of medicinal plants. This step served to establish whether the plants were used for cultural reasons, medicinal reasons, or both. The second step involved searching for information on the plants' known chemical constituents and pharmacological effects. The third step built on the first two and was an evaluation of the claims of the respondents. In other words, is there a plausible biological mechanism by which the plant chemicals and known or possible physiological effects could achieve the results that they described? Heinrich et al. (1992) assume that the more information there is that validates the popular use of a plant in treating a certain illness, the more likely it is to be effective. If sufficient data are available, one of four levels of confidence can be assigned to the plant appraisal:

0) If no information supports use, it indicates that the plant may be inactive.
1) A plant (or closely related species of the same genus) used in geographically or temporally distinct areas in the treatment of similar illnesses attains the lowest level of validity.
2) If phytochemical or pharmacological information also validates the traditional use, the plant is assigned level one validity.
3) If ethnobotanical, phytochemical, and pharmacological data supports the folk use of the plant, it is assigned level two validity and is likely to be effective.

Relevant Medical Terms.—The medical terms used in this article are defined below. In a normal menstrual cycle there is a balance between the hormones estrogen and progesterone. These hormones regulate the buildup of the endometrium (uterine lining of blood and tissue) that is shed each month during menstruation. Dysmenorrhoea is the medical term for pain in the lower abdomen at the beginning of menstruation. Menorrhagia is excess bleeding during menstruation, which may result from insufficient secretion of progesterone, the release of estradiol from fat tissue due to obesity, or recent significant weight loss; as a result the endometrium keeps adding layers, and when it is eventually shed there is substantial bleeding. Estradiol is a steroid produced by the ovarian follicle. Emmen-

agogues are agents that promote menstrual flow and abortifacients are agents used to terminate pregnancy (Conway and Slocumb 1979; Ososki et al. 2002). Lactogogues are drugs or herbs that cause milk secretion or which are believed to increase milk production (Browner 1985).

Ruminant Reproduction.—Ruminants in this paper include cattle, sheep, and goats. In sheep the length of estrus or time between periods of standing heat (when the animal is willing to be bred) varies between 14 and 19 days. Estrus or standing heat lasts about 24 to 36 hours with ovulation occurring approximately 24 hours after the beginning of estrus (Mason and Atkins 2002). The ovaries release the ova (eggs) at 17-day intervals during the breeding season or until the ewe becomes pregnant. The ovaries and ruminant placentae produce the following hormones during pregnancy: estrogens, progesterone and other progestins, and placental lactogen (Mason and Atkins 2002). Cows have an estrus cycle of 17 to 25 days. In the week before a cow comes into heat a dominant follicle develops on one of her ovaries. When she comes into heat and is willing to be bred, the follicle ruptures, shedding an egg into the oviduct.

Gonadotropin releasing hormone (GnRH) stimulates the rupture of the follicle and the release of luteinizing hormone (LH) at ovulation. Follicle cells secrete estrogen until just before ovulation occurs when they begin to secrete progesterone. After ovulation the capsule of the follicle develops into a corpus luteum (CL), which matures for the next 12 to 13 days of the cycle, producing progesterone (Mason and Atkins 2002). Progesterone prevents the development of new follicles and keeps the uterus in a receptive state for conception and also sustains pregnancy if the ovulated egg is fertilized. If conception does not occur, oxytocin from the CL stimulates the release of prostaglandin (Prostaglandin F2-alpha) from the uterus on days 16 to 18 of the cycle, which causes the regression of the CL. A new dominant follicle then develops. In the pregnant cow, the embryo secretes proteins to block oxytocin from generating secretions of Prostaglandin F2-alpha from the uterus, thus maintaining the CL and pregnancy. Progesterone also plays a role in protecting the embryo from immunological rejection by the mother. Genital tract infections can occur due to the immunosuppressive actions of progesterone.

Reproduction and Culture.—As usefully stated by Casteñada et al. (1996), programs aimed at improving reproductive health can only be successful when they take into account the customs, values, and beliefs associated with fertility, pregnancy, and birth. Previous studies have contributed enormously to the elaboration and discussion of the strong cultural traditions that underlie the use of medicinal plants for reproductive health (Bayley 1949; Brody 1981; Browner et al. 1988; Conway and Slocumb 1979; Etkin 1988; Landman and Hall 1983; Nations et al. 1997; Newman 1985; Sobo 1996; Weniger et al. 1982). Before any definitive testing takes place it is often difficult to distinguish between amenorrhoea (absence or suppression of menstruation due to illness, depression, or malnutrition) and early pregnancy. Knowing this difficulty, women deliberately or unconsciously blur the differences between abortifacient and menses-stimulating effects. This gives them some control over reproduction in countries that have strict social, religious or legal restrictions against abortion. Etkin (1988) claims that the Native American

literature contains similar obfuscation. This obfuscation has been called cognitive ambiguity or a "hidden reproductive transcript" that is an unconscious or artful manipulation by poor, otherwise powerless women against their culture's anti-abortion ideology and a protest against a lack of family planning facilities (McClain 1989; Nations et al. 1997). In practical terms this cognitive ambiguity means that there can be no clear operational distinction between emmenagogues (agents used to bring on delayed menses) and abortifacients (agents used to terminate pregnancy) other than the dosage and the timing. Treating a "late" or "missed" period rather than a possible pregnancy helps these women avoid the dilemma of possibly inducing an abortion (Conway and Slocumb 1979).

METHODS

Data Collection.—The previous study (Lans 1996) had noted a difference in the way farmers treated their animals (that is, farmers used plant knowledge learned from their wives or female relatives, but administered the herbal remedies as decoctions rather than as steam). To find out if women would consider decoctions an effective way to treat the animals, Lans conducted interviews with six older women (>50 years) over a six-month period during 1996 and 1997 who were chosen from the group of key informants interviewed during the 1995 traditional veterinary research and from a larger ongoing research project. The sample consisted of a female farmer, two healers, and three housewives who had more than the average amount of knowledge of common remedies or core traditions and were therefore expected to know about and have used the plants previously identified as those utilized for reproductive health. The six women were located in Mason Hall (in Tobago), Paramin (in north Trinidad), San Fernando (in south Trinidad) and Talparo (in central Trinidad).

The women were asked specifically about the plants used during childbirth and for reproductive problems and associated cultural practices. They had used these medicinal plants for their own reproductive health; two had also assisted other women (Lans 1996, 2001). The healers were interviewed three times, but the others only once since they had fewer experiences to relate.

The following information about each plant was collected: common name, uses, part(s) used, mode of preparation, time and duration of application, doses, and expected biological action of the plants (Table 1). This information was documented and categorized. Women were also asked to reconstruct the circumstances and contexts of the plant uses so that the means of administration of the plants could be identified. A qualitative, conversational technique was used in preference to a more formal interview schedule. Plants were collected when available to verify that the common names used by each respondent were the same in each ethnic group as those recorded in the literature. The plants described in this paper were authenticated at the University of the West Indies Herbarium.[1]

Published sources such as journal articles and books and databases on pharmacology and ethnomedicine available on the internet were searched to identify the plants' chemical compounds and clinically tested physiological effects. These data were incorporated with data on the reported reproductive folk uses and their preparation and administration in Latin America, the Caribbean, Asia, and Africa.

These preliminary results were then presented by Lans to two groups of women in 1998. The presentations included draft versions of Tables 1 and 2 and discussions of the local use of the plants by farmers for their animals and by women for themselves. The first group consisted of 35 rural Indo- and Afro-Trinidadians attending a seminar on women's health at a community center in Todd's Road (central Trinidad). Five members of this group spoke up in the question period following the presentation to confirm knowledge of the plants and their uses for women and animals, while others nodded agreement. The same presentation was made four months later to 15 Indo-Trinidadian rural women attending a training session in Biche (south-eastern Trinidad). Lans was conducting participant observation with these women as part of a separate research project. Seven of these women gave verbal confirmation of the knowledge of the plants and their uses in humans and in animals.

RESULTS

The nine plants used in traditional veterinary medicine for reproductive purposes and corresponding uses by women are presented in Table 1. They come from eight different families. Leafy branches of hogplum (*Spondias mombin* L., Anacardiaceae) are fed for retained placenta. Decoctions of leaves and roots of wild coffee (*Senna occidentalis* (L.) Link, Caesalpiniaceae) or gullyroot (*Petiveria alliacea* L., Phytolaccaceae) or a root decoction of minny root (*Ruellia tuberosa* L., Acanthaceae) are used to induce estrus. A decoction or infusion of the grated rhizome of turmeric (*Curcuma longa* L., Zingiberaceae) is given to increase milk production and for retained placenta. Green pods and leaves of okro (*Abelmoschus esculentus* (L.) Moench, Malvaceae) and rice paddy (*Oryza sativa* L., Poaceae) are fed for retained placenta. Bamboo (*Bambusa vulgaris*, Poaceae) leaves are fed to ruminants for fever, after parturition, for milk let-down, and for retained placenta. A decoction of plant tops of vervine (*Stachytarpheta jamaicensis* (L.) Vahl., Verbenaceae) is given to animals to increase milk production.

All the farmer respondents interviewed in 1995 indicated that the plants used for retained placenta were given to their animals immediately after parturition. Farmer respondents described rice paddy as a "heated substance" that was used for retained placenta but not recommended for pregnant animals. One respondent explained the term "heated substance" by claiming that the "heat of the rice paddy would help break down the uterine lining." Both male and female farmers and women use the term 'clot blood' to refer to the blood clots and haematomas associated with birth. Besides the nine plants evaluated in this paper, women use 31 additional plants for reproductive problems but these others were not described as traditional veterinary plants during the five-year research period (Lans 2001).

Forms of Administration.—The preliminary work was presented to the two groups of women in order to get an indication of whether the plants were widely used or known to be useful for reproductive conditions. The circumstances and contexts of the plant uses as reconstructed by the women in the individual and group sessions corresponded with the descriptions obtained from the literature. How-

TABLE 1.—Comparison of traditional veterinary and medicinal plant use in Trinidad and Tobago.

Scientific name	Family	Common name	Traditional veterinary use, parts used, administration	Traditional medicinal use
Abelmoschus esculentus (L.) Moench	Malvaceae	okro	green pods and leaves fed for retained placenta	—
Bambusa vulgaris Schrad. ex Wendl.	Poaceae	bamboo	leaves fed to ruminants for fever, after parturition, for milk let-down and for retained placenta	decoction of leaves used for fever
Curcuma longa L.	Zingiberaceae	turmeric	decoction or infusion of grated rhizome given to increase milk production and for retained placenta	postpartum cleanser
Oryza sativa L.	Poaceae	rice	3 lbs. of paddy is fed to ruminants for retained placenta	—
Petiveria alliacea L.	Phytolaccaceae	gully root	decoction of leaves and roots given to induce estrus	dysmenorrhoea/amenorrhoea
Ruellia tuberosa L.	Acanthaceae	minny root	decoction of roots given to induce estrus	dysmenorrhoea/amenorrhoea
Senna occidentalis (L.) Link	Caesalpiniaceae	wild coffee	a) decoction of leaves and roots given to induce estrus b) leaf infusion/decoction drenched for retained placenta	a) postpartum cleanser b) leaf and root decoction used as a postpartum cleanser
Spondias mombin L.	Anacardiaceae	hogplum	leafy branches are fed for retained placenta	postpartum cleanser
Stachytarpheta jamaicensis (L.) Vahl.	Verbenaceae	vervine	decoction of plant tops given to animals; used to increase milk production	milk let-down and insufficient milk

ever, the main reason to present the work was to clarify how the plants are administered and therefore resolve the previously noted differences in administration. Very few of the non-farming women interviewed during the study said that they utilized the plants as decoctions; rather, in previous times midwives attended women during childbirth and put these plants in a tub of steaming water. The women would then sit over the tub on a stool for up to nine days (Herskovits and Herskovits 1947). This implies that active plant compounds are volatile substances that would be carried by the water vapor. As indicated previously, male and female farmers used decoctions of these plants for their animals, however women rarely used decoctions of the plants for themselves. When queried about plant preparation for animals, the farmer respondents described boiling the plants for 20 minutes and then allowing this decoction to cool. The term "draw" typically means steeping the plant parts in boiling water for about fifteen minutes (an infusion). When a small plant is involved, these respondents used the aboveground part, which they call the "leaves" of a particular plant. Dosages were nonstandard. We can recapitulate here that women use different forms of administration for some of these plants than the farmers. Women used the leafy branches of hogplum, a decoction of roots of wild coffee or leafy branches of bamboo for their own health care. These plants were put in a tub of boiling water and the women then sat over the tub or a stool or over what is called a utensil ('tencil) in Tobago. Women made a decoction of ground turmeric with massala, ginger and salted butter for their own use, to "bring down everything" after parturition. Women used decoctions of turmeric with vervine to "clean out" their bodies.

DISCUSSION

The two presentations of the data to the groups of women in Biche and Todd's Road did not produce new data or insights but indicated that both groups knew of the nine plants and their reproductive uses. This suggests that this particular plant knowledge is not restricted to a certain section of Trinidad's female population. This is important because plants that are known to a large number of informants have a higher ethnographic validity and should be investigated before plants that are known to two or fewer informants (Bourdy and Walter 1992; Heinrich et al. 1992). Presenting findings to research participants as done in the workshops and presentations is useful to assess the credibility of the research account to the respondents and to verify preliminary results (Green and Britten 1998; Mays and Pope 1995; Nations et al. 1997). The reactions of the respondents are often used to reduce errors and to help refine researcher's explanations, and they are incorporated into the findings. Members of both groups of women confirmed the information given in the presentations of the cultural and social reasons for the use of the plants as well as confirming that these were the plants used. Therefore no corrections to our findings were necessary.

Reproductive Health and the Use of Cleansers.—The following section gives a brief description of Latin American and Caribbean views of reproductive health, which provides a partial explanation for the use of plants by the women. Readers are referred to Longuefosse and Nossin (1996) for further details on Caribbean con-

ceptualizations of popular medical concepts. Women in the Caribbean squat over a vessel of hot water filled with medicinal plants because of their belief that the steam enters the body and "melts" all recalcitrant matter, which then slides out (Herskovits and Herskovits 1947; Sobo 1996; Weniger et al. 1982). This practice may derive from the Amerindian belief that the essence of the plant is inhaled through the "steam" and serves as a curative or prophylatic for the condition being treated (Dennis 1988). This form of "steaming" is of little value in treating animals. More relevant is the Caribbean belief that birth, defecation, and menstruation are cleansing processes; therefore mild purgatives are given to induce the quick delivery of the placenta and pregnancy-related waste matter through the vagina (Sobo 1996).

Abortifacients "make baby turn to blood and wash out" (Sobo 1996; Weniger et al. 1982). Emmenagogues are used in Latin America and the Caribbean to restore the menses, to "clean out" the womb, and to restore vitality after pregnancy (Sobo 1996). Purgatives are called "washout" and many women use "washout" ingredients like senna (*Senna occidentalis* and *Cassia obovata*) as emmenagogues and abortifacients (Browner et al. 1988; Kay 1996; Morton 1980; Sobo 1996). This suggests that cultural reasons may explain the inclusion of vervine (*Stachytarpheta jamaicensis*) in abortifacient recipes although its traditional use is to "wash out" worms and "cold" (mucous) (Sobo 1996).

The use of vervine to facilitate milk let-down in women and livestock can be interpreted as cultural since the original Amerindian use of *Stachytarpheta* species was as one of eight plants added to special baths given eight or nine days after childbirth to the mother and to the newborn (Hodge and Taylor 1957). The use of *Abelmoschus esculentus* to facilitate delivery by Jamaican women has been reported (Landman and Hall 1983). This study found that one-quarter of 125 pregnant Jamaican women used okro (*Abelmoschus esculentus*) as one of four teas to speed up delivery, induce labor, ease the pain of delivery, or to "free the birth canal." Bayley (1949) reported on the use of *Petiveria alliacea* for reproductive reasons in Barbados.

Hot-cold Valence.—Latin American and Caribbean women choose plants for reproductive conditions based on the properties that correspond to the hot-cold valence, irritating action, emmenagogic, oxytocic, anti-implantation, and/or abortifacient effects (Browner 1985; Etkin 1988). It is useful to consider these beliefs since they play a role in plant choice. The hot-cold valence in the context of reproductive health refers to the traditional belief that heat opens the body and facilitates the blood's free flow, whereas cold causes the blood to stop flowing and clog the arteries, veins, and womb (Coe and Anderson 1996). The body of a menstruating or pregnant woman is considered extremely hot (Nations et al. 1997). One cause of infertility is termed "cold in the uterus" and fertility enhancers are considered to be "hot" (Ankli et al. 1999; Browner 1985; Cosminsky 2001; Kay 1996).

Two studies explain the use of rice paddy by the respondents. Harrell (1981) documented that Taiwanese villagers provided a "hot" diet consisting of only chicken, sesame oil, wine and rice for a month after childbirth in order to replace the energy lost with the mother's blood at delivery. For traditional veterinary medicine, IIRR (1994) recommends a uterine tonic containing five types of grains

including rice mixed with six ingredients like black pepper and fennel seeds. This tonic is reputed to help cleanse the uterus, expel the placenta, and dispel gas from the rumen of the dam.

Table 2 summarizes Caribbean, Asian, African and Latin American ethnomedicinal literature. This summary indicates that all the plants attain the lowest level of validity established by Heinrich et al. (1992) in that they were used for similar reasons elsewhere. Therefore, a review of the phytochemical literature is warranted.

Evaluating Plant Components to Assess the Validity of the Traditional Veterinary Uses.—Uteroactive plants used in Mexico are described in metaphorical terms of "warming" or "irritating" (Browner et al. 1988). "Warming" the body, blood, and womb, causes the womb to "open" to release detained menstrual flow or expel a full-term fetus or unwanted embryo and associated tissues (conceptus). Uteroactive plants are said to cause stronger contractions and shorten delivery times. "Irritating" plants "open" the uterus and stimulate contractions that will release blocked menstrual blood or push out a full-term fetus or unwanted conceptus. Table 3 shows the chemicals in the plants that fit the Latin American descriptions of "irritating" and "warming."

Chemical constituents that correspond to the term "warming" are those that cause *in vivo* or *in vitro* uterine contractions. Relevant uterine stimulants for this paper are acetylcholine, serotonin (5-hydroxytryptamine), prostaglandins, and oxytocin (Uguru et al. 1998). Acetylcholine and serotonin are neurotransmitters concerned with the transmittal of nerve impulses; serotonin is involved in the regulation of moods and behavior. Prostaglandins are produced in many cells of the body by the action of enzymes on essential fatty acids and have a wide range of functions: in ovulation, reproductive tract motility, transport of sperm to the oviduct at estrus, egg transport, implantation, parturition, and CL regression. The thick middle layer of the uterus (the myometrium) is composed of smooth muscle. Plants that induce smooth muscle contractions or have oxytocic effects may improve sperm transport and conception. Oxytocin is a hormone produced by the ovary that directs behavior such as nest building and acceptance of offspring, pairing of couples, and is responsible for stimulating milk ejection during lactation and uterine contractions during birth. Oxytocic effects would include hastening or assisting childbirth by stimulating contractions of the uterus.

An aqueous extract of *Stachytarpheta jamaicensis* showed spasmogenic activity on the ileum of guinea pigs (Robineau 1991). Further study would be needed to ascertain if extracts of *Stachytarpheta jamaicensis* could also cause uterine contractions. *Petiveria alliacea* seed methanolic extract causes contraction of the rat uterus and this action may involve prostaglandin synthesis (Oluwole and Bolarinwa 1998; Robineau 1991). *Petiveria alliacea* extracts have caused abortions in cattle (Morton 1980). Extracts of *Spondias mombin* produced relaxant activity on smooth muscle and uterine stimulant activity (Robineau 1991) and induced abortion *in vivo* in rats and mice (Offiah and Anyanwu 1989). *Spondias mombin* contains saponins; some saponins have been shown to be uteroactive (Browner et al. 1988). *Bambusa bambos* fresh leaf juice produces uterine stimulation (Kapoor 1990). The anthraquinone glycosides in *Senna occidentalis* are responsible for its laxative action

TABLE 2.—Comparison of plant use for female reproductive problems in different geographical locations.

Scientific name	Ethnoveterinary use	Ethnomedicinal use	Location
Abelmoschus esculentus	retained placenta	decoction of young okro used as a demulcent to soothe genito-urinary complaints, speed up delivery, induce labor, facilitate abortion or ease the pain of delivery	Philippines (Morton 1990), Trinidad (Wong 1976), Jamaica (Landman and Hall 1983)
Bambusa vulgaris	retained placenta	a) leaf decoction used as a remedy for fever, stomach upsets and nervous conditions; root decoction is an abortifacient	a) Latin America and the Caribbean (LAC) (Morton 1981)
		b) leaves used as emmenagogues and as a febrifuge; the fresh juice of the leaves of the plant has a weak ecbolic action, and leaves are also used for diarrhoea, fever, infections, skin rashes and sores	b) India (Kapoor 1990), Nicaragua (Coe and Anderson 1996)
Curcuma longa	retained placenta	a) used with *Trianthema portulacastrum* L. for wounds and vaginal discharges	a) India (Nagaraju and Rao 1990)
		b) dried root powder mixed with water or rhizome; juice drunk as a postpartum medication	b) Indonesia, Malaysia (Grosvenor et al. 1995; Ong and Norzalina 1999)
Oryza sativa	retained placenta	rice water drunk to relieve leukorrhea and vaginitis	Nepal (Bhattarai 1994)
Petiveria alliacea	estrus induction	a) leaves boiled with *Phyllanthus amarus* Schum. & Thonn., bark of *Swieteria mahogoni* Jacq., and the pulp and seeds of *Crescentia cujete* L. for abortions	a) Latin America and the Caribbean (LAC) (Morton 1981)
		b) gully root plant parts used as emmenagogues, for menstrual difficulty, womb inflammation, and as abortifacients	b) LAC (Morton 1981; Ososki et al. 2002; Wong 1976)
		c) slaves used a decoction of the roots of *Petiveria alliacea* after eating large amounts of okro in order to abort	c) LAC (Duke 2000; Morton 1981)
Senna occidentalis	estrus induction	a) large handful of ground leaves mixed in water and drunk to induce birth, to "cleanse" the insides, prevent haemorrhaging, expel the lochia, and "draw organs back to normal"	a) Vanuatu (Bourdy and Walter 1992), Nicaragua (Barrett 1994; Coe and Anderson 1996)

TABLE 2—(continued)

Scientific name	Ethnoveterinary use	Ethnomedicinal use	Location
		b) decoctions and infusions of leaves, leafy stems and flower spikes or roots used for womb inflammation, abortifacients, emmenagogues, purgatives, for menstrual pain, and as postpartum depurants; use of 5 g of roots in 300 g of water can cause abortion	b) Caribbean (Morton 1981), Nicaragua (Coe and Anderson 1996; Dennis 1988)
Spondias mombin	retained placenta	a) leaves boiled with *Cordia cylindrostachya* (Ruiz & Pav.) Roem. & Schult., *Mangifera indica* L. and *Anacardium occidentale* L.; the decoction taken for 9 days after confinement	a) Caribbean (Morton 1981)
		b) aqueous extract of leaves with leaves of *Alchornea cordifolia* (Schumach. & Thonn.) Müll. Arg. used to clean cuts, sores and burns; an aqueous extract of the *Spondias mombin* bark used as a vaginal wash for treating infections and haemorrhages	b) Nigeria (Ajao et al. 1985), Latin America (Ayala Flores 1984; Coe and Anderson 1996; Hazlett 1986)
Stachytarpheta jamaicensis	milk production	a) plant decoction used as a lactogogue and emmenagogue, to clean the system, and relieve painful menstruation; root decoction used as an abortifacient	a) Middle America and the Caribbean (Eldridge 1975; Morton 1981; Wong 1976)
		b) a "bitter plant" used to treat gastrointestinal pain; used for childbirth and pregnancy, fever, respiratory conditions, worms, venereal disease, as a purgative or a laxative	b) Mexico and Haiti (Heinrich et al. 1992), Nicaragua (Coe and Anderson 1996)

TABLE 3.—Evaluation of the plant remedies for reproductive purposes.

Scientific name	Irritating chemicals	Oxytocic/uteroactive chemicals and properties, maintenance of reproductive health
Abelmoschus esculentus	—	—
Bambusa vulgaris	—	acts on cholinergic receptors; leaves have weak ecbolic action
Curcuma longa	—	camphor, terpenene, borneol
Oryza sativa	—	oestrone, vitamin E
Peliveria alliacea	—	induces smooth muscle contractions
Ruellia tuberosa	—	beta-sitosterol, stigmasterol, purgative action
Senna occidentalis	—	anthraquinone glycosides
Spondias mombin	tannins	saponins
Stachytarpheta jamaicensis	tannins	—

and also have oxytocic properties (Robineau 1991). Oestrone is an estrogenic hormone secreted by the ovary in mammals. The oestrone in *Oryza sativa* may account for any role that *Oryza sativa* plays in inducing ovulation (Oliver-Bever 1986).

Stachytarpheta jamaicensis and *Spondias mombin* contain the irritating chemical compounds called tannins. *Curcuma longa* contains the irritating compounds camphor, borneol (very similar to camphor), and terpenene (Duke 2000). These three compounds are commonly found in essential oils.

Ruminant Reproductive Disorders.—In polyestrus animals and some ruminants, infertility is defined more broadly than just failure to conceive. Infertility includes a subnormal number of offspring, in addition to failure to produce any offspring, failure to cycle, aberrations of the estrus cycle and estrus period (based on ovarian and other dysfunctions), and prenatal and perinatal death (Merck 1986). Three basic physiological functions must be maintained during the periparturient period if metabolic diseases like retained placenta and retained fetal membranes are to be avoided: the rumen needs to adapt to a high energy lactation diet, the concentration of calcium in the blood needs to be maintained at normal levels, and the immune system needs to be strong (Goff and Horst 1997).

Increased incidence of retained placenta is associated with many causal factors but the role that each of these factors plays in causing retained placenta is still under investigation (Laven and Peters 1996). Retained placenta is defined in this paper as the presence of fetal membranes 24 hours or more postpartum (Laven and Peters 1996). The delivery of the placenta postpartum is a physiological process, involving the loss of feto-maternal adherence in combination with uterine muscular contractions (Laven and Peters 1996). There is inconclusive evidence that infection of the genital tract with pathogenic organisms or the build-up of virulence of the organisms which are normally present in ruminant housing (Group C *Streptococcus, Escherichia coli, Pseudomonas,* and *Corynebacterium pyogenes*) may lead to retained placenta (Arthur et al. 1989; Laven and Peters 1996). An increase in blood selenium is associated with a decrease in all infections especially those caused by *Corynebacterium* species (Jukola et al. 1996). Selenium is found in rice (Karita et al. 2001).

Increased estrogen has a positive effect on uneventful placental delivery in cattle because estrogens play an important role in the maturation of placentomes and in uterine contractility (Zhang et al. 1999). Placentomes are knobs of tissue connecting the placenta and uterus that exchange nutrients and wastes. When the uterus is undergoing contractions during labor the blood flow between the placenta and uterus decreases and detachment and expulsion of the placenta occurs.

Statistical differences were found in the activities of various enzymes in cows with retained placenta and cows without the condition (Brzezinska-Siebodzinska et al. 1994; Kankofer et al. 1996a; Kankofer et al. 1996b; Mahfooz et al. 1994). Other studies showed that the metabolism of amino acids may be altered in cows with retained placenta and there may be an imbalance in free radical generation and neutralization and lower levels of fast-acting antioxidants in plasma in cows with retained placenta (Brzezinska-Siebodzinska et al. 1994; Kankofer and Maj 1997). These studies imply that the incidence of retained placenta could be reduced by reducing oxidative stress or by boosting the immune system (Kankofer 2002; Miyoshi et al. 2002). Oxidative stress results in cell deterioration. Feeding rice, turmeric, okro, or other plants with antioxidant properties could therefore play a role in reducing the incidence of retained placenta (Araújo and Leon 2001; Jariwalla 2001; Lee et al. 2002; Lin et al. 2002; Osawa 1999; Xu et al. 2001).

Dietary polyunsaturated fatty acids and their role in the synthesis of prostaglandin and provision of energy before calving may be related to retained placenta (Chassagne and Barnouin 1992; Nakao et al. 1997). Some studies show that cows with retained fetal membranes had lower fatty acid content except for linoleic acid (Chassagne and Barnouin 1992; Kankofer et al. 1996a; Kankofer et al. 1996b). Since okro has appreciable levels of 17 amino acids including linoleic acid it may reduce the incidence of retained placenta (Duke 2000).

Inadequate food can prevent ovulation by reducing the amount of circulating luteinizing hormone (LH) below the level needed to stimulate maturation of the ovulatory follicle (Rhodes et al. 1996). Dietary deficiencies can also increase oxidative stress and production of lipid peroxides (Brzezinska-Siebodzinska et al. 1994; Laven and Peters 1996; Michal et al. 1994). Inadequate dietary antioxidants, including beta-carotene/vitamin A and vitamin E, and deficiencies in selenium, iodine, magnesium, copper, zinc, and iron have also been linked to retained placenta and problems with onset of postpartum cyclicity (days to first estrus, days to first service and conception rate). Some studies have found significantly lower serum values for glucose and protein in cows with retained placenta (Choudhury et al. 1993; Mahfooz et al. 1994). These studies substantiate the claim of Barnouin and Chassagne (1991) that old cows fed diets in the prepartum period that are rich in green fodder and calcium but low in cereal content (a description that fits many ruminants and ruminant diets in Trinidad and Tobago) are at maximum risk for retained placenta. To summarize: a complex sequence of events leads to retained placenta, starting with an imbalance of antioxidant capacity of the placenta and followed by a decline in production of estrogen, which results in an accumulation of arachidonic and linoleic acid in placental tissues (Wischral et al. 2001).

The evidence presented in the previous discussion and the chemical constituents of the medicinal plants used for reproductive conditions may provide an

empirical basis for their use. For example *Curcuma longa* (turmeric) is reported to contain 6.3% protein, 5.1% fat, 69.4% carbohydrates, and carotene calculated as vitamin A (50 IU/100g) on a fresh weight basis (Kapoor 1990). When farmers feed ruminants turmeric after parturition they may add to the vitamin A, protein, and glucose in the diet. The plant also has anti-inflammatory and uteroactive effects that may also be effective for retained placenta.

Abelmoschus esculentus (okro) contains antioxidants, tryptophan, niacin, and thiamin (pain relieving, mood altering), arginine (antifertility, spermigenic, pituitary stimulant), linoleic and oleic acids (anti-inflammatory, immunostimulant), pectin (antibacterial, fungicide), amino acids, and most of the minerals and vitamins whose deficiencies are implicated in retained placenta (vitamins E and C, calcium, magnesium, zinc, and copper) (Duke 2000). Linoleic acid plays a positive role in ovarian and uterine function (Staples et al. 1998). *Abelmoschus esculentus* is active against *Stapylococcus aureus* (Verpoorte and Dihal 1987)

Bambusa vulgaris and *Senna occidentalis* are fed to animals within hours after birth and are classified as ecbolics by Duke (2000). This practice matches claims in the literature that ecbolics are only effective for retained placenta if given immediately after parturition (Peters and Laven 1996). Ecbolics are used to treat retained placenta because they are drugs or compounds that increase uterine contractions and physically aid the expulsion of membranes (Peters and Laven 1996). *Spondias mombin* is also fed within hours. This plant has uteroactive effects and its antibacterial, antifungal, and anti-inflammatory properties may play a limited role in controlling the genital tract infections that may lead to retained placenta (Arthur et al. 1989; Lans 2001; Laven and Peters 1996). The vitamin E and estrone in rice paddy may play a role in reducing retained placenta since increased estrogen has a positive effect on uneventful placental delivery in cattle (Zhang et al. 1999). Deficiency in tocopherols (vitamin E) is associated with gestation problems (Oliver-Bever 1986). Rice paddy would also increase the animals' energy and selenium levels (Karita et al. 2001).

Extracts of the rhizome of *Curcuma longa* showed antifertility activity in rats from an anti-implantation effect (Oliver-Bever 1986; Robineau 1991). There are also several analgesic, antibacterial, and anti-inflammatory components in *Curcuma longa* (Araújo and Leon 2001; Duke et al. 1998; Kapoor 1990; Oliver-Bever 1986). Infections are common causes of female infertility (conception failure, early embryonic death, and anestrus). The antibacterial and antifungal properties of *Curcuma longa*, *Abelmoschus esculentus*, and *Spondias mombin* may alleviate any infections present and the affected animal may then return to a fertile estrus.

Stachytarpheta jamaicensis contains irioids that are reported to be mildly laxative and anti-inflammatory. The plant also reduces fever. These plant properties may indirectly reduce fear and stress by relieving pain and helping alleviate painful conditions like udder edema and assisting milk let-down (Heinrich et al. 1992; Melita Rodriguez and Castro 1996; Misra et al. 2001; Robineau 1991; Schapoval et al. 1998). Research conducted in 1990 did not find the antilactogogue compound dopamine in *Stachytarpheta jamaicensis* (Robineau 1991).

Ruellia tuberosa may contain compounds like those found in *Ruellia praetermissa* (luteolin, apigenin, and iridoid glucosides) that are reported to be purgatives (Salah et al. 2000). *Senna occidentalis*, *Petiveria alliacea*, and *Ruellia tuberosa* are used to

induce estrus. These plants have anti-inflammatory, oxytocic, and abortive properties (Benevides et al. 2001; Lopes-Martin et al. 2002; Queiroz et al. 2000). *Ruellia tuberosa* contains stigmasterol and beta-sitosterol, which are phytosterols or natural plant estrogens. Decoctions of various parts of *Petiveria alliacea* have been widely used to treat dysmenorrhoea, and as abortifacients and emmenagogues (Oluwole and Bolarinwa 1998).

CONCLUSION

This paper presents the current state of academic knowledge of the plants used for reproductive health in Trinidad and Tobago and the folk medicinal and cultural explanations for their use. It contributes to the development of methods of validation for traditional knowledge that are affordable and feasible in developing countries. The non-experimental validation of the nine plants indicated that they show intermediate to high levels of validity and merit further investigation. This investigation could include further study into the efficacy of the methods of administration of the plants. Although cultural factors may underlie the traditional veterinary practices found in Trinidad and Tobago and the folk medicines used by women in the Caribbean, India, Africa and South America, the plants are not used solely for these reasons and the symbolic aspects of plant use do not limit their biomedical efficacy.

NOTES

[1] The plants described in this paper were authenticated at the University of the West Indies Herbarium. Voucher specimens were not deposited because the plants are common. The plants were compared to existing collections (hogplum TRIN# 31573,28045; minny root TRIN# 19343; vervine TRIN# 19347; kojo root 32379#; wild coffee 32787# and bamboo 31914#). *Stachytarpheta jamaicensis* is similar to *Stachytarpheta cayennensis* (rat tail vervine), which is also used for milk let-down but not as frequently. *Senna occidentalis* is distinguishable from *Senna alata*, whose leaves are used for ringworm; *S. alata* becomes a tree. *Spondias dulcis* (pomme cythere) is easily distinguished from *Spondias mombin* and has fruit that is eaten more often than *Spondias mombin*, whose fruit is often left to rot or fed to pigs. *Spondias purpurea* var. *lutea* differs from *Spondias mombin* because it is a smaller tree with red flowers that loses its leaves in the dry season. *Petiveria alliacea* and *Ruellia tuberosa* have no similar varieties. *Bambusa vulgaris* is the largest and most common of the many *Bambusa* species and the most frequently used in folk medicine. *Abelmoschus moschatus* is never eaten and rarely used in folk medicine. Its fruit is a different color and texture than *Abelmoschus esculentus*.

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