Economie Botany , 44(3), 1990, pp. 369-381

Herbal Remedies of the Luo of Siaya District, Kenya: Establishing Quantitative Criteria for Consensus

TIMOTHY JOHNS, JOHN O. KOKWARO, AND EBI K. KIMANANI

Data based on independent interviews with 45 herbalists of the Luo of Siaya District, Kenya, comprised 1129 remedy reports and related to 330 species of plants. While 49% of the remedies were encountered only once we list here 66 remedies (49 taxa) that were confirmed through independent reports from three or more individuals. A log-linear model was applied to these data in order to establish criteria for evaluating the likely efficacy of specific remedies. A quantitative interaction effect was calculated for each remedy as a measure of its degree of confirmation. The validity of the values derived from the mathematical model is considered in relation to classical criteria for evaluating ethnomedicinal reports.

Les plantes médicinales Luo du district de Siaya au Kenya: identification des critères d'évaluation quantitative pour fins de consensus. Les résultats d'enquêtes individuelles avec 45 herboristes Luo du district de Siaya au Kenya ont permis de répertorier 330 espèces de plantes médicinales utilisées dans quelques 1129 traitements herboristes. Puisque 49% de ces plantes médicinales n'avaient été mentionnées qu'une seule fois, nous avons bâti une liste de 66 plantes médicinales (49 taxa) dont chacune a été rapportée par plus de trois herboristes. Les résultats obtenus ont été incorporés dans un modèle logarithmique linéaire afin d'identifier des critères d'évaluation de l'efficacité de ces plantes médicinales. Pour chacune des plantes médicinales "l'effet de l'interaction quantitative" a été utilisé comme mesure de son degré de confirmation. La validité des résultats obtenus à partir de ce modèle mathématique a été comparée aux critères classiques d'évaluation des rapports ethnomédicinaux
.

Although Western scientific medicine is accessible to the Luo of Nyanza Province - Kenya, many people continue to depend, at least in part, on herbal remedies. Siaya District is a rural area where practitioners of herbal medicine remain active where opportunities exist to record and evaluate this aspect of the traditional health care of the Luo. Undertaking an ethnomedicinal survey of this district we encountered several methodological problems inherent in ethnobotanical work. These focus around question of the criteria on which to assess the importance of reports from individuals in the collective pharmacopeia of the region. Inconsistency in the information received from informants is compounded by the uneven spatial distribution of plant resources and by the prevalence of certain disease conditions compared to others. Concurrently, if one wants to identify plants that might be the most promising for pharmacological analyses it is important to establish some criteria on which to evaluate the likely efficacy of various remedies. ln compiling a list of herbal remedies from Siaya we have attempted to address these issues by applying a quantitative model to our data.

QUANTIFICATION IN ETHNOBOTANICAL STUDIES

Methodological issues are seldom explicitly addressed in ethnomedicinal surveys. However, ethnobotanical data are anecdotal in nature and reports based on information obtained from a single informant are of negligible scientific validity (Tippo 1989). ln our experience, informants are often contradictory of each other, and it is difficult to attach much weight to ethnobotanical data without some measure of confirmation. Indeed, it is often suggested that informants will respond, to questions with any answer simply oui of a desire to please or because they do not want to appear ignorant (cf. Weiss 1979). On the other hand, researchers may lack the perspective to interpret the context in which data are offered by informants (Etkin 1988). Because it is not always clear how ethnobotanical data are compiled it is often difficult to evaluate their quality. We reviewed 29 papers reporting medicinal use data from primary sources that were published in Economic Botany over the past 10 yr (Vol. 33-42). The few papers that provide information on the numbers of informants and reports gathered (Dennis 1988; Lai and Lata 1980; Lai and Yadav 1983) are exceptional. While quantitative methods may not always be possible or even necessary with data of this type, what is questionable is the general failure of authors (with some exceptions, e.g., Bye 1986; Weiss 1979) to state what criteria they used to select particular data to be reported. Ethnomedicinal papers published in other journals follow the same pattern, although many recent papers appearing in the *Journal of Ethnopharmacology* (e.g., Encarnacion D. et al. 1987; le Grand and Wondergem 1987; Moskalenko 1987) are more attentive to methodological details.

If a plant is used in a consistent fashion it is a reasonable assumption that there are biological and/or cultural bases for the phenomenon. Testing with bioassays, the comparison of folk uses of a plant with those in western pharmacopoeia or comparison with pharmacological data on the known chemical constituents of a plant can further rationalize the use of particular folk remedies (Camazine 1986; Croom 1983; Lozoya et al. 1987).

Various observers approach the issue of establishing consensus regarding the application for a particular plant remedy with the premise that plants which are used in some repetitive fashion are more likely biologically active and efficacious (Croom 1983; Trotter and Logan 1986). Trotter and Logan (1986) discussed historical depth (the consistency of use of plants over time in a certain area), cross-cultural comparisons of inventories of herbal remedies in two or more cultural areas, and frequency of appearance of remedies in a community or in market or trade

networks. ln developing a methodology for establishing the degree of consensus of the use of a plant within a cultural group they described a quantitative method for analyzing data. We describe another. Such approaches provide a basis for more conscious attempts to refine ethnobotanical methodology.

THE LUO OF SIAYA DISTRICT

Siaya District occupies most of the Kenyan territory immediately north of Lake Victoria (Fig. 1). Most of the ca. 500,000 Luo-speaking inhabitants of the region subsist by traditional agriculture (DuPré 1968; Wilemskl 1977). Migration of people between Siaya and the centers of Kisumu and Nairobi has an important impact on the economy and the culture of the region.

Traditional Luo customs and beliefs relating to disease have been described (Odhalo 1962; Whisson 1964). Some ethnobotanical data from Siaya are included in the Luo-English botanical dictionary (Kokwaro 1972), and we have reported on the food plants of the region (Johns and Kokwaro n.d.).

METHODS

We carried out interviews of the medicinal uses of plants in Siaya District in July-August 1986 and March-April 1988. The five Divisions in this district of 4523 km2 were represented in the survey, and the following locations within these Divisions were selected for formal study: East Ugenya (Ukwala Division), Central Gem (Yala Division), Central and West Alego (Boro Division), East Asembo and East Uyoma (Rarieda Division), and West Sakwa, South Sakwa, and East Yimbo (Bondo Division). Within each location a minimum of three recognized herbalists was identified and contacted with the assistance of the local chief. ln total, interviews were conducted with 45 individuals. Study sites are indicated in Fig. 1.

Herbalists were interviewed independently from each other during prearranged appointments generally lasting 1-2 h. Follow-up interviews were conducted with individuals who were particularly knowledgeable and articulate. Information was solicited in an open-ended fashion. Informants were asked to tell us what remedies they used and how they used them. We consciously avoided introducing bias by soliciting information on particular plants or particular diseases. The preferred method of interview involved walking with individuals and discussing plants as they were encountered. Alternatively, informants were allowed to collect samples before we arrived; discussions followed in their homesteads. All interviews were conducted by Luo-speaking students and staff from the University of Nairobi (a team of two individuals in each field session).

Among the Luo, herbalism is a recognized profession and it is expected that practitioners receive payment either for treating patients or for direct imparting of information. ln accordance with this tradition informants were paid a nominal sum for their time and information.

Herbarium specimens were prepared of all plants that had not been collected and positively identified previously during the study and are deposited at NAI (University of Nairobi), UC (University of Califomia, Berkeley), or MTMG (McGill University). Specimens JAO and the data they support were collected by Johns, E. Achola, and T. Omenda. Similarly, specimens JWY were collected by Johns, W. Wallunya, and E. A. O. Yuko. Identifications were made by the collectors, by the authors, or by Simon Mathenge of the University of Nairobi.

RESULTS AND DATA ANALYSIS

From the 45 interviews 1129 remedy reports were recorded. When concoctions were used, a record was made for each component and added to the total number of remedies reported. This list comprises 330 species in 254 genera.

Disease names were recorded in English where their nature was easily understood, alternatively by Luo name or English description. For the data analysis all reported diseases were categorized into 44 categories generally based on physiological systems. Not all Luo disease concepts translate directly into physiological concepts; some such as chira have no direct equivalent in Western medicine. Particular diseases such as kuom and yamo overlap simple categories, and categorization into specific concepts was sometimes arbitrary and unavoidably imprecise.

- kuom is explained as the disease that causes hunchback and likely has multiple causes.
- yamo refers to a disease that results in stomach pains and/or swelling on the skin. While it may often correspond to anthrax, the term refers to a general group of ailments.

The overall impression obtained from the data is of inconsistency and a high degree of randomness. Most remedies were reported only once (553, 49% of reports). Our criterion for consensus was that remedies be confirmed through independent reports from three or more individuals (cf. le Grand and Wondergem 1987). Although 82 such remedies were recorded, 16 were deleted after re-examination because the difficulty in establishing disease categories makes it problematic to rationalize their authenticity. ln addition to the 66 confirmed remedies reported in Appendix l, 108 remedies (of which 44 seem meaningful when reexamined) were reported independently by two individuals.

Confirmation is not a single true measure of the potential efficacy of any remedy.

We mentioned above the effect of prevalence of plant and disease on the likelihood of encountering any particular remedy. Thus there is greater probability of a common plant (common either in abundance or in its cultural value as a medicine) being reported to treat a common disease than a rare plant to treat a disease of limited occurrence.

ln attempting to establish some measure of confirmation independent of the simple probability of encountering specifie plants and diseases, we applied a log-linear model (Bishop et al. 1984) to our data.

If n_{ij} is the total number of people who said that plant i is used to treat disease j, then we postulate that the n_{ij} is influenced by factors that are due to abundance of plant i, prevalence of disease j, and the potential for plant i as a cure for disease j. We assume the following log-linear model:

$$\log(n_{ij}) = \mu + \alpha_i + \beta_j + \tau_{ij} + \varepsilon_{ij}$$

where μ is an overall effect, α_i is the main effect due to plant i, β_j is the main effect due to disease j, τ_{ij} is the interaction effect, and ε_{ij} is random variation in cell (i.j). The interaction of i and j, which indicates the potential for plant i as a cure for disease j, is of interest as a quantitative measure of the degree of confirmation of any particular remedy.

ln Appendix 1 the numbers in parentheses following each remedy indicate the number of informants confirming the report and the interaction effect τ_{ij} The 10 largest interaction effects are listed in order in Table 1.

DISCUSSION

Herbal medicine among the Luo

Although traditional herbal medicine is practiced throughout Siaya District it is being replaced in part by Western medicine and pharmaceuticals. For example, remedies for malaria, one of the most serious health problems in Siaya, are notably uncommon in the Luo pharmacopeia (total of nine, only two confirmed by one other informant). ln treating this disease, commercial pharmaceuticals such as chloroquine and Fansidar (sulfadoxine and pyrimethamine) are readily available and widely used. Their recognized usefulness in treating this pervasive problem has undoubtedly supplanted whatever traditional remedies the Luo had for malaria.

Traditional medical knowledge is least in the most economically developed areas of Siaya, for example in Central Gem. On the other hand, traditional healers retain considerable influence in other areas and undoubtedly contribute positively to health of the population. Many individuals involved are fulltime professionals of considerable influence within and beyond their local communities.

The Sakwa area (vicinity of Bondo, Fig. 1) has a reputation throughout Siaya as the source of the best plant remedies. Sakwa is sparsely populated and is the area where native vegetation, particularly in open woodlands, is the most extensive.

Traditional Luo medicine is similar to medical systems occurring worldwide in containing both a psychosocial component and a rational physiological component. The Luo deeply appreciate the social causation of disease and have methods for curing strictly functional disorders (Whisson 1964). We encountered sorcery and *juogi* (free-roaming spirits) as the causes recognized for many diseases. Chira is generally speaking a disease caused by ritual impurity (Whisson 1964) although among our informants it was usually translated as "thinning disease" or infertility and is associated with young women.

Although some traditional practitioners are primarily magicians (witch doctors), most employ a mixture of magic, ritual, and herbalism. Along this continuum we tended to find women to be the purveyors of the most pragmatic form ofherbalism, while the activities of men involved a greater degree of magical and ritual elements. For the treatment of certain diseases there is relatively little consistency in the information we received, suggesting that in these cases the plants themselves are only vehicles for delivery of treatments of strictly sociocultural significance. Most striking among treatments that appeared essentially non-rational are those for snakebite. Of the 37 remedies we received for snakebite only two were confirmed and these only by one other person.

The most widely used medicinal plants in Siaya are *Albizia coriaria*, *Aphania senegalensis*, *Harrisonia abyssinica*, *Lannea stuhlmanii, Ocimum* spp., and *Zanthoxylum chalybeum*. Although these are used for a range of diseases, some of the uses of each are among the confirmed remedies.

Remedies with the greatest interaction effects (τ_{ij}) should by the criteria of consensus be those that are the more rational biological treatments employed by the Luo. lncluded in Table 1 are remedies for gastrointestinal problems, respiratory problems, and wounds and other skin problems. We attempted to corroborate this consensus by extending our consideration of these plants to include two of the criteria discussed above: (1) cross-cultural comparison and (2) rationalization in relation to known chemical constituents of the plants. Additionally the use of bioassays to test the efficacy of specifie remedies is discussed briefly below.

Cross-cultural comparison

While each of the plants in Table 1 is used for a variety of purposes by different cultural groups, for most of them the uses reported here are consistent with at least some information found in the literature. ln some cases the consistency with which the remedies are used over large distances is remarkable.

Cassia didymobotrya is used in East Africa for stomach problems and constipation (Kokwaro 1976; Von Reis and Lipp 1982), and *Cassia occidentalis* is used similarly in South America (AltschuI1973; Freise 1933; Von Reis and Lipp 1982), the Caribbean (Asprey and Thomton 1954;Oakes and Morris 1958; Woodworth 1943), Philippines (Quisumbing 1951), and in various parts of Africa (Altschul 1973; Amico 1977; Kokwaro 1976; Von Reis and Lipp 1982).

Cassia siamea is used to treat diarrhea in New Caledonia (Rageau 1973), Burma (Perry 1980), and Tanzania (Von Reis and Lipp 1982).

Harrisonia abyssinica is used to treat stomach problems in East Africa (Kokwaro 1976; Von Reis and Lipp 1982), and species of Ocimum are widely used to treat stomach problems in Africa (Amico 1977; Boulos 1983; Burkill 1985; Kloos et al. 1987; Kokwaro 1976; Leiderer 1982; Von Reis and Lipp 1982; Weiss 1979) and Asia (Duke and Ayensu 1985; Quisumbing 1951; Rageau 1973; Rao and Jamir 1982).

Ageratum conyoaides is an important hemostatic and vulnerary in North (Boulos 1983), South (Amico 1977), East (Kokwaro 1976), and West (Gbile and Adesina 1987; Oliver-Bever 1986) Africa; this use is equally widespread in Asia (Bedi 1978; Chaudhuri et al. 1975; Duke and Ayensu 1985; Perry 1980; Quisumbing 1951; Rageau 1973; Rao and Jamir 1982) and Australia (Lassak and McCarthy 1983).

Species of *Lantana* are used to treat respiratory problems in West Africa (Oliver-Bever 1986), New Caledonia (Rage au 1973), the Carribbean (Hodge and Taylor 1957; Wong 1976), and Peru (Soukup 1970).

Vegetative parts of *Abrus precatorius* are widely used in Africa to treat coughs and colds (Ayensu 1978; Gbile and Adesina 1987; McClure 1982; Von Reis and Lipp 1982); parallel uses in the Caribbean appear to have African roots (McClure 1982; Wong 1976). This plant is also used in Peru (Soukup 1970) and Asia to treat respiratory problems (Duke and Ayensu 1985; McClure 1982; Rageau 1973).

Decoctions of *Albizia coriaria* are reported as treatments for a variety of dermatological conditions in Cameroon (Leiderer 1982).

Rationalizatian in relation ta known chemical canstituents of the plants

Biologically active natural products that have been reported from the plants listed in Table 1 include germacranolides (*Schkuhria pinnata*; Pettei et al. 1978), limonoids and chromones (*Harrisania abyssinica*; Hassanali et al. 1987; Okorie 1982), and volatile oils (*Lantana camara,* Oliver-Bever 1986; Ocimum suave, Chogo and Crank 1981). Eugenol in *Ocimum suave* is responsible for the mosquito repellant properties of this plant (Chogo and Crank 1981). Leaves of *Abrus precatorius* contain high amounts of glycyrrhizin (Duke 1985). From *Ageratum canyzoides* a mixture of constituents, many with antibacterial activity, have been isolated (Oliver-Bever 1986). Methanolic extracts of root bark of *Albizia coriaria* contain saponins and are toxic to mice. ln many cases the pharmacological effects of these known constituents correspond with the folk use of the plants. Similarly, many of the remedies not included in Table 1 have a recognizable physiological explanation.

QUANTITATIVE MODELS IN ETHNOMEDICINE

Models can facilitate the understanding of complex biological and cultural phenomena, and hypotheses derived from models can provide directions for research. The model presented here is a preliminary attempt to refine our ethnobotanical methods; the numerical values derived from the mathematical model should not be viewed as having an absolute meaning. The capacity of the model to predict rational and efficacious treatments can be directly tested with bioassays. Our preliminary studies of the activity of gastrointestinal remedies against the human enteric protozoan pathogen *Giardia lamblia* showed only limited predictability, but do provide insights for further refinement of the model and improvement of our field data-collection methodology.

A fundamental premise of our approach was to seek confirmation of phenomena. However, as a consequence of a quantitative approach we obtained additional insights. Specifically, we were impressed by the degree of randomness in our data. While some of this may reflect variation in the reliability of informants, randomness should also be considered as valid in its own right. Inconsistency is not necessarily equivalent to unreliability. Rather we view inconsistency as an indication that individuals undertake considerable exploration of the plant environment. The reality that the population uses a large number of plants for a variety of illnesses suggests to us that the acquisition of medicinal-plant knowledge is a dynamic process. Certain remedies, specifically those in Appendix l, are widely recognized and have biological and/or cultural significance. When no treatment is clear, on the other hand, curers appear to innovate with what plants are available. The interrelationship of psychosocial and physiological components in Luo medical practice would seem to encourage this exploration. In an evolutionary way such fluid interactions of humans with plant resources may lead progressively to encounters with whatever truly ration al solutions are potentially available in an environment.

The intercurrence of biology and culture in determining why and how plants are used for medicine contributes to the inherent difficulty in understanding ethnomedicinal data. To attach significance to anecdotal reports, one of the important tasks for ethnobotanists is to distinguish these cultural and biological determinants in specifie cases. ln addition, without appreciation of complex aspects of plant ecology and of human ecology it is difficult to appreciate why certain plants are used in the way they are. Quantitative methods of analyzing biological and cultural data can assist in exploration of the nature of herbal medicine on various theoretical and practical levels. A goal of such approaches should be to add greater depth to our understanding of herbal medicine as a dynamic phenomenon. Concurrently, as we understand the context in which plants are used we can better understand the function of specific herbal remedies.

Appendix 1: Remedies of the Luo of Siaya District confirmed independently by three or more informants.
Scientific name/family/Luo name (in italics)/herbarium specimens/use(s). Numbers in parentheses indicate the number of informants followed by the interaction (τ_{ij}).

Abrus precatorius L./Fabaceae/ ***ombulu***
JWY 88-14, NAI; 88-93, NAI
Leaves are chewed or juice from pounded leaves is taken for coughs (4, 1.05).

Acanthus arborea Forsk./Acanthaceae/ ***otagalo***
JAO 86-338, NAI, UC
Decoction of pounded roots is drunk for stomach problems (3, 0.40).

Ageratum convzoides L.I Asteraceae/ ***oluoro-chieng***
JAO 86-40, NAI; 86-425, NAI, UC; 86-446, NAI
Leaves crushed and the juice is used as a hemostatic (6, 1.44).

Albizia coriaria Oliv./Fabaceae/ ***ober***
JAO 86-68, NAI, UC; 86-140, NAI; 86-389, NAI
Bark and roots made into a decoction that is drunk to treat coughs (3, 0.57) and stomach probiems (6, 0.91) including those attributed to yamo; also used as a bath for skin problems (*mbahe*) in children (4, 0.99); stem used as a chewing stick.

Aloe spp./Liliaceae/ ***ogaka***
JAO 86-354, NAI; JWY 88-59, NAI; 88-251, NAI
Roots and stem are pounded and made into a decoction that is drunk to treat stomach problems (5, 0.64).

Aphania senegalensis (Poir.) Radlk ./Sapindaceae/ ***ochol***
JWY 88-68, NAI; 88-152, NAI; 88-165, NAI
One of the most important remedies for stomach problems used by the Luo. Mainly used as a strong cathartic that treats constipation (16, 1. 70); also used to treat stomach problems associated with yamo (7,1.13).

Balanites aegyptiaca (L.) Del./Balanitaceae/ ***olhoo***
JWY 88-26, NA!; 88-220, NA!; 88-341, NAI
Bark is ground, mixed with salt, and licked to treat coughs (3, 0.74).

Barleria acanthoides Vahl/Acanthaceae/ ***akudho.onyango arungu***
JWY 88-102, NA!; 88-124, NA!
Infusion or decoction of roots used to treat gastrointestinal upset (3, 0.34).

Capparis fascicularis DC./Capparaceae/ ***ong'ono/***
JWY 88-5, NA!; 88-71, NA!; 88-182, NAI
Decoction of the roots is drunk to treat stomach pains (6, 0.98).

Carica papaya L./Caricaceae/ ***poi poi***
JAO 86-145, NA!, UC
Roots are cooked with other species including *Carissa edulis* and the decoction is drunk to treat venereal disease (3, 0.75).

Carissa edulis (Forsk.) Vahl/Apocynaceae/ ***ochuoga***
JAO 86-448, NA!; 86-467, NA!; JWY 88-70, NAI; 88-125, NA!; 88-168, NAI/
Roots are decocted with other species. Concoctions including roots of *Aphania senegalensis*, *Rhoicissus communis,* and *Rhus natalenis* are drunk as a cathartic to treat stomach problems (5, 0.46) and yamo. Concoctions including *Carica papaya* and *Euclea divinorum* are drunk for venereal disease (5, 0.78).

Cassia spp.lFabaceae/ *Cassia didymobytra* Fres/ ***owinu***
JAO 86-390, NA!; JWY 88-80, NA!; 88-96, NAI;
Cassia hildebranditii Vatke/ ***akech***
JWY 88-35, NAI, MTMG; 88-326, NAI, MTMG;
Cassia occidentalis L/ ***nya-yado, ohingla lhieng***
JWY 88-79, NAI; 88-248, NAl;
Cassia siamea Lam./ **oyieko**
JAO 86-198, NAI; JWY 88-247, NA!, MTMG/
Decoctions of infusion of leaves and roots are drunk to relieve stomach problems and constipation (18, 2.00); leaves of *Cassia occidentalis* are said to prevent or treat stomach problems when eaten as potherb.

Catharanthus roseus Don/ Apocynaceae/ ***maua***
JWY 88-1, NAl; 88-218, NAl, MTMG
Roots chewed or made into decoctions to treat stomach problems (3, 0.34).

Coleus kilimandscharica Gürke/Lamiaceae/ ***okita***
JWY 88-56. NA!, MTMG; 88-223, NA!, MTMG/
Leaves pounded, mixed with hot water, and taken to relieve constipation (5, 0.89).

Commiphora africana (A. Rich.) Engl./Burseraceae/ ***arupien, keyo***
JWY 88-133, NAI
Roots are added to various concoctions to treat gastrointestinal problems (3, 0.26).

Crotalaria brevidens Benth./Fabaceae/ ***mitoo***
JAO 86-129. UC; 86-130, NA!, UC; 86-207, Nal
Leaves consumed as a cooked vegetable are considered a remedy for stomach pains (3, 0.45).

Erythrococca bongensis Pax/Euphorbiaceae/ ***hariadho, siriedho***
JAO 86-114, NA!, UC; 86-386, NAl; JWY 88-196, NA!; 88-354, NAI, MTMG; 88-363, NAl/
Leaves are pounded and decoction is drunk for chira (3, 0.92).

Euclea divinorum Hiern/Ebenaceae/ ***akado***
JAO 86-235, NAl, UC; 86-406, NAI
Roots pounded, boiled in concoctions including *Carissa edulis*, and drunk to treat .venereal disease (3, 0.66).

Gutenbergia cordifolia Benth./Asteraceae/ ***akech, pom pom***/
JAO 86-227, NA!; JWY 88-272, NAI
Plants are pounded and mixed with water, and infusion is given to children to treat stomachache caused by sorcery (sihoho) (5, 0.41).

Gynandropsis gynandra (L.) Briq./Capparaceae/ ***akeyo***
JAO 86-123, NAI, UC; JWY 88-11, NAI; 88- 23, NA!; 88-140, NAI
When eaten as a cooked vegetable is believed good for stomach problems (3, 0.45).

Harrisonia abyssinica Oliv.lSimaroubaceae/ ***pedo***
JAO 86-65, NA!, UC; 86-383, NA!; JWY 88-167, NAl, MTMG; 88-385, NAII
Decoction of the roots, either alone or in combination with Aphania senegalensis and other species, is taken for the treatment ofstomachache and yamo (8, 1.30); various concoctions are also drunk for venereal disease (3, 0.64).

Jasminium floribundum Fresen./Oleaceae/ ***omen***
JWY 88-27 3, NA!; 88-393, NAI
Leaves are pounded and added to water, and the infusion is drunk or used as a bath for chira (3, 0.49).

Kedroslis foetidissima (Jacq.) Cogn./Cucurbitaceae/ ***angwe***
JWY 88-115, NAI
Plant pounded, mixed with water, and used as a bath for children with measles (3, 0.51).

Lannea stuhlmannii (Engl.) Engl./Anacardiaceae/ ***kuogo***
JAO 86-165, NAI; JWY 88-99, NAI; 88-149, NAl; 88-206, NAI; 88-219, NAI
Infusions or decoctions from the bark, roots, or leaves are drunk to treat severe headache (hudha) (3, 0.39), general swellings over the body (akuodi) (3, 0.39), and venereal disease (3, 0.23); decoctions are drunk or used as a bath for skin eruptions in children (mbahe) (4, 0.68); decoctions are drunk for dysentery and other stomach problems (8, 0.33); leaves are chewed for coughs (3, 0.21).

Lantana spp./Verbenaceae/ ***magwagwa, nyabend-winy***
Lantana camara L., JWY 88-279;
Lantana trifolia L., JWY 88-419, NAI
Leaves pounded and made into an infusion that is drunk for coughs (5, 1.12); stem is chewed as a toothbrush (3, 0.73).

Leonotis nepetifolia R. Br./Lamiaceae/ ***osuno-osuno madongo***
JAO 86-453, NA!; JWY 88-221. NAII
Decoction made from pounded roots is drunk for gastrointestinal problems (3, 0.11).

Leucas calostachys Oliv./Lamiaceae/ **bware**
JWY 88-200, Nal/
lnfusion of leaves and roots is drunk for stomachache (5, 0.81).

Melia azedarach L./Meliaceae/ ***dwele***
JAO 86-52, NAl, UC; 86-144, NA!, UC; JWY 88-2, NAI
Decoction from leaves is drunk for constipation and stomachache (3, 0.34).

Microglossa pyrifoiia (Lam.) O. Kuntze/ Asteraceae/ ***nyabung-odide***
JAO 86-367, NAI, UC; 86-456. NA!; 86-465, NA!; JWY 88-166. NAl/
Roots are either chewed or taken in decoction for colds (4.0.82); decoctions are drunk for stomachache (4, 0.53).

Ocimum spp./Lamiaceae/
Ocimum basilicum L./ ***mieny, bwar***
JWY 88-244, NA!; 88-471, NAl;
Ocimum suave Willd./ ***bwar***
JAO 86-33, NAl, UC; 86-369, NAl; JWY 88-75, NA!; 88-243A, NAI
Leaves are chewed or taken as a decoction for constipation and stomach problems (II, I .31); leaves of *Ocimum suave* are placed in houses as a mosquito repellant.

Ormocarpum trichocarpum (Taub.) Engl./Fabaceae/ ***det***
JWY 88-48, NAl; 88-114, NAl; 88-138, NA!; 88-184, NAl
Roots and leaves are taken for diarrohea and other stomach problems (4, 0.30).

Oxygonum sinuatum (Meisn.) Dammer/Polygonaceae/ ***nyatiend gweno, okuro***
JAO 86-126, NA!, UC;
86-241, NA!, UC; JWY 88-90, NA!, MTMG
Roasted leaves are applied to boils to burst them (3, 0.55).

Phyllanthus ftscheri Pax/Euphorbiaceae/ ***kagno***
JWY 88-173, NA!; 88-271, NAl
Leaves chewed or the decoction drunk for chira (7, 1.26); leaves pounded and applied on back for "hunchback" (kuom) (3, 0.59).

Phytolacca dodecandra L'Herit.iPhytolacaceae/***mahoho, owoho***
JAO 86-224, NAl, UC; 86-371, NAI, JWY 88-224, NA!; 88-254, NA!, MTMG
Juice from pounded leaves is said to induce abortion (4, 0.39).

Plumbago zeylanica L./Plumbaginaceae/ ***rachier***
JAO 86-388, NAl; 86-391, NAl; JWY 88-81, NA!; 88-116, NAl
Decoction of pounded roots or leaves is drunk or bathed in to treat general illness (yamo) (4, 0.55).

Psiadia arabica Jaub. et Spach/ Asteraceae/ ***atilili***
JWY 88-65, NA!; 88-73, NA!; 88-113, NAI, MTMG/
Decoction of roots drunk for stomachache (3, 0.11).

Rhoicissus revoilii Planch./Vitaceae/ ***rabongo***
JAO 86-396, NAI; JWY 88-67, NAI; 88-126, NAI; 88- 150, NA!; 88-187, NA!, MTMG
Decoction from root tubers is drunk (often in concoctions with *Aphania senegalensis* or other plants) to treat serious stomach problems (5, 0.71) including those associated with yamo (3, 0.45); decoction of the roots is a treatment for sterility and in various concoctions is drunk for venereal disease (3, 0.52).

Rhus spp./Anacardiaceae/ ***sangala***
Rhus natalensis Krauss JWY 88-112, NA!, MTMG; 88-123, NAI, MTMG;
Rhus vulgaris Meikle JAO 86-336, NAI
Decoctions of roots, often in concoction with other species, is drunk for gastrointestinal problems including those associated with yamo (7,0.63); stems are chewed for toothache (3, 0.50).

Ricinus communis L./Euphorbiaceae/ ***odagwa***
JWY 88-230, NAIIRoots are chewed or decoction of roots (or leaves) is taken to facilitate expulsion of the placenta or to hasten parturition (4, 0.90).

Schkuhria pinnata (Lam.) O. Kuntze/Asteraceae/ ***akech, onyalo biro***
JWY 88-3, NA!, MTMG; 88-146, NAI, MTMG; 88-294, NAI
Decoction ofpounded plant is drunk for stomachache (12,1.68).

Solanurn sessilistellatum Bitter/ Solanaceae/ ***ochok madhako***
JWY 88-320, NAI
Juice of fruit is given orally to treat anthrax and other livestock diseases (3, 0.76).

Sonchus schweinfurthii Oliv. et Hiem/ Asteraceae/ ***achak***
When eaten as a cooked vegetable is said to relieve stomach problems (3, 0.40).

Spilanthes mauritiana (A. Rich.) DC./Asteraceae/ ***ajuok-olaw, asol-olaw***
JAO 86-277, NAl, UC
Leaves, roots, and flower buds are chewed for toothache (3, 0.92); induces salivation.

Toddalia asiatica (L.) Lam./Rutaceae/ ***ajua, nyalwet kwach***
Roots are chewed or taken as a decoction for relief of stomachache (6, 0.60).

Tylosema fassoglensis (Schweinf.) Torre et Hillc./Fabaceae/ ***ombasa***
JAO 86-405, NAI; JWY 88-52, NAl; 88-171, NAI
Decoction of roots is drunk for constipation and other gastrointestinal problems (3,0.55).

Vernonia spp./ Asteraceae/ ***akech, olulusia***
Vernonia amygdalina Del.,
JWY 88-201, NAI
Decoctions of roots and leaves are used to treat stomach pains (3, 0.45).

Warburgia salutaris (Bertol.f.) Chiov./Canellaceae/ ***sogo-maitha***
Does not grow in Siaya, but the bark is sold in markets by herbalists as a remedy for constipation and stomachache (3, 0.15).

Ximenia americana L./Olacaceae/ ***olemo***
JWY 88-356, NA!; 88-377, NA!; 88-407, NA!, MTMG/
Decoctions of the roots in combinations with other species are drunk to treat constipation and other gastrointestinal problems (4,0.79).

Zanlhoxylum chalybeum Engl./Rutaceae/ ***rook***
JWY 88-148, NAI
Twigs have an aromatic taste and are popular as toothbrushes and breath fresheners (5, 0.95); decoctions of the roots or seeds are drunk to treat chest pains (8, 0.83) and to treat stomach problems including those ascribed to yamo (8,0.44).

Table 1: Ten Higest Interaction Magnitudes of Luo Remedies

Plant	Disease Category	Interaction γ_{ij}
Cassia spp	gastrointestinal	2.00
Aphania sengalensis	gastrointestinal	1.70
Schkuhria pinnata	gastrointestinal	1.68
Ageratum conyzoides	dermatological (wounds)	1.44
Ocimum spp.	gastrointestinal	1.31
Harrisonia abyssinica	gastrointestinal	1.30
Phyllanthus fischeri	"chira"	1.26
Lantana spp	respiratory	1.12
Abrus precatorius	respiratory	1.05
Albizia coriara	dermatological	0.99

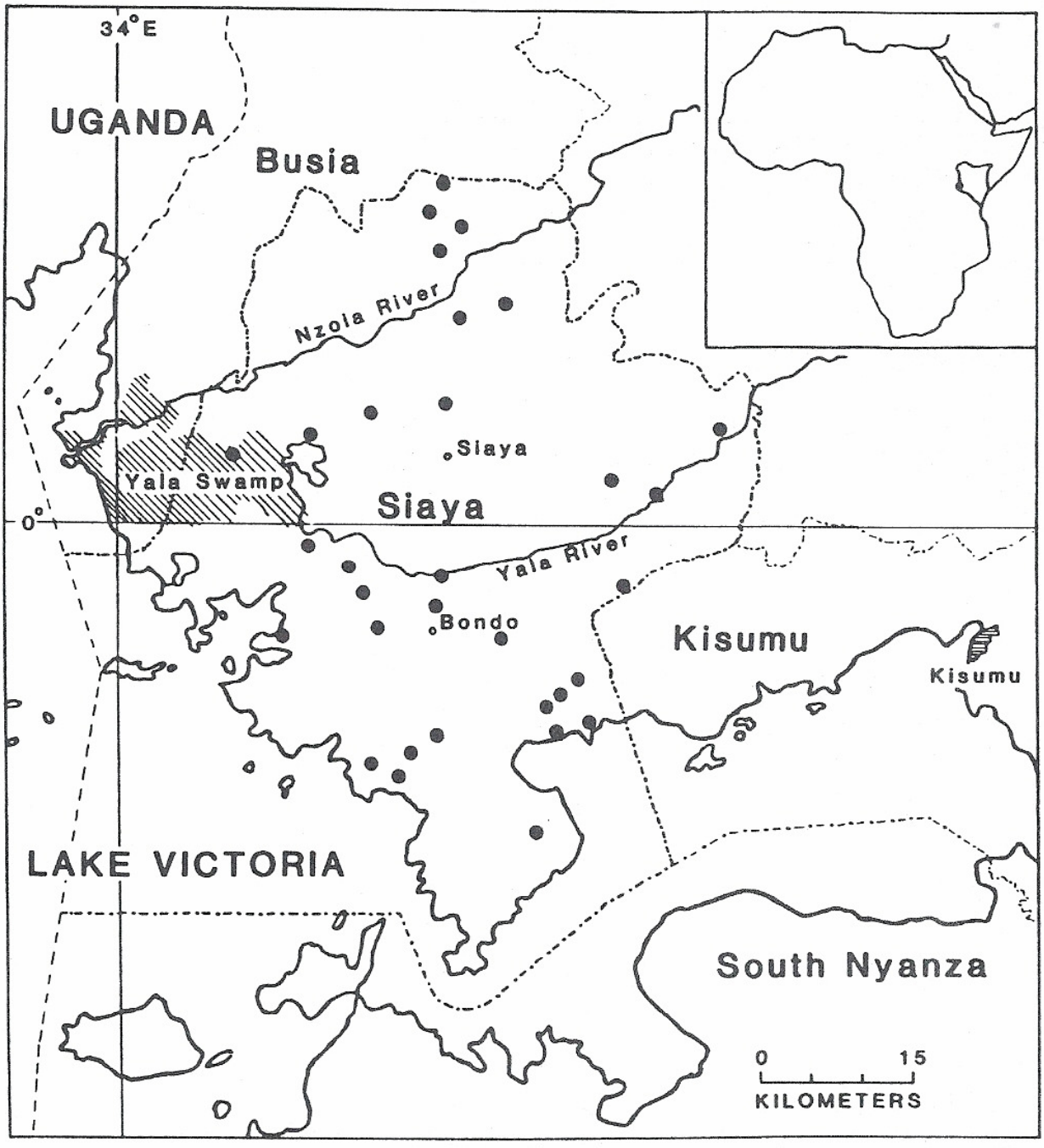

Fig. 1. Study sites in Siaya District, Kenya