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A D D E N D U M

A Research Proposal for
a Study
on
NUTRIENT ANALYSIS OF UPPER VOLTAIC VEGETATION

Submitted to
Dr. Sam Kahn, Technical Reviewer
Research and University Relations
Bureau of Science and Technology
United States Agency for International Development

Submitted by
W. A. Lyghtner Kirchhofer, Principal Investigator
Assistant Professor Food and Nutrition
Lincoln University
Jefferson City, Missouri 65101

June 6, 1984

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Submitted to

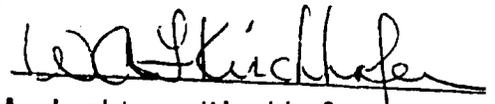
Coordinator
Research and University Relations
Bureau of Science and Technology
United States Agency for International Development

Submitted by

LINCOLN UNIVERSITY
Jefferson City, Missouri 65101



Dr. Thomas Jenkins
President
Lincoln University



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Assistant Professor
(Principal Investigator)
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FEBRUARY 1984

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SECTION B: RELEVANCE OF PROPOSED
WORK TO US-AID

I. Relevance of Proposed Project to AID Mission in Upper Volta

A major aim of the government of Upper Volta and AID is food self-sufficiency. AID projects focus on food production activities. With an increasing population growth rate, reaching food self-sufficiency and satisfying basic human needs becomes more difficult. Greater emphasis is placed on maximizing existing resources. This proposed project is aimed at improved use of naturally occurring vegetation. Uncultivated vegetation, appropriately combined with other foods, can supply basic nutrient needs. Nutrient analysis of Upper Voltaic vegetation is needed to fully evaluate the contribution of the dietary food. Food planning strategies, policy formulators and health educators can benefit from knowledge of these food compositions. The incorporation of locally used food items is supportive of improving management of limited resources. The use of local food items is a step toward food self-sufficiency and a higher quality of rural life in the context of improved health and nutrition.

II. Upper Voltaic Participation in Proposed Project

The Voltan Centre for Scientific Research coordinates the studies of expatriate researchers. This Center will assist in the classification of the vegetation samples. It is through this research Center that laboratory facilities can be located. Preliminary

cooperation with this Center has already been established during the 1983 Dietary Survey leading to this proposed project.

A field assistant, with local language capabilities, will work in sample collection as well as with sample preparation processes. The University of Ouagadougou's English Department, was responsible for identifying the field assistant in the previous 1983 project.

Laboratory facilities will be identified with the assistance of the National Cereals Office's (OFNACER) Grain Marketing Project Director, Dr. M. Moussie. Efforts will be made to establish professional relations with the Muraz Medical Center in Bobo Dioulasso. Exchange of information with this health center could expand the benefits of these nutrient composition analyses by the application to other areas in Upper Volta as well as throughout West Africa, beyond dietary evaluation.

III. Application of Proposed Project Findings

In order to evaluate the degree of malnutrition and the consequent food needs of a population, it is necessary to know the quantity and quality of the food supply. Food composition information is necessary for the calculation of nutritional quality of a local diet. It enables the identification of nutrient deficiencies. This is necessary for the introduction of appropriate complementary foods to combat malnutrition.

Efforts are underway by FAO/WHO to bring together analytical data on African food composition. Many foods have not been analyzed. A partial listing of African vegetation with limited analysis is given in Appendix A. This project can provide useful data for the African Food Composition Tables. The table can provide direction to those involved in the evaluation and improvement of the diets consumed in Africa. Local vegetation found to be particularly rich in specific nutrients in which diets are deficient can be brought to the attention of health and nutrition educators with the view of encouraging increased consumption.

Since protein adequacy depends on both protein quantity and quality, the analysis of local vegetation for complementary amino acids contributes directly to the utilization of limited resources to expand protein availability.

SECTION C: SCIENTIFIC ASPECTS
OF PROPOSED PROJECT

INTRODUCTION

In 1983, Lincoln University's International Programs Office supported W. A. Lyghtner-Kirchhofer, Assistant Professor, Food and Nutrition, in the competition for a Women In Development Fellowship awarded by the South East Consortium for International Development (SECID). Kirchhofer was awarded the fellowship which provided for a short-term Third World research experience in conjunction with a currently active SECID-Lincoln University development project. The Grain Marketing Development Project in Upper Volta, West Africa, was the target project selected by Kirchhofer. This SECID project is under the direction of Lincoln University faculty: Dr. M. Moussie and Mr. T. Mooney. The Grain Marketing Development Project's purpose is to assist the government of Upper Volta to establish a set of conditions within the country that will lead to food self-sufficiency by improvements in the operational efficiency and managerial capabilities of the National Cereals Office (OFNACER). A specific goal of the Grain Marketing Development Project is to improve the marketing and distribution of grains for the purpose of providing food security, especially to grain deficit areas and during the pre-harvest (hungry) season. It is toward this goal that Kirchhofer directed her research.

The research was a dietary survey of grain consumption and preparation patterns of the population in the grain deficit areas during the hungry season. Utilization methods were directly related to grain availability. This information was intended to be directional in planning for distribution of grains and supplementary foods by OFNACER. Additionally, findings of

the dietary survey would represent a course of information for the host nation to use in health and nutrition planning. A sound knowledge of the population's intake patterns is essential in planning improved dietary practices that are compatible with the established food styles.

It is the findings of this dietary survey (Kirchhofer, 1983) (Attachment 3) that initiated this proposed research project. The survey provided a broad overview of the sample population's use of the grains sorghum and millet. The observation was made that a wide variety of leaves, greens, fruits, and other uncultivated vegetation are consumed with the grains. In an effort to evaluate the quality of this diet combination, it was found that nutrient information on these African vegetations was limited. The Food Composition Table for Use in Africa (FAO/WHO, 1968), presents the limited data available. The authors of this compilation of research on African food composition have made a request for researchers to cooperate in closing the gap in knowledge of African food composition.

If dietary survey information of preparation and consumption patterns is to make a significant contribution in combating the ~~the~~ effects of hunger and malnutrition, the nutritional composition of the various dietary components must be known. With nutrient compositions of commonly consumed food items, the diet can be evaluated in terms of approximating the needs of the population.

The purpose of this proposed project is to extend the knowledge gained from the 1983 dietary survey of rural Upper Volta by determining the nutrient composition of commonly consumed uncultivated vegetation.

PROJECT HYPOTHESIS AND OBJECTIVES

Upper Volta, the site of the project, has a population of 6 million and a growth rate of 2.5%. Upper Volta is facing the second year of severe drought and for this reason has been added to FAO/WHO's list of most famine affected nations (Intercom, 1984). The climate is arid, harmatan and characterized by long dry seasons and limited rainfall. The period of the project coincides with the pre-harvest (hungry) season when staples are scarce. Cultivated vegetation is limited by drought. Uncultivated vegetation constitutes a large portion of the diet. The major protein and energy sources are grain: sorghum and millet. Corn and rice are used, but to a lesser degree. For maximum human growth and maintenance, the grain protein is complemented with other amino acid sources. The assumption being, other plant proteins supply these complementary amino acids (Pickett, 1970). In the population observed in the Upper Volatic survey, uncultivated vegetation was the major other food consumed (Kirchhofer, 1983). The question is, are the appropriate complementary amino acids present in the vegetation, and in adequate amounts, to provide approximate protein needs of the population. Nutrient analysis of the most commonly consumed accompaniments to sorghum and millet is needed to determine this answer. The null hypothesis of the research project being:

the nutrient quality of commonly consumed uncultivated vegetation of Upper Volta is inappropriate to adequately complement the nutrients of the staple grains in providing recommended nutrient requirements of the population at risk.

In order to test this null hypothesis, the following objectives will direct the project research:

- 1. Commonly consumed uncultivated vegetation will be collected in representative regions of Upper Volta.*
- 2. Uncultivated vegetation samples will be classified for reference to French and English literature.*
- 3. The vegetation samples will be weighed and heat dried until weight is constant. Moisture content will be determined. The dried samples will be air transported to the USA-Lincoln University, Human Nutrition Research Laboratories.*
- 4. The samples will be analyzed for nutrient profiles: crude fat, crude protein, crude fiber, and carbohydrate by difference. The ash will be analyzed for minerals.*
- 5. The protein composition will be analyzed for select amino acids.*
- 6. Determination of appropriate vegetation/grain combination will be calculated to provide adequate amino acids for maximum protein utilization.*

PROEDURE

The project consists of three major phases: (1) Sample collection, classification, and heat drying with moisture determination; (2) Proximate analysis of the samples at Lincoln University; and, (3) Determination of appropriate combinations for improved nutritional benefit.

Phase 1, June-July 1984

The samples are to be collected from three distinct areas of Upper Volta, representing the diversity of the country's environment and cultural groups: (1) The Dori area, in the northeast which is

sub-Saharan and dominated with nomadic Fulani and Turareg; (2) The Koudougou area which represents the plateau with a dominance of Mossie peoples; and (3) The swampy southern region of Bobo Dioulasso which is populated with the Bobo people.

The vegetation samples will be classified with the Center for Scientific and Technologic Research (CNRST-Centre Nationale de la Recherche Scientifique et Technologique).

The samples will be heat dried using a forced draft oven and high temperatures. Moisture content will be calculated at this point. The dried samples will be transferred to the Lincoln University Laboratory in air-tight plastic containers. This first phase of the project requires a local field assistant with language capabilities for the regional sample collection. This assistant will provide help in the laboratory work of preparation of samples for transport to the USA.

Phase II, Nutrient Analysis, August 1984-February 1985.

Official methods of analysis of the Official Analytical Chemists, 13th ed., 1980, will be utilized for the nutrient analysis procedures of the heat dried vegetation samples. Lincoln University's Nutrition Laboratories have all of the required equipment for carrying out the

analyses including an atomic absorption spectrophotometer and an amino acid analyzer. Proximate analysis of crude fat, crude protein, crude fiber, minerals and carbohydrate by difference will provide a profile of the nutrient composition of the vegetation samples. Amino acid selection for analysis will be determined by the protein content of the samples.

Phase III, Data Analysis, March-May 1985

Evaluating the nutrient profiles and the amino acid content will suggest the appropriateness of the uncultivated vegetation in meeting the approximate needs of the population. Dietary intake surveys can be evaluated with regard to this information.

IV. REFERENCES

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- Carr, W. R. (1956) The Preparation and Analysis of Some African Foodstuffs. The Central African Journal of Medicine. Vol. 2, No. 9, September.
- Dreyer, J. J., DuBruyn, D. B., Brandy, J., and others. (1964) A preliminary note on the nutrient composition and protein value of greenmaize. South African Medical Journal, 38:648.
- Dubois, M., et al. (1956) Colormetric method for determination of sugars and related substances. Analytical Chemistry 28, 350.
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- FAO/WHO (1973) Energy and Protein Requirements - Report on a Joint FAO/WHO Ad Hoc Committee, Rome, FAO Nutrition Meeting Report Series No. 52.
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- Lewis, J. P., and Kallab, R. (1983) Preliminary Assessments of the World Food Situation. Rome.
- Meloan, E. C., and Pomeranz, U. (1978) Food Analysis: Theory and Practice. Avi Publishing Co., Inc.
- Morris, D. M. (1979) Measuring the condition of the world's poor: the Physical Quality of Life Index. Pergamon.

REFERENCES, continued

- Pickett, R. C. (1970) Inheritance and improvements of protein quality and content in *Sorghum vulgare*. Pers. Progress Report to January 1970. USAID/Purdue University Contract AID/csd-1175.
- Sukhatme, P. V. (1972) "A Statistical Appraisal of the Protein Problem", in Statistical Papers in Honor of George W. Snedecor, Iowa State University Press.
- Toury, J. (1961) Chemical composition of 66 samples of leaves, fruits, seeds and tubercles eaten in Senegal. Qual. Plant. Mat. Veg. 8(2).
- Wall, L. W.Sr., and Gehrke, C. W. (1975) Journal of the Association of Official Analytical Chemists, 58, 1220-1226.
- Wehmeyer, A. S. (1966) The nutrient composition of some edible wild fruits found in Transvaal. South African Medical Journal 40:1102-1104.

SECTION D: RESUME

RESUME

WILMA ARDINE LYGHTNER KIRCHHOFER

ADDRESS:

917 Fairmount Boulevard
Jefferson City, Missouri 65101

TELEPHONES:

Home: (314) 635-6785
Office: (314) 751-2325
Ext. 245

SOCIAL SECURITY NO: 483-50-8054

EDUCATION
BACKGROUND

Candidate	Ph.D. - Human Nutrition and International Community Development University of Missouri-Columbia
1977	M.C.H. - Community Health Emory University School of Medicine, Atlanta, GA
1963	B.S. - Food Science Iowa State University

PROFESSIONAL
EXPERIENCE

1982-Present	Assistant Professor Food and Nutrition and Human Nutrition Research Assistant, Lincoln University (Missouri) <i>Coordinate Food and Nutrition curriculum in Home Economics Program; teach Food and Nutrition courses; advise undergrad- uates; and plan, implement and evaluate program promotion and recruitment strategy. Initiate and conduct research in inter- national nutrition.</i>
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Resume
Wilma Ardine Lyghtner Kirchhofer

PROFESSIONAL
EXPERIENCE
(continued)

1977-1982

Assistant Professor Nutrition Education,
Community Health Nutrition, Georgia State
University, Atlanta

*Developed and implemented courses in
teaching skills for a coordinated under-
graduate program in dietetics; initiated
and implemented nutrition continuing
education programs for state agencies.*

1974-1977

Instructor and Nutrition Education Specialist,
Atlanta and DeKalb Boards of Education,
Georgia.

*Developed, implemented and evaluated
nutrition education curriculum for
elementary and high school; coordinated
and conducted teacher training courses
in nutrition education methods.*

1968-1974

Freelance Home Economist, Zurich, Switzerland.

*Market research and evaluation for
American products in European retail
outlets.*

1963-1968

Product Home Economist, Betty Crocker Depart-
ment, General Mills, Inc., Minneapolis, MN.

*Interpret consumer needs for specific
products; evaluate product for quality
and competitive comparison; recipe
development and market research; and
liaison for marketing and advertising
representatives.*

Page 3
 Resume
 Wilma Ardine Lyghtner Kirchhofer

PUBLICATIONS

"Nutrition Education and Research in a Comprehensive Health Model for Elementary Schools", School Food Service Research Review. 2:1, 1978, p.41.

"Audiovisual Resources for Nutrition Education Bibliography", School Food Service Research Review. 3:2, 1979, p.97.

Contributor: Taylor, R. B., Ureda, J. R., and Denham, J. W., Clinical Applications. Appleton-Century-Crafts, Norwalk, CN, 1982.

Contributor: Feldman, E., Nutrition in the Middle and Later Years. Wright, PSG, Inc., 1983.

Contributor: NIH Publication No. 83-1528, Heart to Heart: A Manual on Nutrition Counseling for the Reduction of Cardiovascular Disease Risk Factors. National Heart, Lung, and Blood Institute, Bethesda, MD, 1983.

INTERNATIONAL EXPERIENCES

Freelance Home Economist, Homemaker, and Student; Switzerland and Germany, 1968-1974.

Studied German language and European cuisines; and market research consultant for American retailers.

Belize, Central America; Nutrition Consultant, Cardio-Graphic Diagnostic Clinic, Inc., May 1981.

Market research feasibility study for health education concepts.

Upper Volta, West Africa; Dietary Survey, South East Consortium for International Development-US Agency for International Development (SECID-USAID) Fellowship, June-August 1983.

Proposed, designed and conducted survey of dietary patterns of rural villagers in Koudougou area.

Page 4
Resume
Wilma Ardine Lyghtner Kirchhofer

PROFESSIONAL
ORGANIZATION

American Dietetic Association
Society for Nutrition Education
American Home Economics Association

LANGUAGE
CAPABILITY

German - good
French - functional

SECTION E: BUDGET INFORMATION

ESTIMATED BUDGET (June 1984-May 1985)

1. Faculty Release Time (approximately 1/3 effort, with full-time summer); Annual Salary \$18,000 for Mrs. Kirchhofer	\$ 6,000
2. Fringe Benefits (20%) ¹	1,200
3. Travel:	
(a) Local	500
(b) Air - Missouri/Upper Volta for Kirchhofer ²	2,200
(c) Upper Volta ground transportation ³	1,000
4. Subsistence:	
Upper Volta - 65 days @ \$99/day ⁴	6,435
5. Field Assistant:	
Upper Volta - \$250/month for 2 months	500
6. Student Assistant: Missouri, Lincoln University	2,000
7. Supplies:	
(a) Transport samples Upper Volta to Missouri	1,000
(b) Consumable supplies (transport containers, reagents, etc.)	2,000
	SUB TOTAL
	\$ 22,835
8. Contingencies (10%)	2,284
	\$ 25,119
9. Lincoln University Indirect (overheads) ⁵	
53% of salaries and benefits	5,063
	4,904
	30,182
	\$ 30,023

WJ
3/22/84

NOTES ON BUDGET

- ¹ Lincoln University's standard fringe benefit charge is 20% of base salary.
- ² Roundtrip fare from Jefferson City to Ouagadougou has been inflated by 10% for possible unscheduled increases.
- ³ Ground transportation in Upper Volta provides for use of rental cars, local taxis, etc.
- ⁴ Per diem rates for subsistence are based on US-AID's "Allowance for Foreign Areas".
- ⁵ Lincoln's official Overhead (Indirect Costs) rates are 53.3% charged on salaries, wages and fringe benefits.

SECTION F: ATTACHMENTS

1. Partial List of Vegetation of West Africa
2. Letters of Support
3. Grain Consumption and Preparation Survey,
Kirchhofer, 1983

UNITED STATES
INTERNATIONAL DEVELOPMENT COOPERATION AGENCY
AGENCY FOR INTERNATIONAL DEVELOPMENT
OUAGADOUGOU, UPPER VOLTA

UNITE STATES ADDRESS
OUAGADOUGOU (I.D.)
DEPARTMENT OF STATE
WASHINGTON, D.C. 20520

March 5, 1984

INTERNATIONAL ADDRESS
U.S.A.I.D.
C/O AMERICAN EMBASSY
B.P. 35
OUAGADOUGOU UPPER VOLTA

To Whom It May Concern;

I would like to present information and ideas that may be useful to you when considering the proposal of Ardine Kirchofer in which she seeks to continue her investigation of food consumption in rural Upper Volta.

For the African people who could benefit from the results of this study there are implications that are significant for personal health and life itself. This is partly due to the nature of food assistance now being provided to Upper Volta and other Sahelian countries. The typical contribution is in the form of cereal grains. This is an obvious replacement for crops lost during the current drought and the low yields of the past seven years.

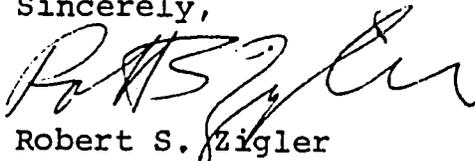
The day may be present when the other elements of nutrition, those to be studied by Ardine Kirchofer, are also no longer available. Replacement for these losses may also be necessary.

It should also be mentioned that her findings could have value to all the people of the Sahelian countries as well as Upper Volta.

I would also like to comment on the performance of Ardine Kirchofer during her short visit of last year. She established an excellent reputation for herself which was based on her self-reliance, independence, adaptability, and her ability to communicate effectively. For a person who had never worked before in Africa, her success in obtaining transportation, food, housing, and personnel was outstanding. Characteristics such as these can be even more valuable and essential than technical knowledge. They should be carefully assessed when reviewing her proposal.

I hope that this letter will be of value to you. If you should need more information, please contact me here in Ouagadougou.

Sincerely,



Robert S. Zigler

23



United States
Department of
Agriculture

Animal and
Plant Health
Inspection
Service

Federal Bldg.
Hyattsville, MD
20782

February 17, 1984

Dr. Ardine Kirchhofer
Nutrition Research Laboratory
Lincoln University
Jefferson City, Missouri 65101

Dear Dr. Kirchhofer:

This is in reply to your January 24 letter to Mr. Frank Cooper requesting authorization to import African vegetation samples for research.

We understand that the samples of a large variety of plants and plant products will be ground and ashed at high temperature in Africa. Plant samples which have been processed in this manner may enter the United States without a written U.S. Department of Agriculture permit. The samples will be subject to examination and verification at the first port of arrival in the United States. Treatment will not be required unless pests are found.

A copy of this letter should accompany the shipment(s) to prevent delay at the port of arrival.

Sincerely,

W. H. Forster
Head, Permit Unit
Regulatory Services Staff
National Program Planning Staff
Plant Protection and Quarantine

SECID



The South-East Consortium for International Development

Center for Women in Development

January 20, 1984

Dr. Colin Weir
Director, Office of International Programs
Lincoln University
Jefferson City, MO

Dear Dr. Weir:

I would like to formally thank you for all the support you provided last year in preparing Ardine Kirchhofer for her fellowship in Upper Volta. It was invaluable in making her experience successful. I am very impressed with the work that Ardine did in the field. Her research was well conceived and executed. Judging from the very positive reports we have received from our project team and AID/Upper Volta, her research was most relevant to problems currently facing Upper Volta in the area of nutrition and grain consumption. Not only did Ardine prove herself technically competent to conduct research in an international setting, but she also demonstrated a great personal adaptability and patience. The ability to dig in and adjust to local customs and conditions is equally important to the success of field research.

I sincerely hope that Ardine will continue to apply her professional and personal skills to the field of international nutrition. I feel that she has a great contribution to make.

Thank you again for all of your assistance.

Sincerely,

A handwritten signature in cursive script that reads "Ellen Fenoglio".

Ellen Fenoglio
Project Manager

cc: Ardine Kirchhofer

African Plants for Nutrient Analysis Research Import Permission
Requested by Ardine Kirchhofer.

<u>Scientific Name</u>	<u>English Name</u>
<i>Abrus precatorius</i>	Rosarypea; jequirity
<i>Acanthosicyos horrida</i>	Narasplant
<i>Achyranthes aspera</i>	<i>Achyranthes</i> , sp.
<i>Adansonia digitata</i> (<i>A. sphaeocarpa</i>)	Baobab; monkey-bread
<i>Adenia gummifera</i>	<i>Adenia</i> , sp.
<i>Aerva lanata</i>	<i>Aerva</i> , sp.
<i>Afraegle paniculata</i> (<i>Balsamocitrus paniculata</i>)	<i>Afraegle</i> , sp.; kokodi
<i>Amaranthus</i> spp.	Amaranth; Chinese spinach
<i>Asystasia gangetica</i>	<i>Asystasia</i> , sp.
<i>Boscia salicifolia</i>	<i>Aisen</i> , sp.
<i>Butyrospermum parkii</i> (<i>B. paradoxum</i>)	Shea-butter seed; shea-nut; lulu kernel
<i>Cassia obtusifolia</i>	<i>Senna</i> , sickle; foetid cassia
<i>Cleome monophylla</i>	Nsonyo
<i>Combretum paniculatum</i>	<i>Combretum</i> , paniced
<i>Conyza aegyptiaca</i>	<i>Conyza</i> , sp.
<i>Corchorus olitorious</i> and <i>Corchorus</i> spp.	Jute, spp.; busj okra; jews-mallow
<i>Crassocephalum rubens</i> (<i>Gynura cernua</i>)	<i>Crassocephalum</i> , sp.
<i>Crateva adansonii</i> (<i>C. religiosa</i>)	<i>Crateva</i> , sp.
<i>Crotalaria ochroleuca</i> (<i>C. intermedia</i>)	<i>Crotalaria</i> , sp.
<i>Cucumis dipsaceus</i>	Teaselgourd
<i>Emilia coccinea</i> (<i>E. sagittata</i> ; <i>Cacalia coccinea</i>)	Tasselflower, earleaf
<i>Erythrococca bongensis</i>	<i>Erythrococca</i> , sp.
<i>Euadenia</i> spp.	<i>Eudenia</i> , spp.
<i>Foeniculum vulgare</i>	Fennel, common
<i>Grewia</i> spp. (<i>G. bicolor</i>)	<i>Grewia</i>

Continued.

<u>Scientific Name</u>	<u>English Name</u>
Gynandropsis gynandra (G. pentaphylla)	Spiderherb, African;
Hibiscus sabdariffa	Sorrel, red; Indian sorrel; Jamaica sorrel; roselle; rosemallow; sour-sour
Hillieria latifolia	Hillieria, sp.
Justicia spp.	Justicia, spp.
Leucaena leucocephala (L. glauca)	Lead-tree; white popinac; jumpy-bean
Moringa oleifera (M. pterygosperma)	Horseradishtree
Pennisetum spp.	Unclassified millets:
Portulaca quadrifida	Purslane, sp.
Securidaca longipedunculata	Tree-violet
Sorghum spp.	Sorghum, spp.; guinea corn; kaffir-corn
Spilanthes oleracea	Spotflower, Paracress
Zizyphus spina-Christi	Jujube, Christ-thorn