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## **HERBAL REMEDIES OF THE BATEMI OF NGORONGORO DISTRICT, TANZANIA: A QUANTITATIVE APPRAISAL**

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Herbal Remedies of the Batemi of Ngorongoro District, Tanzania. A Quantitative appraisal  
Data based on independent interview with 22 males of the Batemi of Ngorongoro District, Tanzania, comprised 299 remedies reported and related to 73 species of plants. We list here 58 remedies (41 taxa) that were confirmed through independent reports from two or more individuals. A quantitative interaction effect was calculated for each remedy as a measure of its degree of confirmation. Implications and application of the statistic are discussed.

Plantes médicinales des Batemi, dans le district de Ngorongoro en Tanzanie: Evaluation quantitative.

Les résultats d'enquêtes individuelles avec 22 hommes Batemi du district Ngorongoro en Tanzanie ont permis de répertorier 73 espèces de plantes médicinales utilisées dans quelques 299 traitements herboristes. Nous présentons une liste de 58 plantes médicinales (41 taxa) dont chacune était rapportée indépendamment par un minimum de deux herboristes. Un effet d'interaction est calculé pour chaque plante médicinale et représente le degré de confirmation. Implications et conséquences pratiques de ce modèle sont discutées.

**Key Words:** ethnobotany; medicinal plants; Tanzania; East Africa; log-linear model

The Batemi are a Bantu-speaking group of agropastoralists living in Sale Division, Ngorongoro District, in north-central Tanzania. Because of their relative isolation and cultural conservativeness they maintain a traditional lifestyle and rely on wild plants for medicine and other purposes. We are involved with the Batemi communities in a study of the sustainable use of the local flora in relation to their nutrition and health and report here their most important herbal remedies.

The approximately 11000 Batemi are generally known to outsiders as the Sonjo, although they prefer the former name. They have been the subjects of few investigations although they are recognized as having distinct language and culture (Gray 1963) and are noted for their elaborate irrigation systems. The Batemi occupy a semi-arid territory with three types of dominant vegetation: i) *Acacia tortilis-Balanites aegyptiaca-Euphorbia candelabrum*; ii) *Vangueria apiculata -Ficus sycomorus-Trichilia emetica*; and iii) *Croton dictygamous-Euphorbia tirucalli-Grewia bicolor* (Smith 1993). The area of approximately 400 km<sup>2</sup> is situated between 2° 04'-2° 18' S Latitude and 35° 40'-35° 52' E Longitude and ranges in altitude from 1200 to 1600 m above sea level.

Quantitative approaches to a range of ethnobotanical issues have been recently summarized by Phillips and Gentry (1993a) and are reflective of a greater interest in methodological issue, among ethnobotanists. In addition quantitative models facilitate the examination of patterns in ethnobotanical data and the testing of hypothesis relating to the use of plants (Johns and Kimanani 1991; Phillips and Gentry 1993a,b). While quantitative approaches may not always be possible in ethnobotanical studies it is imperative that the methods employed be reported in sufficient detail to allow the evaluation of the data. A goal of investigations that purport to be scientific should be to make ethnobotanical data, which are by nature anecdotal, as reproducible as possible. Where this is not possible, it is our opinion that it is essential that clear justification and the criteria used to select particular data to be reported be given (Johns, Kokwaro and Kimanani 1990).

In this investigation we employed the methodology developed in an ethnobotanical study among the Luo of Siaya District, Kenya (Johns, Kokwaro and Kimanani 1990). In attempting to establish some measure of confirmation independent of the simple probability of encountering specific plants and diseases, we applied a log-linear model where the interaction of **i** and **j** ( $\tau_{ij}$ ) which indicates the potential of plant **i** as a cure for disease **j**, is of interest as a quantitative measure of the degree of confirmation of any particular remedy (defined as the use of a specific plant to treat a specific disease). The relative cultural homogeneity of the Batemi in a geographically circumscribed area provides a different context to test the methodology and mathematical mode

## METHODS

We carried out interviews on the uses of plants for medicine and food among the Batemi of Sale Division in July 1991, and July 1992. Interviews were conducted in each of the Batemi villages: Samunge (including Mditu), Digodigo, Muholo, Kisangiro, Oldanyosambu and Sale, although Sale is underrepresented. Individuals who were locally recognized as knowledgeable on plant use were identified with the assistance of village leaders. Although our initial intent was to interview men and women, only men participated in the interviews. In total, interviews were conducted with 22 men who ranged in age from 27 to 70 years (mean age 44 years). We employed the same open-ended interviewing technique described previously (Johns, Kokwaro and Kimanani 1990). 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. All interviews were carried out in either Batemi or Swahili by a team made up of EBM, an experienced interviewer, and PS, a fluent Batemi speaker. Herbarium specimens were deposited at ITM (Institute of Traditional Medicine) Dar es Salaam and NAI (University of Nairobi) and identified by the authors or by Simon Mathenge of the University of Nairobi.

## RESULTS AND DATA ANALYSIS

From the 22 interviews 299 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 73 species in 59 genera.

For the data analysis all reported diseases were categorized into 24 English categories generally based on physiological systems.

In Appendix 1 we report all medicinal plants that were mentioned by three independent interviewees or for which the use was consistent between two independent interviewees.

Fifty- eight plant-disease combinations (remedies) were independently corroborated by at least two informants.

In Appendix 1 the number in parentheses before the remedies represent the total number of remedy reports for the plant and the numbers in parentheses following each remedy indicate the number of corroborating informants and the interaction effect ( $\tau_{ij}$ ) Thirty-three remedies were reported independently by three or more individuals, a criterion for consensus that we have generally found useful (Johns. Kokwaro and Kimanani 1990).

A mean interaction effect for each of the categories of disease encountered (Table 1) was calculated using only confirmed remedies. Each of these means was compared to the rest as a group using a simple t-test. Categories that had only one confirmed remedy were not included because the standard error of their means was undetermined

Table 1. TEN DISEASE CATEGORIES MOST FREQUENTLY REPORTED AND THEIR MEAN INTERACTION EFFECTS.

Disease category	Number of remedy reports	Mean interaction
Gastrointestinal	59	0.98 ± 0.47
Fever	44	1.03 ± 0.55
Tonic	43	0.77 ± 0.50
Respiratory	43	1.21 ± 0.51
Rheumatism	31	1.17 ± 0.72
Body pain	20	1.33 ± 0.53
Dermatological	10	0.44
Spleen/gall bladder	6	1.14
Venereal disease	6	0.50
Gynecological/childbirth	6	0.00
Total for complete data set	299	0.99 ± 0.57

Table 2. TEN HIGHEST INTERACTION MAGNITUDES OF BATEMI REMEDIES.

Plant	Disease category	Interaction ( $\tau_{ij}$ )
<i>Harrisonia abyssinica</i>	rheumatism	2,16
<i>Pappea capensis</i>	tonic	2,09
<i>Acacia nilotica</i>	gastrointestinal	1,97
<i>Myrsine africana</i>	body pain	1,97
<i>Albizia anthelmintica</i>	fever	1,90
<i>Ormocarpum kirkii</i>	respiratory	1.86
<i>Salvadora persica</i>	rheumatism	1,83
<i>Acacia senegal</i>	respiratory	1,74
<i>Warburgia salutaris</i>	fever	1,58
<i>Clerodendrum myricoides</i>	body pain	1,55

## DISCUSSION

### HERBAL MEDICINE AMONG THE BATEMI

The data on medicinal plant use obtained from the Batemi is, as judged by our experience among the Luo of the Lake Victoria basin (Johns, Kokwaro and Kimanani 1990), remarkably consistent with a much lesser degree of apparent randomness. Whereas in Siaya 49% of the 1129 remedies reports were encountered only once, in our present much smaller data set only 30% of 299 remedy reports were similarly unconfirmed. This can be accounted for by the homogeneity of the study site both geographically and socially. The study area is small and the population interacts over the area. In addition the Batemi have an age set system like their Maasai neighbours in which knowledge and life skills are imparted in an organized way to all of the male age mates (Gray 1963). There are no traditional herbal specialists in the society; rather all men are expected to possess the basic repertoire of information essential for treating the major conditions encountered in the community. Our interviewees acknowledge that there is some knowledge held exclusively by women that would not have been recorded in this survey. They assert that this is exclusively related to conditions associated with childbirth and gynecology ("women's problems"), but that it is men not women who possess the basic pragmatic knowledge for treating everyday afflictions of adults and children. We are unable to confirm this assertion although the absence of knowledge by men of remedies relating to childbirth and gynecological problems (Table 1) is apparent.

### APPLICATIONS OF THE INTERACTION EFFECT

Table 2 lists remedies with the ten highest interaction in order to demonstrate some application of the interaction effect ( $\tau_{ij}$ ) in establishing patterns in the use of plants by a particular community. Table 1 examines the most common conditions treated by the Batemi and the use of the interaction effect to assess the consistency of treatment of particular conditions. In each case we make the assumption that consistency of use of plants is directly related to efficacy in treatment from either a biological or cultural perspective (Johns, Kokwaro and Kimanani 1990). We have hypothesized that plants used as gastrointestinal remedies should be the most consistently applied in folk medicine (Johns 1990; Johns and Kimanani 1991). While gastrointestinal remedies are reported more frequently by the Batemi than any other disease type, the interaction effect does not support this general hypothesis. Only one of the plants in Table 2 is used as a gastrointestinal remedy. In the whole data set, confirmed gastrointestinal remedies have a mean interaction effect of  $0.98 \pm 0.47$  which is not significantly different ( $P > 0.05$ ) from that of all other remedies combined (Table 1). The most consistent use of plants by the Batemi is to treat pain. The body pain category has a mean interaction effect of  $1.33 \pm 0.53$  which is significantly greater ( $P < 0.01$ ) than the mean interaction of the rest: and body pain accounts for two of the top ten remedies. An additional two of the top remedies are for the treatment of rheumatism, a condition often described by the Batemi as pain in the joints. The rheumatism category has a mean interaction of  $1.17 \pm 0.72$ , and body pain and rheumatism together have a mean interaction of  $1.23 \pm 0.62$ . An additional two of the remedies with highest interaction effects treat fevers, bringing to six the number of the top remedies that treat diseases mediated through the nervous system. A seventh, *Pappea capensis* (Spreng). Eckl. & Zeyh., is used as a tonic which may indicate a stimulant effect (cf. Watt and Breyer-Brandwijk 1962).

The validity of the quantitative interaction effect as a predictor of the efficacy of a particular remedy can only be established with independent measures of confirmation. Consistency of use

with other tribes is a relative measure of validity. All of the plants contributing the highest ten remedies are listed in major compendia of African medicinal plants such as Iwu (1993), Kokwaro (1976) and Watt and Breyer-Brandwijk (1962).

All but one of the remedies in Table 2 are consistent with the remedies of one or more other tribes and are reported in the above three compendia and other ethnobotanical reports from East Africa (e.g. Chhabra, Mahunnah and Mshiu 1990; Gachathi 1989; Leakey 1977). Considering corroboration from these independent sources as upholding of the validity of the interaction effect, we conjecture that remedies with strong interaction effects but which are not substantiated by reports from other cultural groups are potentially the most novel and interesting to study further. In our collaborative work with the Batemi communities we are particularly interested in the sustainable use of these medicinal plants. Ancillary ecological studies (Smith 1993) showed that half of the important medicinal plants listed in Table 2: are locally rare or located far from Batemi communities. Our quantitative method contributes to the designation of *Harrisonia abyssinica* Oliv., *Papp capensis*, *Warburgia salutaris* (Betol.f.) Chiov. and *Croton megalocarpus* Hutch. as species warranting conservation attention in this area.

## APPENDIX 1

Remedies of the Batemi confirmed independently by two or more informants.

Scientific name/family/Batemi name (in italics)/ herbarium specimens /total number of informants for the plant (in parentheses) and use(s). Final numbers in parentheses indicate the number of informants for the use followed by the interaction (  $\tau_{ij}$  )

*Acacia goetzei* Harms/Fabaceae/ *msigisigi*

Mhoro & Johns 91-71 ITM, NAI/(4)

Decoction of bark added to soup as a strengthening tonic (3. 0.81).

*Acacia mellifera* (Vahl) Benth./Fabaceae/ *mng' orora*

Mhoro & Johns 91-41 ITM. NAI: 91-59 ITM. NAI/ (12)

Infusion of bark or roots drunk for fever (5. 1.44).

Acts as an emetic: decoction of bark or roots taken or put into soup to treat diarrhoea and other gastrointestinal problems (3. 1.11); Bark used to treat coughs (2. 0.63).

*Acacia nilotica* (L) Del./Fabaceae/ *kijemi*

Mhoro & Johns 91-16 ITM. NAI: 91-57 ITM. NAI/(13)

Decoction of bark or roots added to soup or drunk as a digestive aid and appetite stimulant (7.1.97) or as a strengthening tonic (4. 1.15).

*Acacia nubica* Benth./Fabaceae/ *oldebe*

Mhoro & Johns 91- 76 ITM. NAI/ (9)

Decoction of root or branches drunk or added to soup for joint and-muscle pain (4. 1.34):

Root decoction added to soup as a strengthening tonic (2. 0.4 7).

*Acacia senegal* (L) Willd./Fabaceae/ *mhuti*

Mhoro & Johns 92-31 ITM, NAI; 92-42 ITM, NAI/ (7)

Roots chewed and juice swallowed or decoction drunk to treat coughs (6, 1. 74).

*Acacia tortilis* (Forsk.) Hayne/Fabaceae/ *mkamahe*

Mhoro & Johns 91-58 ITM, NAI/ (4)

Decoction of bark added to soup for medicinal purposes.

*Acacia xanthophloea* Benth./Fabaceae/ *mrera*

Mhoro & Johns 91-66/ (3)

Roots added to soup as an emetic or cathartic (2, 0.79).

*Albizia anthe/min/ica* Brongn.lFabaceae/*mrira; mukutani* (Maasai)

Mhoro & Johns 93-275 NAI/ (10)

Infusion drunk or infusion or decoction of root bark added to soup to treat malaria and other fevers (8, 1.90). Acts as an emetic.

*Aloe volkensii* Engl./Liliaceae/ *lugaka*

Mhoro & Johns 92-62 ITM, NAI/ (3)

Drop of juice used to treat eye problems (2, 0.49).

*Balanites aegyptiaca* (L.) Del /Balanitaceae/ **mjuiya**

Mhoro & Johns 91-79 ITM, NAI/ (5)

Decoction or infusion or bark of roots or stem drunk to relieve high fever (4, 1.14). Acts as an emetic.

*Boscia coriacea* Pax./Capparaceae/ **jugumetu**

Mhoro & Johns 91-75 ITM, NAI/ (3)

Decoction of roots is drunk or taken in soup for medicinal purposes.

*Carissa edulis* (Forsk.) Vahl.! Apocynaceae/ **mbaghao; ngamrvaga**

Mhoro & Johns 91-82 ITM, NAI/ (9)

Roots boiled in water or soup are used to treat coughs (4, 1.33); roots used to treat fever (2, 0.53).

*Cissampelos mucronata* A. Rich./Menispermaceae/ **mugulita**

Mhoro & Johns 92-11 ITM, NAI/ (2)

Root chewed and juice swallowed for indigestion (2, 0.41).

*Clerodendrum myricoides* R.Br./Verbenaceae/ **mgutugutu; mhurambura**

Mhoro & Johns 91-31 ITM, NAI; 92-38 ITM, NAI; 91-89 ITM, NAI (6)

Decoction of roots drunk or added to soup for relief of pains (4, 1.55) or as atonie (2, 0.53).

*Commiphora madagascarensis* Jacq./Burseraceae/ **misisiyo**

Mhoro & Johns 91-33 ITM, NAI/ (2)

Latex is applied to rashes and other skin problems (2, 0.44).

*Croton dictygamous* Pax./Euphorbiaceae/ **msiniya; mgilalugi**

Mhoro & Johns 91-87 ITM, NAI/ (6)

Stems or decoction of stems used in soup as a strengthening tonic (3, 0.88).

*Croton megalocarpus* Hutch./Euphorbiaceae/ **ekita-lambu; kitalambu**

Mhoro & Johns 91-35 ITM, NAI; 91-52 ITM, NAI/ (11)

Decoction or powder of bark is added to soup or tea and taken to treat abdominal problems associated with gall bladder and spleen problems (4, 1.14); powdered bark is added to boiled milk to treat and prevent malaria and other fevers (2,0.49);

An infusion of the powdered bark and potash is given orally to goats as a conditioner (2,0.66). f..

*Euclea* spp. (Ebenaceae)/ **msanganetu**

*Euclea divinorum* Hiern.

Mhoro & Johns 91-91 ITM, NAI;

*Euclea racemosa* Murr. ssp. *schimperi* (A.DC.) F. White,

Mhoro & Johns 91-34 ITM, NAI/ (4)

Stem bark added to soup as tonic (3, 0.84).

*Grewia villosa* Willd./Tiliaceae/ **msabasabwa**

Mhoro & Johns 92-.10 ITM, NAI/ (2)

Roots to treat coughs (2, 0.33).

*Gynandropsis gynandra* (L.) Briq.!Capparaceae/ **nanseganii**

Mhoro & Johns 91-15 ITM, NAI/ (3)

Plant used medicinally.

*Harrisonia abyssinica* Oliv./Simarubaceae/ **toro**

Mhoro & Johns 91-73 ITM, NAI/ (25)

Roots added to milk, root decoction drunk or added to soup for joint pain (rheumatism) (9, 2.16); root decoction drunk for body pain (2, 0.81); root decoction added to soup to relieve fever (4,1.25); roots chewed and juice swallowed for cough (4, 1.36); root added to soup to remove water from body (diuretic) (2, 0.90).

*Hypoetes forskalii* R.Br./ Acanthaceae/ **msababo**

Mhoro & Johns 91-60 ITM, NAI; 92-1 ITM, NAI/(4)

Drink decoction of root or chew and swallow juice for relief of stomachache (4, 1.10).

*Lannea schimperi* (A. Rich.) Engl./ Anacardiaceae/ **mginkinywa**

Mhoro & Johns 91-51 ITM, NAI; 91- 62 ITM, NAI; 91-94 ITM, NAI/ (3)

Bark and roots are used medicinally.

*Myrsine africana* L./Myrsinaceae/ **nghasi**

Mhoro & Johns 92-60 ITM, NAI/ (14)

Fruits and roots whole or powdered are prepared as decoctions or added to soup, tea, porridge or other foods or beverages to relieve body pain (6, 1.97), as an anthelmintic (4, 1.49), or as a strengthening tonic (2, 0.54).

*Ormocarpum kirkii* S. Moore/Fabaceae/ **kilemanjagu; mlemanjagu**

Mhoro & Johns 91-50 ITM, NAI; 92- 12 ITM, NAI/ (9)

Decoction of bark is drunk or added to soup or inner bark is chewed and juice swallowed in order to relieve coughs (6, 1.86).

*Ozoroa mucronata* (Bernh.) R. & A. Fernandes/ Anacardiaceae/ **mgalati**

Mhoro & Johns 91-70 ITM, NAI; 92-33 ITM, NAI/ (7)

Stem bark or decoction added to milk, or inner bark is chewed and juice swallowed, to treat cough (7, 1.59).

*Pappea capensis* (Spreng) Eckl. & Zeyh./Sapindaceae/ **kiboboyo**

Mhoro & Johns 91-37 ITM, NAI; 91-49 ITM, NAI; 91-81 ITM, NAI (12)

Branches are cut into pieces and boiled; decoction is added to soup, honey beer, milk or tea as a strengthening tonic (10, 2.09).

*Periploca linearifolia* Dill & A. Rich./ Asclepiadaceae/ **mte wa masaba; mkangabana**

Mhoro & Johns 92- 63 ITM, NAI (4)

Roots chewed and juice boiled or decoction drunk for stomachache (4, 1.10).

*Phytolacca dodecandra* L'Herit./Phytolacaceae/ **mhaka**

Mhoro & Johns 92-56 ITM, NAI/ (4)

Root chewed and juice swallowed as a cathartic and/or emetic (4, 1.10), often for the treatment of fever.

*Ricinus communis* L./Euphorbiaceae/ **mubono**/ (3)

Decoction of roots drunk for stomachache (3, 0.81).



*Salvadora persica* L./Salvadoraceae/ **msago**

Mhoro & Johns 91-61 ITM, NAI/ (15)

Decoction of roots drunk or added to soup for relief of pain in joints or other parts of body (7, 1.83); decoction added to soup as a strengthening tonic (4, 1.09); infusion or decoction of roots drunk for treatment of fevers (2, 0.47). Acts as an emetic.

*Sansevieria* sp./ Agavaceae/ **mdubai;oldubai**

Mhoro & Johns 93-229 !TM, NAI! (4)

Decoction of chopped stems or roots taken in soup to treat joint pains (2, 0.44) and syphilis (2, 0.50).

*Sarcostemma viminalis* (L.) R. Br./ Asclepiadaceae/ **mbebe**

Mhoro & Johns 91-5 ITM, NAI; 91-26 ITM, NAI/ (2)

Stems added to soup as a tonic (2, 0.15).

*Sericomopsis hildebrandtii* Schinz/ Amaranthaceae/**nalubaru; nambaru; namboro**

Mhoro & Johns 92-41 ITM NAI; 92-55 /TM, NAI/ (3)

Infusion of roots used as an emetic to treat high fever (2, 0.48).

*Solanum incanum* L./Solanaceae/ **mdaghu**/ (2)

Roots boiled or added to milk and drunk for gastrointestinal problems (2, 0.41).

*Solanum setaceum* Dammer/Solanaeae/ **mghamia mariba**

Mhoro & Johns 91-64 ITM, NAI 92-46. ITM. NAI/ (4)

Decoction of roots drunk or added to soup for coughs and colds (4, 1.03).

*Strichnos henningsii* Gilg/Loganiaceae/ **kibunja**

Mhoro & Johns 91-46 ITM, NAI/ (8)

Roots or decoction of roots added to soup as a strengthening tonic (3, 0.85) or to treat joint pain (2, 0.62).

*Trichilia emetica* Vahl./Meliaceae/ **mdaghamira**

Mhoro & Johns 91-45 ITM, NAI/ (2)

Decoction or infusion of bark drunk as an emetic (2, 0.41).

*Vernonia amygdalina* Del./ Asteraceae/ **msembereghu; mtembereghu**

Mhoro & Johns 92-2 ITM, NAI/ (3)

Decoction of roots to treat joint pain (rheumatism) (2,0.62).

*Warburgia salutaris* (Bertol.f.) Chiov./Canellaceae/ **msegu**

Mhoro & Johns 91-32 ITM, NAI; 92-37 ITM, NAI/ (14)

Infusion or decoction of bark drunk to relieve fevers (7, 1.58) including malaria; decoction of bark added to soup for relief of body pains (3, 0.98); bark added to soup as a tonic (2,0.25) or for relief of stomachache (2, 0.51).

*Ximenia caffra* Sond./Olacaceae/ **mloma**

Mhoro & Johns 91-11 ITM, NAI/ (4)

Decoction of root drunk to relieve cough (3, 1.05).