COMMUNITY DYNAMICS AND FUNCTIONAL STABILITY:

A RECIPE FOR CULTURAL CONTINUITY IN THE VIETNAMESE DIASPORA

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ABSTRACT

This dissertation is an ethnobotanical study that documents and analyzes the reconstruction of culinary practices of the Vietnamese diaspora in Hawai'i. The basic approach was a comparative study of Vietnamese in Honolulu, Hawai'i and Biên Hòa, Vietnam. A triangulation of methods was employed that included: (1) interviews, both, (a) ethnographic and (b) participant observations with key informants and during community events, (2) documentation of food plants from Vietnamese market places, and (3) an analysis of food reconstruction using an ecological community analysis and species functions model approaches applied to a culturally significant food.

A checklist of over 200 food plants that includes the taxonomic groupings, scientific and vernacular nomenclature in Vietnamese, English and French was compiled. Changes in food plant usage from a foundation in Vietnam to a modified diet in Hawai'i are noted. Acculturation of food plant knowledge of Vietnamese in the Hawai'i compared to their counterparts in Vietnam was documented. While there was a positive correlation between age and knowledge of food plants in both communities, older Vietnamese immigrants demonstrated greater recognition of plants than younger ones and Vietnamese born in the U.S. Younger Vietnamese in Hawai'i also used significantly fewer Vietnamese plant names compared to older Vietnamese.

Colocasia gigantea (Blume) Hook. f.) (Araceae) was documented as a significant plant in the culinary history of Vietnamese-Americans. It is an indicator species in the Vietnamese soup, **canh chua.** An ecological community analysis of **canh chua** recipes in cookbooks from the U.S. and Vietnam demonstrated that its reconstruction has been a

dynamic process of plant substitutions that fulfill specific taste functions. Stability of functions is significant to maintaining the structure and recreating the cultural experience of the food.

This dissertation documents a dynamic community of people and assemblage of food plants reflecting (1) the natural and social climates of Hawai'i, (2) increased trade between Vietnamese in Hawai'i and Vietnam, and (3) the economic flexibility of Vietnamese in the U.S. These findings are considered in designing a culturally informative cookbook that is the reciprocal return to the communities where I worked.

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INTRODUCTION

1.1 Background

1.1.1 The study of a culture's food habits

The study of food habits is an important way to understand and describe human cultures. Food selection, preparation, ways of serving, and eating, are all shaped by cultural inheritance (Kalcik 1984). There are intra-cultural variations by geographic region, among social classes, by celebrations and mourning periods, religious codes, gender rules, and during different stages of life (Barer-Stein 1999). So significant are the food habits of society that they are equated with a language, present in all societies, that translates the culture's structure (Lévi-Strauss 1966).

Although food traditions are cultural traits most resistant to change (Airriess and Clawson 1994; Kalcik 1984), like culture, food habits are dynamic through historical periods of foreign introductions and adaptations (Barer-Stein 1999; Chang 1977). Food habits are affected by migration as people adapt to their new environments (Brown and Mussell 1984).

The exodus of Vietnamese after reunification of northern and southern halves of the country in 1975 received much global attention. This is referred to as the "Vietnamese diaspora" among academic circles. Drawing parallels from the Diaspora of the Jews out of Palestine (modern Israel), the academic study of cultural diaspora has evolved for other indigenous groups, as well (e.g., African diaspora, Indian diaspora).

Vietnamese refugees settling in different countries and environments faced new natural and social settings of their new homes. Natural (e.g., plants) and social (e.g., communities and markets) components are key elements in the construction and reconstruction of the assemblage of food plants and culinary practices of a society. Ethnobotany is the branch of science that describes plant use and plant-human interrelationships embedded in dynamic ecosystems of natural and social components (Alcorn 1995). Food choices and practices fall within the domain of ethnobotany (Balick and Cox 1996). Thus, ethnobotany includes the study the food habits of Vietnamese communities.

In view of the relationships between food habits, culture, migration, and the natural environment, this dissertation uses ethnobotanical methods to explore, describe and analyze botanical and social characteristics of Vietnamese food habits in Honolulu, Hawai'i compared to Biên Hòa, Vietnam. It is hoped this dissertation will offer new insight towards understanding the reconstruction of culinary practices in the Vietnamese diaspora.

1.1.2 Culture and the effects of migration and acculturation

Human interactions with plants have contributed significantly to the development of cultures (Balick and Cox 1996). Membership in that culture requires learning a language, skills, and pattern of reasoning that combine to provide a cultural worldview (Zent and Zent 2004). Its development is a process that must occur in each generation and is therefore dynamic and adaptive to new environments (Nagle 1994). Exposure to a new

cultural environment may lead to acculturation, the process of change in knowledge, attitudes, cultural beliefs, values, and practices (Olmedo 1979). Acculturation among populations that have migrated from their home countries is an important issue because it can lead to a loss of customs (Grivetti and Paquette 1978), and language (Lanca *et al.* 1994; Zhou and Bankston III 1998), which has been shown to lead to the loss of ethnobotanical knowledge (Zent 2001) and biological diversity (Cox 1997).

Acculturation among Vietnamese immigrants has been documented in loss of traditional knowledge of gardening (Airriess and Clawson 1994) and changes in food habits in the United States (Crane and Green 1980; Story and Harris 1989) and Australia (Marino *et al.* 2000). Language acculturation is an important concern among Vietnamese adults regarding learning the host country language (Gum 1997), and among second generation Vietnamese with regard to losing knowledge of the Vietnamese language (Do 1999; Zhou and Bankston III 1998). As the large Vietnamese-American second generation reaches adulthood, acculturation of their cultural values, including food choices and ultimately their interactions with plants, may have a significant effect on the diversity of foods and food plants in the United States.

1.2 Vietnamese in the Unites States

1.2.1 Vietnamese immigration to Hawai'i

Since 1975, approximately 700,000 Vietnamese refugees have settled in the United States. The U.S. Census 2000 population data reports approximately 1.2 million people of Vietnamese ancestry living in the United States. Vietnamese refugees began

coming to Hawai'i just before the fall of Saigon (now Ho Chi Minh City) in April 1975. During that year, the Vietnamese population in Hawai'i increased from almost none to over 2500 (Nguyen 1977). There are now approximately 7900 Vietnamese living in Hawai'i, the majority residing in Honolulu (~7400). Vietnamese are represented in the professional, private, government, business and non-profit fields in Hawai'i. There are also numerous ethnic associations, religious organizations, cultural celebrations, and a Vietnamese language newspaper that attest to the Vietnamese' contribution to Hawai'i's modern cosmopolitan society (Sananikone 1996).

1.2.2 Vietnamese immigration studies

The visibility of the Vietnamese immigration created much research interest regarding their assimilation (Barker 1977; Ferguson 1979; Nguyen 1977), social adaptation (Chung 1980), and socioeconomic status (Viola 1979). These social issues and Vietnamese culture, in general, continues to be an area of research interest in Hawai'i (Gum 1997; Mai 1997; Yontz, 1995; Sananikone 1991; Soedirham 1999) and the larger United States (Fjelstad 1995; Hein 1991). With the second generation Vietnamese identified as one of the largest groups of children of refugees in the United States (Zhou and Bankston III 1998), there is an emergence of literature concerning their cultural and social experiences (Do 2002; Thai 1999; Zhou and Bankston III 1998).

1.2.3 Vietnamese food in the United States

Traditional foods and foodways are important to refugee and immigrant families because they ease the shock of entering a new culture and serve to maintain ethnic identity (Barer-Stein 1999; Kalcik 1984; Story and Harris 1989). This is well documented in research of foodways of ethnic groups in the United States. For example, food traditions were so esteemed by many Italian immigrants that to abandon them for Americans foods was equated to abandoning community, family and religion (Gabacia 1998: 54). Among Latino women, feelings of ethnic-group belonging have been expressed during the shared act of preparing traditional foods (Inness 2001).

For Vietnamese, the making of traditional food has not only served to maintain ethnic identity, but has also introduced that ethnic food to American palates. Vietnamese food introduced via restaurants and cookbooks gained popularity due to its characteristic blend of ingredients and perceived healthfulness conveyed by the usage of copious fresh and raw herbs and vegetables (Ngô and Zimmerman 1986; Pham 1996; Read 2001; Tran 1990; Trang 1999).

While social scientists have investigated Vietnamese foodways with regard to acculturation and maintenance of ethnic identity (Kalcik 1984), in the United States, there has been little research about the roles of plants in the foods and in the lives of the Vietnamese, in general.

1.3 Ethnobotany

1.3.1 Defining ethnobotany

John W. Harshberger, in a lecture delivered before the University Archeological Association, December 4, 1895, coined the term "ethno-botany" as the study of useful plants by aboriginal peoples (Harshberger 1896). Since then it has undergone different interpretations by numerous authors (Cotton 1996). For example, Balick and Cox (1996) broadly defined ethnobotany as the study of relationships between people and plants. While Berlin (1992) recognizes two distinct fields of ethnobotany: (1) cognitive ethnobotany, how humans view and classify plants, and (2) economic botany, how humans utilize plants. The research conducted in this dissertation best follows the description of ethnobotany as outlined by Alcorn (1995): the branch of science that describes plant use and plant-human interrelationships embedded in dynamic ecosystems of natural and social components.

In addition to ethnobotany, elements of this dissertation are purely economic botany in scope. Economic botany is the study of how humans utilize plants. The identification and compilation of food plants used by Vietnamese is an economic botany work that provides a database of knowledge. It is hoped that this knowledge contributes to building a strong foundation upon which future studies of Vietnamese uses of and interactions with plants may be built upon.

1.3.2 Ethnobotany in an urban context

Much of the current work in ethnobotany is concerned with the loss of traditional knowledge and preservation of biological diversity in remote parts of the world. By recognizing the dynamic and widespread use of plants by ethnic communities in urban centers, interesting ethnobotanical studies can be designed for this environment (Balick *et al.* 2000). Much can be learned from working with immigrant communities in large cities (Corlett *et al.* 2003; Staples and Kristiansen 1999). Moreover, urban ethnobotany is often supported by the community because it maintains and gives value to cultural ties (Balick *et al.* 2000).

Marketplaces found in urban and rural areas are rich sources of ethnobotanical information (Bye and Linares 1983, Martin 1992). They are places of intensive interaction between people (vendors and consumers) and people and plants, they are readily accessible and cost effective places of fieldwork, and they can provide qualitative and quantitative data concerning cultural, social and economic aspects of a plant's usage (Alexiades 1996).

1.4 Vietnamese Ethnobotanical Research – Vietnam

From the arrival of Jesuit missionaries in 1614, through 100 years of France's colonial rule over Vietnam from 1858 through 1954, botanical and ethnobotanical research of Vietnam has been pursued directly by French scientists or others (e.g., ethnic Vietnamese scientists in France) influenced by French scientific work. The purpose of early French botanical explorations of Vietnam was to search for new and better tropical

economic plants (Lanessan 1886; Lecomte 1908-42). Scientists were also interested in the health and nutritional aspects of food eaten by the Vietnamese French (Vassal 1933; Vialard-Goudou 1959). French colonization of Vietnam also introduced and incorporated into the local agricultural systems many new food plants and other economic plants of interest to the French (Crevost *et al.* 1917-1941).

The 60 plus ethnic minorities of Vietnam have been the subjects of ethnobotanical and ethnographic studies by French and Vietnamese scientists (Bùi 1999; Chu 1991; Condominas 1994; Condominas and Haudricourt 1952; Dournes 1955; 1971). Exceptional among these is Condominas' (1957) (and translated to English (Condominas 1977; 1994) participant study with the Mnong Gar in the central highlands of Vietnam from 1948-1950. His is an excellent example of ethnobotanical work where detailed ethnographic notes were recorded along with the collecting of plant vouchers that were deposited in a herbarium (Condominas and Haudricourt 1952). Recent works by American scientists focused on ethnic minority women and traditional knowledge in the wake of Vietnam's economic development (Ireson and Ireson 1996; Sowerwine 2004).

Although they comprise the majority population of Vietnam, much less has been written about the **Kinh,** or **Việt** (most literature and conversation using the term "Vietnamese" are referring to this later group rather than an "ethnic minority") (Đinh 1981; Hickey 1964; Hodel *et al.* 1999; Nguyen 2000; Ogle *et al.* 2003). Hickey's (1964) work is an important ethnographic and ethnobotanical study conducted in southern Vietnam describing social and family structure, and many aspects of the material culture. Both Hickey's (1964) and Condominas' (1957) ethnographies became important sources

of information to non-Vietnamese governments regarding the people of Vietnam during the Vietnam-American War. Đinh's (1981) dissertation attempts to be a nearly comprehensive overview of Vietnamese ethnobotany with lists of plants used for food and drink, medicine and ornamentals. Much of his data was gathered from observations of plants sold at markets and displayed around homes. While his dissertation identifies plants and their uses, it is not possible to confirm his findings due to the absence of voucher specimens.

1.5 Vietnamese Ethnobotanical Research – France

Many Vietnamese migrated to France after the end of colonial rule and the division of Vietnam in 1954. The use of food plants by the Vietnamese in France has been extensively discussed (Krowolski 1987; Nguyen 1993; Nguyen 1983; Simon and Simon-Barouh 1972; Walujo 1985). Đinh, in particular, has written extensively on usage of plants for foods, beverages and customs associated with food (Đinh 1975; 1988; 1990a; 1990b), plant nomenclature (Đinh 1976), and in relation to other Asians in France (Đinh 1997).

1.6 Vietnamese Ethnobotanical Research – United States

Although the Vietnamese are credited with introducing or increasing the availability of twenty to thirty taxa of plants in the United States (Kuebel and Tucker 1988), the literature sources regarding Vietnamese plant use in the United States are few.

The presence of "Vietnamese" food plants and vendors consistently selling them resulted in the Vietnamese-Americans re-constructing their culinary traditions or foodways in an environment in which many foods items they knew in Vietnam were not available. Kuebel and Tucker (1988) noted the Vietnamese immigration to have been a "boon" to herb growers and "fanciers of exotic foods." Interviewing Vietnamese immigrants in central Texas over a five-year period, Kuebel and Tucker recognized two classes of Vietnamese "seasoning herbs": those eaten raw and those cooked. They regarded the Vietnamese custom of eating raw herbs as unique and unmatched in current "western" cooking. Airriess and Clawson's (1994) analysis of home gardens from a Vietnamese community in New Orleans showed the gardens were an important source of cultural foods and happiness for the elderly immigrants who tended them. Recently, a new generation of ethnobotanists has taken interest in documenting the Vietnamese-American interactions with plants. Owens' (2003) study of Vietnamese home gardens in Lincoln, Nebraska supported Airriess and Clawson's (1994) findings that gardens were an important source for cultural foods. In some of my work (Nguyen 2003; 2005a) I investigated adoptions and substitutions of food plants as well as the continuation of traditional food customs of Vietnamese in Hawai'i.

Despite the influence on the food, market, and garden flora of the United States, our knowledge of food plants used by the Vietnamese is preliminary (Airriess and Clawson 1994; Kuebel and Tucker 1988; Nguyen 2003; 2005a; Owens 2003). Furthermore, there are no currently published surveys of food plants sold in Asian markets in the United States (Chung and Ripperton 1929; Porterfield Jr. 1951). The

paucity of discussions regarding plant usage by the Vietnamese largely ignores the culture's traditionally deep-rooted relationship with the natural environment (Jamieson 1993; Rambo 1973). French geographer, Pierre Gourou, coined the concept 'Civilisation du végétal' to describe the people of Indochina, which includes the Vietnamese, that he observed extensively utilizing vegetation in numerous aspects of daily life (Gourou 1948).

1.7 Current Research Objectives

To fill a gap in the literature regarding Vietnamese ethnobotany and to elucidate the reconstruction of Vietnamese culinary practices in the Vietnamese diaspora in Hawai'i, the following objectives directed this dissertation: 1) to identify the assemblage of food plants used by Vietnamese in Hawai'i and to compare it with that used in Biên Hòa, Vietnam; 2) to document the extent of acculturation in food plant knowledge and food habits of the Vietnamese in Honolulu compared to their counterparts in Vietnam; 3) using a case study approach, to identify key species used for substitutions of plants not available to Vietnamese in the Untied States; and 4) analyze how those substitutions are important in the reconstruction of a traditional Vietnamese food in the United States.

1.8 Study Period and Sites

This research was conducted in Honolulu, Hawai'i, and Biên Hòa, Vietnam. A pilot research project involving interviews was conducted in Biên Hòa, Vietnam during July 2000 and Honolulu, Hawai'i from April 2000 through January 2001. A primary

research period that included conducting interviews, participant observation and market collections was conducted from January 2002 through April 2003 in Honolulu and November 2003 through March 2004 in Biên Hòa. The two locations are comparable based on the following: (1) Honolulu has an established population of Vietnamese people; (2) many Vietnamese immigrants in Honolulu are originally from southern Vietnam (Nguyen 1977); (3) Biên Hòa is in southern Vietnam (ca. 30 km north of Ho Chi Minh City); and (4) both locations are urban environments with food markets (i.e., open air markets selling food plants).

Herbarium research was conducted at the Herbarium Pacificum (BISH) of the Bishop Museum in Honolulu, Hawai'i, at the Herbier, Laboratoire de Phanérogamie (P) of the Muséum National d'Histoire Naturelle in Paris, France, at the Herbarium of the Royal Botanic Gardens, Kew (K), and the Phòng tiêu bản thực vật (Herbarium) of the Viện Sinh học Nhiệt dới (Institute of Tropical Biology) in Ho Chi Minh City, Vietnam.

1.9 Methods

Methods employed in ethnobotanical studies are drawn from the various disciplines that make up the field including, botany, anthropology, ecology, linguistics, and pharmacology. Selecting the method(s) most appropriate for the study requires an understanding of the research question(s) and the methods available (cf. Alexiades 1996, Cotton 1996, Cunningham 2001, Martin 1995). The triangulation of methods allows for cross-verification of data by attempting to answer a question using three different methods (Martin 1995). In this work to ascertain the reconstruction of Vietnamese

culinary practices in the Vietnamese diaspora, the three main methods employed are interviews (structured and participant observation interviews), botanical collections of food plants from market places, and an analysis of food reconstruction using tools in ecology applied to Vietnamese cookbooks from the United States and Vietnam. I provide detail and background for these three important methods here. Other methods specific to each research objective are outlined in their respective chapters. Permission to conduct the research, a research visa, and approval by the Committee on Human Subjects (University of Hawai'i) were obtained from the authorities and communities in Vietnam and Hawai'i prior to beginning this research project.

1.9.1 Interviews

The sample of Vietnamese people used in this study was selected using a purposive sampling method (Bernard 2002). In purposive sampling, the purpose or characteristic(s) one wants an informant (or communities) to serve is decided upon in advance, and then the group is chosen. This sampling technique is often used in life history research and qualitative research on special populations (Bernard 2002). It was appropriate for my research because I wanted to interview Vietnamese immigrants and second generation Vietnamese. For example, I used purposive sampling to select the Vietnamese community of Đong Tam Baptist Church when I begin my research. Once the community was identified and contacted, the interviewees were selected using (1) convenience and (2) snowball sampling methods (Bernard 2002). In convenience sampling, subjects that are available or easily accessible are interviewed. For my work,

this would include those members that were willing to talk with me and be interviewed when I first came to the church. Convenience sampling was often followed by or used in conjunction with snowball sampling. In snowball sampling, subjects with particular attributes are identified, interviewed or surveyed, and then asked to refer others who possess similar attributes. Those referrals are then contacted, and the process is repeated if necessary until no new informants are identified. It is an effective method to find a sample of people in a small population (e.g., Vietnamese living in Honolulu) and to explore the full range of their network. These sampling methods were also used to find interviewees in Vietnam.

Interviews with informed consent (Alexiades 1996), including: a) structured interviews (Spradley 1979) using questionnaires (Martin 1995) conducted with men and women of different ages to collect data on current food plant use, and b) participant observation interviews (Spradley 1980) with key informants and during community events. This involved assisting with the purchasing, preparation, and processing of food plants, and cooking of foods. Community events involved monthly fellowship dinners, church lunches and cultural celebrations where the assisting in preparation and eating of the food occurred. The interviews and participant observation are used to identify plant species used by the Vietnamese.

1.9.2 Botanical collections, sites and voucher repositories

The out-door food markets of Chinatown, Honolulu, Hawai'i and in Biên Hòa, Vietnam are the primary sites for collection supplemented by collections from home gardens. Many Vietnamese in Hawai'i have expressed the importance of the availability

of Vietnamese food plants at the Chinatown markets to their well being and satisfaction of living in Hawai'i. Asian markets offer a source for traditional vegetables (Hutton 1996). Herbarium vouchers of the plants collected are deposited at the herbaria of the University of Hawai'i (HAW) and the Bishop Museum (BISH), both in Honolulu, Hawai'i, and the herbarium of the sponsoring Vietnamese institution, Viện Sinh Thái Và Tài Nguyên Sinh Vật (Institute of Ecology and Biological Resources) (HN) in Hanoi, Vietnam.

The collection of cultivated plants from the markets, their preparation for vouchers, and use presents challenges for the ethnobotanist. Cultivated plants are usually available in the markets without anatomical features that are traditionally required for making a good voucher specimen (i.e., they are without floral parts for identification, fragmentary, or dried). Thus, they may be difficult to identify and not desirable to herbaria curators. Due to their importance and the challenges of using them, I review research, conventions, and make recommendations based on my methods and experiences regarding cultivated plant collections from market places separately in Chapter 2.

1.9.3 Analysis of recipes from Vietnamese cookbooks

Vietnamese cookbooks from the United States and Vietnam were used to analyze the reconstruction of a traditional Vietnamese food, **canh chua cá lóc**, in the United States. It was chosen as a case study to test the hypothesis that Vietnamese immigrants in United States have used plant substitutions to reconstruct and maintain traditional

culinary practices. Recipes of **canh chua cá lóc** are analyzed using an "ecological community" multivariate analysis of plant species used in the recipes.

Cookbooks and recipes are appropriate resources for data on cultural food habits. Writing on the ethnobiological history of Chinese foods, Simoons (1991) used English-language Chinese cookbooks to provide additional information on uses of plants in recipes and cooking ways. He recognized that although the cookbooks were written for what he called "Western readers" they were still invaluable sources for providing information on China's food scene not available in other literature (Simoons 1991). Authors of ethnic cookbooks often substitute or simplify ingredients and methods of preparation; because either the ingredients are difficult to obtain or it's felt that the users of the books will not want to invest the time or effort to prepare the dish the traditional way (Brown and Mussell 1984). However, while ingredients can change easily, rules (i.e., recipes) governing structure persists over time. Recipes are more complex than food items because they: (1) emphasize the structure rather than content; and (2) incorporate rules for relating items: segregating, combining, and opposing them (Goode *et al.* 1984, Rozin 1973).

1.10 Organization of Chapters

Chapter 2 reviews research and conventions for the collection of cultivated plants from markets places, and the preparation, maintenance, and use of voucher specimens from these. I make recommendations on methodology based on experiences working with

these collections. This article has been published by the journal *Ethnobotanical Research and Applications* as "Cultivated plant collections in market places" (Nguyen 2005b).

Chapter 3 identifies food plants listed and observed to be used by Vietnamese in Hawai'i and southern Vietnam. This work was conducted to address the need for a reference of scientific and Vietnamese plant names with the complete diacritical markings. A checklist of over 200 taxa was compiled and includes: (1) the current botanical nomenclature and taxonomic groupings, (2) plant life form or part utilized, (3) Vietnamese vernacular names with diacritical markings, (4) English, and (5) French translations. Substitutions and deletions of plant species in the assemblage of food plants used by Vietnamese in Hawai'i are also highlighted. This paper is being submitted to the journal *Muossons* as "Replications, insertions, and deletions: Evolution in the assemblage of Vietnamese food plants."

Chapter 4 addresses the question of acculturation in food plant knowledge and food habits of the Vietnamese in Honolulu compared to their counterparts in Vietnam. This work was part of the pilot study that laid down the early logistics involved in this dissertation. This chapter has been published in the journal *Economic Botany* as "Comparison of food plant knowledge between urban Vietnamese living in Vietnam and in Hawai'i" (Nguyen 2003).

Chapter 5 is a continuation of the question of food use knowledge lost by Vietnamese in Hawai'i addressed in Chapter 4. Linguistic data gathered during the same pilot study described in Chapter 4, was used to test the hypothesis that the Vietnamese community in Hawai'i has less knowledge of plant names than those still living in

Vietnam. This chapter is being submitted to the *Journal of Ethnobiology* as "Acculturation of food plant knowledge among Vietnamese in Hawai'i."

Chapter 6 discusses *Colocasia gigantea* (Blume) Hook. f. in the culinary history of Vietnamese-Americans. This chapter describes the economic botany, introduction to the U.S., status and outlook of *C. gigantea* use by Vietnamese in the United States. This chapter is in press with the journal *Economic Botany* as "**Bạc hà** (*Colocasia gigantea* [Blume] Hook. f.) in the Culinary History of Vietnamese-Americans" (Nguyen 2005a). The discussion of *C. gigantea* in Chapter 6 sets the foundation for the research discussed in Chapter 7.

Chapter 7 describes a case study of a traditional Vietnamese food, **canh chua cá lóc**, used to test the hypothesis that Vietnamese immigrants in United States have used plant substitutions to reconstruct and maintain traditional culinary practices. Recipes of **canh chua cá lóc** from Vietnamese cookbooks published in the United States and Vietnam are analyzed using an ecological community analysis. The research shows that it is not the plant species, but rather the structure and experience of traditional foods that is maintained after migration. This chapter is being prepared for publication under the title, "Community dynamics and functional stability: an ecological analysis of culinary knowledge."

In Chapter 8, I present a synopsis of the finding and implications of my study. I explain gaps in the research and discuss recommendations for future projects.

1.11 Conclusion

Modernization of traditional cultures results in the modification of indigenous knowledge systems as people move away from traditional ways and adopt foreign ideals (Balick and Cox 1996). In the wake of unprecedented world development and globalization, careful yet expeditious studies of indigenous knowledge are imperative to documenting and preserving biological and cultural diversity (Cox 1997). This is crucial among Vietnamese refugees and immigrants, as well as those that have remained in Vietnam due to new market opportunities now available due to international trade and the people's desire for culturally foreign items. The community often supports ethnobotanical research in urban centers because it maintains, revalidates, invigorates, and enhances the values of community cultural traditions, especially those associated with plants (Balick *et al.* 2000; Shanley and Laird 2002). This ethnobotanical research may help to conserve traditional, cultural, botanical knowledge of the Vietnamese both in United States and in southern Vietnam through *in situ* conservation of food plants within their cultural environmental setting (Miller 1933; Wester and Chuensanguansat 1994). It is also the first ethnobotanical comparison of diasporic Vietnamese in the United States with Vietnamese still residing in Vietnam. In the current state of world affairs, with people moving frequently from their homes, it is my hope that the conclusions and concepts developed as a result of this work may be applied to address ethnobiological concerns for Vietnamese communities and other cultural groups throughout the world.

CHAPTER 2

CULTIVATED PLANT COLLECTIONS FROM MARKET PLACES

2.1 Abstract of Published Manuscript

The study of cultivated plants from markets places can reveal interesting information on the interactions and relationships between people and plants. Despite this, cultivated plants are often overlooked and not vouchered in ethnobotanical studies. This article was written for Ethnobotany Research and Applications to reaffirm and to reach a wider audience of colleagues, via an electronic journal, the importance and proper conventions for the collection, maintenance, and use of voucher specimens, particularly for cultivated plants. A case study with *Colocasia gigantea* (Blume) Hook. f. is presented to help illustrate these points.

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CHAPTER 3

SUBSTITUTIONS, INSERTIONS, AND DELETIONS: EVOLUTION IN THE ASSEMBLAGE OF VIETNAMESE FOOD PLANTS

3.1 Introduction

Despite nearly 30 years of influence on the food, market, and garden flora of the United States, our knowledge of the food plants used by the Vietnamese is only preliminary (Airriess and Clawson 1994; Kuebel and Tucker 1988; Nguyen 2003; 2005a; Owens 2003). Furthermore, while other waves of Asian immigrants (e.g., Chinese, Japanese, and Filipino) have introduced their foods there are no current published surveys of food plants sold in Asian markets in the United States although there are older reports (Chung and Ripperton 1929; Miller 1933; Porterfield Jr. 1951).

From the recent reports involving Vietnamese economic and ethno- botanical studies in Vietnam (Ogle *et al.* 2003; Tanaka 2004) and in the United States (Owens 2003; Staples and Kristiansen 1999), it is evident that there is a need for a reference of accurate scientific and Vietnamese plant names. The main issue is the absence or misuse of diacritics when writing Vietnamese words. If one understands that a single stroke of the pen can change the meaning of a word from "melon fruit" to "coconut palm", one would agree that it is important to not only record, but also to share and report the accurate name. Such is the case with the names of plants in the Vietnamese language. As a native speaker and an ethnobotanist, I contend the unambiguous understanding and use of Vietnamese vernacular botanical nomenclature for laying a solid foundation for the field.

The purposes of this report are: 1) to identify food plants salient to Vietnamese in Hawai'i and southern Vietnam, 2) to analyze the plant taxa elicited in order to test the hypothesis that an 'evolution' in the assemblage of food plants salient to Vietnamese in Hawai'i has occurred demonstrated by plant substitutions, insertions, and deletions, and 3) to provide a reference of scientific and vernacular names of food plants used by Vietnamese people that (i) is current in botanical nomenclature and taxonomic groupings, (ii) is accurate in the diacritical and tonal Vietnamese vernacular names of plants, and (iii) provides English and French vernacular names for cross-referencing research. To facilitate accurate and efficient research and reporting, I provide information for typing diacritic Vietnamese fonts.

3.2 Vietnamese Language and Vernacular Botanical Nomenclature

3.2.1 The Vietnamese language

Vietnamese is the national language of the [Socialist Republic of] Vietnam and of the **Kinh** or **Việt** ethnic group (represents the majority of diasporic Vietnamese). Vietnamese is only one of the over 90 languages spoken by the 54 ethnic groups in Vietnam but is spoken by nearly 90% of the population. The northern (NV), central, and southern (SV) dialects are reflected by the numerous examples of multiple vernacular names for a single subject and pronunciations for a single word. With the Vietnamese diaspora, the language is spoken everywhere they have settled throughout the world (SIL 2004).

3.2.2 Vietnamese diacritics and their importance in plant names

The Vietnamese language incorporates a system of diacritical marking that are applied to the vowels a, â, ă, e, ê, i, o, ơ, u, ư, and y. The alphabet also includes the consonant, "đ." This "đ" is pronounced similarly to the English "d," as in the word "dog." In contrast, the Vietnamese letter "d," while written the same as the English "d," is actually pronounced as the English "z," as in "zebra" (NV) or "y," as in "yellow" (SV). These diacritics are used to designate tones in spoken words and are requisite in distinguishing the meanings of otherwise similarly spelled words (Table 3.1). This indispensable use of diacritics to distinguish meaning is also present in the Vietnamese botanical nomenclature (Table 3.2). See Đinh (1976) for an in-depth analysis of the botanical nomenclature, including the Chinese and French influences.

Table 3.1. Tones and diacritical marks used in Vietnamese writing. Examples of their application for "ma" and the corresponding English translations.

Tone	Diacritic	Vietnamese	English[a]
mid-level	none	ma	funeral
high-rising	´	má	mother
low-falling	`	mà	but
high-rising-glottal	~	mã	horse
low-falling-rising	̉	mả	grave
low-falling- glottal	.	mạ	rice seedling

[a] English translation according to the first usage in Nguyễn and Nhóm's (2000) Vietnamese-English dictionary.

Table 3.2. Changes in the botanical meaning of the word "dua" with the application of diacritical marks. Example for the consonants, "đ" and "d" and the vowels "u" and "ư".

Consonant and Vowel	Diacritic	Vietnamese Generic	English or Latin [a]
đ + u	none	đua	to compete
d + u	none	dua	no meaning
d + ư	none	dưa[a]	*Cucumis* or *Citrullis*
	´	dứa[a]	*Ananas*
	`	dừa[a]	*Cocos*
	~	dữa	no meaning
	̉	dửa	no meaning
	.	dựa	to lean

[a] As applied with the prefix "**trái**" meaning a fruit (e.g., **trái dưa**, *Cucumis* fruit).

In fact, it is the French that have been most diligent (for non-Vietnam based scientists) in using diacritics in their Vietnamese botanical research. French researchers compiled extensive Vietnamese botanical literature and specimens due to France's colonization of and economic interests in Vietnam. Vietnamese names were recorded: (1) on many herbarium vouchers collected during botanical explorations (e.g., a rice cultivar (in this case with a French translation): "**lúa bông giâu, fleur de múrier**" on

voucher 14 March 1869, *Oryza sativa* var. mutica *Pierre* 122 P!); (2) in publications concerning botany in Vietnam (cf., Crevost *et al.* 1917-1941; Đinh 1981); and (3) in publications concerning the ethnobotany of the Vietnamese in France (Simon and Simon-Barouh 1972; Walujo 1985).

Important as it is, few have been as careful in their employ of Vietnamese plant names as the French (Hodel *et al.* 1999; Kuebel and Tucker 1988; Nguyen 2003; 2004; 2005a). This is notable due to the recent increase of Vietnamese ethnobotanical publications, both from studies in Vietnam (Ireson and Ireson 1996; Nguyen 2000; Ogle *et al.* 2003; Tanaka 2004) and in the United States (Airriess and Clawson 1994; Corlett *et al.* 2003; Nguyen 2000; Owens 2003; Staples and Kristiansen 1999). This increase in Vietnamese research is a contribution towards balancing a historically American continent dominated focus in ethnobotanical research publications (American continent > 40% vs. Asia <25% (Cotton 1996)). At this stage in particular, it is counterproductive for progress, to publish reports less than complete with the diacritical language. Reasons for not using diacritics include: (1) confusion regarding their correct application; (2) lack of reliable, comprehensive references to check Vietnamese names; and (3) technology difficulties (i.e., incompatible language programs and formatting difficulties in word processing programs) (personal communication, R. Owens 2003, and G. Staples 2000).

3.2.3 Vietnamese vernacular botanical nomenclature

Vietnamese vernacular botanical nomenclature may be generalized to glosses based on: (1) large taxa defined by plant form or structure utilized (Atran 1990)

(Appendix B); (2) generic ranks; and (3) specific "species" or "varieties" (Berlin 1992) that may be labeled as binomials. Examples of plant names based on form or part utilized include **nấm** (mushroom), **rau** (leafy vegetable), and **trái** (fruit). Examples of generic names include **dưa** (*Cucumis*), **chuối** (*Musa*), and **cải** (*Brassica*). Examples of specific names include **dưa chuột** (*Cucumis sativa* L.), **chuối hột** (*Musa balbisiana* Colla.), and **cải ngọt** (*Brassica rapa* cv. Chinensis (L.) Kitamura). The plant form or part utilized is also a prefix that in some cases may designate the generic name. Examples include **nấm mèo**, for the tree-ear fungus (*Auricularia* sp.), and **trái dưa chuột**, the fruit of cucumber (*C. sativa*).

The prefix is important in cases where two species of different genera or even families share a generic name. An example is the generic name **dứa** (different from **dưa** without a rising-tone diacritic) (see Table 3.2). The examples in Table 3.2 refer to meaning when combined with the prefix for a fruit, as in **trái dứa**, referring to the fruit of *Ananas comosos* (L.) Merr (SV). When it is combined with the prefix for leaf, as in **lá dứa**, it refers to the scented leaves of *Pandanas amaryllifolius* Roxb. used in cooking.

A single species may be referred to by different vernacular names corresponding to its use at different developmental stages or to distinguish the part utilized. This is well illustrated in the seeded banana, **cây chuối hột** (tree + *Musa* + seed). The staminate inflorescence, referred to as **bắp chuối** (SV) (**bắp** describes its oblong shape) or **hoa chuối** (NV) ("banana flower") and the young, green fruits, **trái chuối chát**, (fruit + banana + astringent taste) are used as raw vegetables. The fully developed seeded fruits,

trái chuối hột, are dried and used medicinally. While the leaves, **lá chuối**, are valued for their use as a food wrapping, especially for cooking glutinous rice preparations.

Many plants introduced during the French colonial period were named with a Vietnamese life form or generic name followed by a Vietnamese version of the French name. Adopting and modifying western names of introduced plants is common in indigenous cultures (cf. McClatchey *et al.* 2000). To illustrate, the Vietnamese name for *Daucus carota* L., **củ cà-rốt**, is the result of combining the Vietnamese term for a root crop, bulb, or rhizome, **củ**, with the French **carotte**. Some introduced plants that are morphologically similar to traditional plants have names that reflect this morphology (e.g., **măng tây**, literal translation, "bamboo shoot of the French (or west)," otherwise known as *Asparagus officinalis* L.). The descriptor **tây**, meaning "west," was used to designate plants introduced by the French.

3.2.4 Writing Vietnamese diacritical characters

The Vietnamese diacritical characters in this manuscript were written in "Unicode." Writing diacritics was once problematic due to formatting and word processing difficulties. These problems have been overcome by the use of Unicode fonts and Vietnamese language programs. The Unicode Standard is an international character coding system designed to support the worldwide interchange, processing, and display of written texts of diverse languages (UNICODE 1991-2004). A number of Vietnamese language fonts and programs using Unicode are available and free to download from the Internet (UNIKEY 1991; VPS 1993-2001). Unicode characters are also available as

standard symbols in Microsoft® Word and are supported by a number of applications (e.g. EndNote® 8). I recommend using the Unicode Standard for Vietnamese fonts (inserted either from Microsoft Word's "Insert - Symbols" menu or as the Unicode option in the font program of choice). Both methods are broadly available and transferable without formatting corruption.

3.3 Methods

3.3.1 Study period and sites

The food plant list presented here was compiled as part of my dissertation research on food plant knowledge and practices of Vietnamese in the United States and in Vietnam. The research was conducted from January 2002 through April 2004 in Honolulu, Hawai'i, and Biên Hòa, Vietnam. The comparability of the two locations has been outlined in Chapter 1, section 1.8 (p. 11).

3.3.2 Interviews and participant observation

Ethnographic, structured interviews (Spradley 1979) with informed consent (Appendix C and D) (Alexiades 1996) using questionnaires (Appendix E and F) (Martin 1995) were conducted with Vietnamese men and women at least 18 years of age to collect data on food plant use and culinary habits. Interviewees were selected by snowball sampling (Bernard 2002) initiated with a Vietnamese immigrant woman in Honolulu and a Vietnamese woman of similar age in Vietnam. The free listing technique was used to obtain food plant species known and used by each interviewee (Martin 1995). Food

plants were demarcated by three uses: (1) "vegetables" (**rau cải**), defined as any plant part or life-form of the plant that can be eaten and is often not sweet compared to most fruits of plants (e.g., leaves, stems, corms, and mature or immature fruits of the Cucurbitaceae and Solanaceae families), (2) "fruits" (**trái cây**), the developed ovary of a seed plant that may contain seeds, and (3) "spices and other ingredients for preparing food" (**nguyên liệu gia vị**), a plant or non-plant substance that is used to add aromatic, pungent, salty, or other additional seasoning to foods.

Participant observation (Spradley 1980) with informed consent was conducted with members of the Vietnamese communities in private homes and at public events to observe plants actually being used. This was to supplement plant data from the free-lists and to record those not listed in the interviews.

3.3.3 Plant collections

Vouchers of plants recorded in Hawai'i and Vietnam were collected in triplicate from some home gardens, but mostly from the produce markets of Chinatown, Honolulu (Hawai'i) and Biên Hòa (Vietnam) (Bye 1986b; Martin 1995). Vouchers were deposited at the herbaria of the University of Hawai'i (HAW), the Bernice P. Bishop Museum (BISH) in Hawai'i, and the Institute for Ecology and Biological Resources (HN) in Hà Nội (Hanoi), Vietnam. Plants in home gardens represented by few individuals were collected singularly or in duplicate only. These specimens are deposited only at HAW. Some vouchers were recorded using only digital photography. These have been deposited in the herbaria as well.

Many of the plants were cultivated species for which their identification is commonly known. Others were identified using the most comprehensive flora of Vietnam currently available (Phạm 1999; 2000; 2003). Specimen identifications have been confirmed by staff of BISH and HN. The Vietnamese plant names recorded from the interviews were cross-checked using Phạm (1999; 2000; 2003) and if not included then checked in (Võ 2003). Latin names and taxonomic groupings were checked using Mabberley (1997) and APG II (2003).

3.3.4 Plant taxa analysis

Descriptive statistics were used to identify plant taxa in each use-group (explained in section 3.3.2 as vegetables, fruits, and spices and other ingredients) that were listed most frequently for Hawai'i and Vietnam grouped interviews. The lists and taxa recorded during participant observations in Hawai'i and Vietnam were used to identify taxa substituted, inserted (added), and deleted (not used) in Hawai'i.

3.4 Results

3.4.1 Interviews

Interview responses were grouped by location, Vietnam or Hawai'i. Interviewee demographics were recorded (i.e., gender, age, occupation). As the main purpose of this report is to identify the assemblage of plant taxa used by Vietnamese location rather than the differences in plant knowledge potentially due to social characteristics (Zent and Zent 2004), an analysis based on these demographics is not included in this paper and will be

discussed in a separate paper. In both locations, I began to reach a point of diminishing returns (few or no new species listed) (Martin 1995) with approximately 30 interviews. In Biên Hòa there were a total of 41 (26 female, 15 male) interviewees. In Honolulu, there were a total of 34 (25 female, 9 male) interviewees. I believe the reason for there being more female than male interviewees is due to (1) my being female and Vietnamese and (2) the snowball method used to find interviews. As a middle aged Vietnamese woman, it is culturally easier and more appropriate for me to meet and talk with women. I believe my use of the snowball sampling method resulted in higher numbers of female interviewees because the person identifying another to be interviewed often identified a friend or relative of the same gender. Interviewees from Biên Hòa listed a total 143 taxa of food plants, which included 90 taxa referred to as "vegetables" or "spices" and 53 taxa as "fruits." While in Honolulu, 67 and 43 taxa were listed for the same food plant groups.

3.4.2 Vietnamese food plant assemblage

The Vietnamese food plants (Appendix G) represent a compilation of the plants recorded from structured and participant interviews in Honolulu, Hawai'i and Biên Hòa, Vietnam. The checklist has been prepared with the scientific family names and Latin binomials. In some cases, taxa and names are different from those in the floras and other recent literature on food plants of Vietnam. Plant families are presented in alphabetical order so that the checklist may be most accessible to a variety of users. Fungi appear at the end of the list. Within families, genera and species are presented in alphabetical order, followed by Vietnamese names, in different dialects where applicable, and if available, in

English and French. English and French names are those that occurred in descriptions of plants in Phạm (1999; 2000; 2003) and Crevost and Lemarié (1917) (French only). The French names are provided to facilitate research and use of the extensive French literature concerning Vietnamese economic plants. Also listed for each species is the plant part or life form reported as being utilized by informants.

3.4.3 Plant taxa analysis

Plant taxa lists from Hawai'i and Vietnam were used to order the frequency of taxa demarcated by the three uses: (1) "vegetables" (**rau cải**) (Table 3.3), (2) "fruits" (**trái cây**) (Table 3.4), and (3) "spices and other ingredients for preparing food" (**nguyên liệu gia vị**) (Table 3.5). The vegetables and fruits tables display the top 30% of the most frequently listed plants and are discussed in the next section. The spices table includes only the order of frequency due to missing data.

Taxa substituted, inserted (added), and deleted (not used) in Hawai'i are identified using a case studies approach. The purpose of this method is to allow for a detailed culturally informative discussion of a few notable examples of their traditional use in Vietnam compared to contemporary use or in Hawai'i.

3.5 Discussion

3.5.1 Site bias

Due to the locations of the study sites, Hawai'i and southern Vietnam, the checklist produced may be representative of plants most salient to Vietnamese of

southern Vietnam origin and living in a subtropical U.S. environment with a large East and Southeast Asian population. If this study was carried out in northern Vietnam or a northern U.S. city including different demographics, the checklist produced may include different species representative of those different climatic areas and cultural make-up.

3.5.2 Plant taxa descriptions

The list of Vietnamese food plants includes over 200 taxa. More taxa were added to the list or assemblage of food plants from recordings of plants observed to be used during participant observation interviews. The majority of species represent the Brassicaceae, Cucurbitaceae, Fabaceae, and Poaceae families. Species in Rutaceae and Musaceae are used most frequently for their sweet fruits. Fungi and algae are used infrequently. They were never listed in structured interviews but were observed being used during participant interviews. The fungi observed are included in the checklist. Due to the infrequency of algae use, I did not collect algae and only mention here their Vietnamese life-form term, **rong**.

The most frequently listed vegetables (Table 3.3) include *Ipomoea aquatica* (L.) Lamk., in both Biên Hòa and Honolulu, *Lactuca sativa* L., second most frequent in Biên Hòa and third most frequent in Honolulu, and *Brassica oleracea* L. cv. Capitata group (cabbage), third most frequent in Biên Hòa and second most frequent in Honolulu. *Ipomoea aquatica* is a traditional vegetable eaten throughout Vietnam. It's saliency in the Vietnamese culture is illustrated through proverbs associated with the vegetable. That it is also highly salient in Hawai'i may be an artifact of the location. *Ipomoea aquatica* is an

important and popular food plant for other Asian groups in Hawai'i as well. It was noted as one of the early introductions by Asian immigrants to Hawai'i long before the Vietnamese came (Chung and Ripperton 1929). *Lactuca sativa* and *B. oleracea* are common food plants that are in both locations. Other vegetables that were frequently listed in both locations include *Brassica rapa* cv. Chinensis Group and *Daucus carota.*

Table 3.3. Most frequently listed vegetables in interviews from Biên Hòa, Vietnam and Honolulu, Hawai'i. (Approximately top 30%)

Vegetables			
Biên Hòa, Vietnam		Honolulu, Hawai'i	
%	Species	%	Species
63	• *Ipomoea aquatica*	70	• *Ipomoea aquatica*
54	• *Lactuca sativa*	50	• *Brassica oleracea* cv. Capitata Group
39	• *Brassica oleracea* cv. Capitata Group	47	• *Lactuca sativa*
37	• *Brassica rapa* cv. Chinensis Group	43	• *Ocimum basilicum*
	• *Daucus carota*	40	• *Brassica rapa* cv. Chinensis Group
32	• *Lycopersicon esculentum*	33	• *Daucus carota*
29	• *Rorippa nasturtium-aquaticum*	30	• *Mentha aquatica*
	• *Solanum tuberosum*		• *Raphanus sativus* cv. Longipinnatus

Vietnamese in Honolulu more often list aromatic herbs (e.g., *Ocimum basilicum*, *Mentha aquatica*) as vegetables than respondents in Biên Hòa. This raises questions about the understandings and demarcations of food categories by respondents in the two locations. Indeed, the English term "vegetable" and the closest Vietnamese translation, **rau cải**, are not equivalent in their inclusion of food plants. "Vegetable" is often understood as, and was defined in this study as any plant part or life-form of the plant that can be eaten and is often not sweet compared to most fruits of plants (e.g., leaves, stems, corms, and mature or immature fruits of the Cucurbitaceae and Solanaceae families). In

comparison, **Rau cải** is not as comprehensive. Though, generally understood as "vegetables," **rau cải** but more specifically refers to leafy and stem vegetables. People may not consider other plant forms. For example, corms are generally referred to as **củ**, or **củ cải**, referring to the swollen roots of plants also eaten as leafy vegetables. While aromatic herbs were included in the most salient vegetables for Vietnamese in Honolulu, the same was not true for those in Vietnam. This category, **rau thơm**, meaning "aromatic leafy vegetables" includes herbaceous plants such as cilantro (*Coriandrum sativum* L.) and those in the mint family (Lamiaceae) including mints (*Mentha* spp.) and basils (*Ocimum basilicum* L.). **Rau thơm** refers to those plants usually eaten raw as a garnish or included in the common table salad, **rau sống** (raw or uncooked vegetables that may also include raw non-leafy foods, particularly cucumbers (*Cucumis sativus* L.). Even with these difficulties, most interviewees seemed to understand that I was interested in the broad definition of **rau cải** and included a range of "vegetables" in their listing.

Responses to listing fruits (Table 3.4) or **trái cây** came much easier for the interviewees. Pomelos (*Citrus maxima* [Burm.] Merr.), durians (*Durio zibethinus* Murray), and a common orange (*Citrus sinensis* [L.] Osbeck) are among the top three fruits named in Biên Hòa. In Honolulu, the common orange is listed most frequently, followed by apples (*Malus* sp.) and then mangoes (*Mangifera indica* L.). *Citrus maxima* was also frequently listed in Honolulu but at a lower percentage than in Biên Hòa. Other frequently listed fruits shared between the two locations include *Musa* sp., *Vitis* sp., and *Carica papaya.* Similar to the responses in Biên Hòa, *Durio zibethinus* and *Citrus reticulata* are highly salient to those respondents in Honolulu, although they appear just

below the 30% frequency of listing. As with the vegetables listed, the fruits results are also probably due to site bias. This is particularly so for fruits such as mangoes and pomelos that are common to Hawai'i but may not be as common in temperate U.S. cities.

Comparing the two sites reveals that the Vietnamese in Vietnam have a greater diversity of fruits most salient or commonly used than Vietnamese in Honolulu. For the top 30%, 15 species of fruits were listed in Biên Hòa compared to seven fruits in Honolulu. Thus, the Vietnamese in Honolulu use more frequently a smaller assemblage of fruits than Vietnamese in Biên Hòa even though many of the same fruits are available in both locations.

Table 3.4. Most frequently listed fruits in interviews from Biên Hòa, Vietnam and Honolulu, Hawai'i. (Approximately top 30%)

Fruits			
Biên Hòa, Vietnam		Honolulu, Hawai'i	
%	Species	%	Species
54	• *Citrus maxima*	82	• *Citrus sinensis*
51	• *Durio zibethinus* • *Citrus sinensis*	73	• *Malus domestica* • *Mangifera indica*
49	• *Mangifera indica*	63	• *Musa* sp.
46	• *Citrus reticulata*	47	• *Carica papaya*
41	• *Musa* sp. • *Vitis* sp.		
37	• *Psidium guajava* • *Spondias cytherea* • *Artocarpus heterophyllus* • *Pyrus* sp.	33	• *Vitis* sp.
34	• *Carica papaya* • *Citrullus lanatus* • *Nephelium lappaceum*	30	• *Citrus maxima*
32	• *Dimocarpus longan*	27	• *Citrus reticulata* • *Durio zibethinus*

Due to initial difficulties I faced in my data collection for spices or ingredients used to season foods, I do not compare the percentage values of responses from Hawai'i with those from Vietnam here. A preliminary review (Table 3.5) indicates the spices most commonly listed in both locations include black pepper (*Piper nigrum* L.), chilies (*Capsicum annuum* L.), garlic (*Allium sativum* L.) and onions (*Allium cepa* L.) in Hawai'i or shallots (*Allium cepa* L. cv. Aggregatum group) in Vietnam. The first three spices are ingredients used to make **nước chấm**, the ubiquitous dipping sauce made with **nước mắm**. In Vietnam and Asian markets in the United States these plant ingredients, along with onions (*Allium* spp.) and limes [*Citrus* X *aurantiifolia* (Christm.) Swingle], are usually sold side-by-side by a single vendor providing a "one-stop shopping" situation (Figure 3.1). Thus Vietnamese in Hawai'i have maintained this assemblage of spice plants, except where onions are used more frequently in Honolulu as opposed to shallots in Vietnam. Vietnamese have reported the shallots are sweeter than the larger onions. This may be a substitution of onion species by Vietnamese in Hawai'i possibly due to the greater availability of the larger onions in U.S. markets.

Table 3.5. Most frequently listed spices in interviews from Biên Hòa, Vietnam and Honolulu, Hawai'i. Listed by order of frequency in each location (1=most frequent).

Spices		
Biên Hòa, Vietnam		Honolulu, Hawai'i
Species	Order	Species
• *Piper nigrum*	1	• *Allium sativum*
• *Capsicum annuum*	2	• *Piper nigrum*
• *Allium sativum*	3	• *Capsicum annuum*
• *Allium cepa* cv. Aggregatum Group	4	• *Allium cepa*
• *Citrus* X *aurantiifolia*	5	• *Allium fistulosum*
• *Allium fistulosum*	6	• *Citrus* X *aurantiifolia*
• *Cymbopogon citratus*	7	• *Zingiber officinalis*

Figure 3.1. Spices vendor with an assemblage of plant species often used together to make the dipping sauce, **nước chấm**. Hanoi, Vietnam.

3.5.3 Notable substitutions, insertions, and deletions

3.5.3.1 Substitution for aroma and taste

Persicaria odorata (Lour.) Soják (**rau răm**, Vietnamese mint, indigenous to Southeast Asia). It is used most notably and traditionally in salad dishes, called **gỏi** and as an accompaniment with the partially developed duck egg dish, **hột vịt lộn**. It is listed as a recent introduction by Vietnamese immigrants (Kuebel and Tucker 1988) and is not included in a checklist of Asian food plants in Hawai'i (Chung and Ripperton 1929), or other Hawai'i plant lists before 1975 (Neal 1965; St. John 1973). In the United States, I have not observed the partially developed duck egg dish being consumed. However, I am told that it is available in the markets in Chinatown in Honolulu and other areas with large Vietnamese communities. Regarded as a snack food, it is neither described in Vietnamese cookbooks from the United States (Miller 1968; Ngô and Zimmerman 1986; Nhan and Sox 2003) nor Vietnam (Nguyễn 2003; Triệu 1999; Văn 1984). For salads included in the cookbooks from the United States, the aromatic "herbs" *Coriandrum sativum* (indigenous to Southwest Asia) and/or *Ocimum basilicum* (indigenous to the old-world tropics) is commonly listed rather than *P. odorata*. For example, green papaya salad (**gỏi đu đủ**) is prepared with *O. basilicum* rather than *P. odorata*. While *P. odorata* is available in the Chinatown markets in Honolulu, its use appears to be limited and I have never observed it used as an ingredient in Vietnamese restaurants in Hawai'i. Only during participant observations with the Vietnamese group of Đồng Tâm Baptist Church, and during meals in Vietnam have I eaten **gỏi** with *P. odorata.* It is also the women of the Đồng Tâm group that stress that Vietnamese salads must have *P. odorata* in order to be

genuinely and properly prepared, **gỏi**, with the proper taste. According to traditional Vietnamese use, *P. odorata* aids in the digestion of the partially developed duck eggs. Its antibacterial properties (Nguyễn 1993) may explain its traditional use in raw salads that may harbor harmful bacteria.

3.5.3.2 Deletion and substitution used for color

Momordica cochinchinensis (Lour.) Sprengel (**gấc**, indigenous to India, Japan to New Guinea). This spectacular fruit (Figure 3.2) of which there is no English common term is related to bitter melon (*M. charantia* L.). The thick, red arils of the large seeds are used to impart a red coloring for a glutinous rice dish, **xôi gấc**, traditionally served for celebrations such as weddings, **đầy tháng** (the celebration of exactly one month old of a baby), and **Tết** (Lunar New Year). The aril covered seeds are first soaked in rice liquor. The arils are then removed from the hard seeds and mixed with uncooked glutinous rice that has been soaked in water and the mixture is steamed. Coconut milk is added to sweeten this food. The black hard seeds are not eaten as they are removed prior to or during the mixing stage. A number of seeds may be left in the mixture or are reserved to be used as decoration on top of the cooked **xôi gấc** as evidence that *M. cochinchinensis* was indeed used instead of an artificial food coloring (Figure 3.3). In Hawai'i, at every event when a reddish colored glutinous rice dish was available, I have been told it is called **xôi gấc** and upon asking, I am told "[artificial] color is added" to make it red. The food coloring imparts a light red to pink hue rather than the orange-red produced when using the arils of *M. cochinchinensis.*

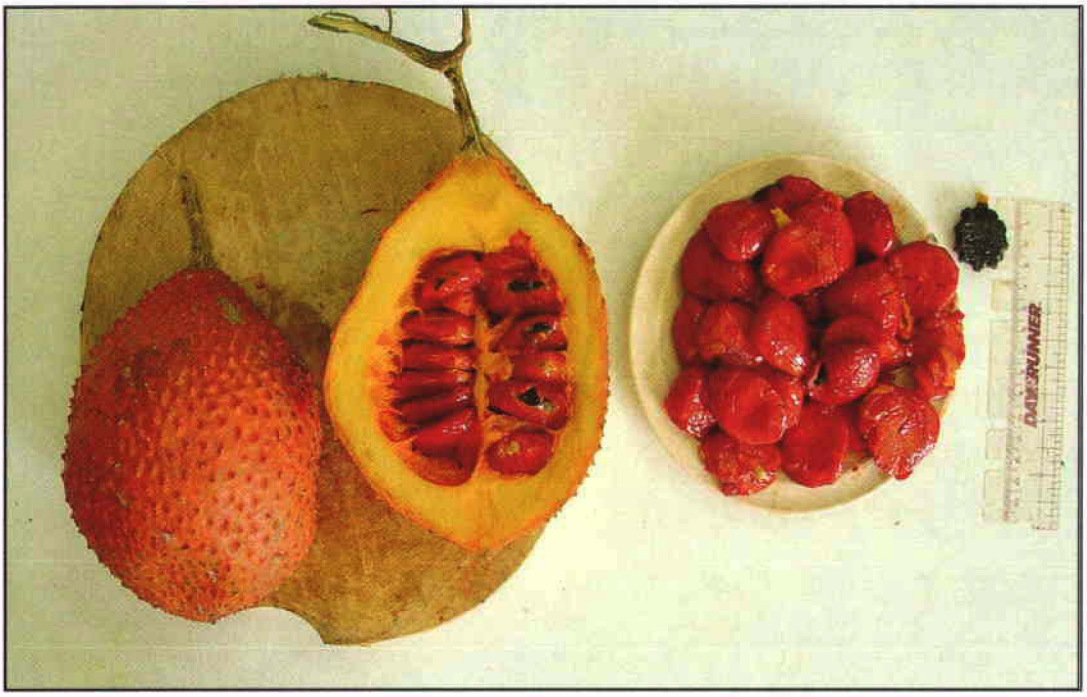

Figure 3.2. *Momordica cochinchinensis* (Lour.) Sprengel (**gấc**). The thick, red arils of the large black seeds are used to impart a red coloring to food.

Figure 3.3. **Xôi gấc** served at a wedding in Vietnam. A *Momordica cochinchinensis* seed left in the glutinous rice mixture as proof of *M. cochinchinensis* use is being removed just before eating the food.

While the genuine use *M. cochinchinensis* for the red of **xôi gấc** is important in Vietnam, its deletion in Hawai'i due to unavailability and subsequent substitution with food coloring does not appear culturally important for Hawai'i based Vietnamese. In February 2005, I attended a celebration of the first full year of a baby where there was **xôi gấc** prepared using powered *M. cochinchinensis*. The powered preparation of the arils of *M. cochinchinensis* has recently become available in Vietnam and was brought back to Hawai'i by a Vietnamese woman. The powder gave the glutinous rice the deep orange-red color similar to what I have observed when the fresh arils are used. This powder is not available in Hawai'i and may become another product soon to be imported for Vietnamese immigrants.

Pandanus amaryllifolius Roxb. (**lá dứa**, scented pandanus, indigenous to the old world tropics, possibly first found in the Moluccas). *Pandanus amaryllifolius* leaves are used to perfume and to impart a green color to foods. For example, both scent and coloring properties are used to make a sweet food called, **chè sôi nước**, which consists of green colored spheres filled with sweetened mung bean paste. The green spheres are made with glutinous rice flour traditionally colored using water boiled with *P. amaryllifolius*. In Hawai'i, **chè sôi nước** is often made with green food coloring even though *P. amaryllifolius* is available. As with *M. cochinchinensis,* the substitution of *P. amaryllifolius* is explained to me without much empathy for traditionalism. For these two examples in Hawai'i, the convenience of the artificial food coloring outweighs the traditionalism of the plant use. The substitution of coloring for *M. cochinchinensis* is compounded by its unavailability in Hawai'i.

3.5.3.3 Substitutions, insertions and deletions for texture

Colocasia gigantea (Blume) Hook. f. (**bạc hà**, often referred by "taro stem," indigenous to Indomalasia to Australia). *Colocasia gigantea* is valued for the spongy aerenchyma and crunchy texture of its petiole. The petiole has no flavor of it own, but absorbs the broth of the soup it is specifically used in, **canh chua cá lóc** (sweet and sour snakehead mullet fish soup). The ingredients used to make **canh chua cá lóc** provide its characteristic balance of sourness, sweetness, and spiciness. These combinations are important characteristics of Vietnamese food (Đinh 1990a; Pham 2001; Trieu 1998). Less discussed is the necessity of certain plants to provide texture, as is the function of *C. gigantea* in this soup.

Vendors in Biên Hòa identified plant taxa used as substitutes for *C. gigantea* in **canh chua** (Table 3.6). Like *C. gigantea*, these plants have little or no flavor and absorb the flavor of the soup. Species 1-3 and 7 have aerenchyma, and thus are similar to the "structure" quality of *C. gigantea*. The plants listed for Honolulu are those I have observed in use. *Apium graveolens* L. var. *dulce* (Miller) DC is listed as an insertion in Honolulu because I did not observe it used or available in southern Vietnam. The bamboo listed under Honolulu is cooked and canned versus a sour preparation in Biên Hòa.

The *C. gigantea* substitutes that occur in Biên Hòa, except bamboo shoots and *Sesbania grandiflora* (L.) Pers., are not available in the Honolulu's Chinatown markets, and thus are considered to be "deleted" from the Hawai'i based Vietnamese food plant

assemblage. *Nelumbo nucifera* Gaertner in the form of the "lotus roots" are available in Chinatown, but the shoots as they are used for **canh chua** are not available.

Table 3.6. Plant taxa substitutions for *Colocasia gigantea,* deletions and insertions for making *canh chua.*

Standard	Biên Hòa[a] (substitutions)	Honolulu (insertions)
Colocasia gigantea (Blume) Hook. f. (petiole used)	1) *Limnocharis flava* (L.) Buchenau (flowering shoots of "**keo neo**") 2) *Nelumbo nucifera* Gaertner (shoots of "sacred lotus") 3) *Nymphaea pubescens* Willd. (flowering shoots of "night lotus") 4) bamboo shoots <u>- From Mekong Delta region:</u> 5) *Sesbania grandiflora* (L.) Pers. (blossoms) 6) *Sesbania sesban* (L.) Merr. (blossoms) <u>- From northern Vietnam:</u> 7) *Neptunia prostrata* (Lam.) Baillon (whole plants, spongy stems)	1) *Apium graveolens* var. *dulce* (Miller) DC (petiole) 2) bamboo shoots
[a] Substitutions for Biên Hòa. Except for bamboo shoots, are all deletions from Hawai'i plant use.		

Sesbania grandiflora (L.) Pers. and *Sesbania sesban* (L.) Merr. are ingredients characteristic to **canh chua** of the Mekong Delta (in Vietnamese known as **miền tây**). *Sesbania sesban* flowers are described as available only during the flood season and

growing along the water ways of the Mekong Delta where people use small boats to collect them from semi-aquatic *S. sesban* plants. *Sesbania grandiflora,* grows in Hawai'i, is sold in the Chinatown markets by Filipino vendors and is used by Filipinos as a vegetable. Yet, I have only eaten it in **canh chua** in Hawai'i when it was prepared by visiting Vietnamese from the Mekong Delta region.

In recent years, the improved economic situation in Vietnam and for many Vietnamese immigrants in Hawai'i, has enabled people to include in **canh chua** a greater variety of ingredients and include those formally more expensive [e.g., pineapple (*Ananas comosus* (L.) Merr.) and okra (*Abelmoschus esculentus* (L.) Moench)] (Mrs. Nguyễn Thị Nhơn, personal interview 2004). As a result, different species of vegetables, herbs and fish (and other meats) are now popular in **canh chua** in Vietnam and in the United States. The plant and animal species used for **canh chua** have been substituted, deleted and others inserted in their place, but the characteristics of the soup remain constant: sour, sweet, spicy, and a texture - provided by the aquatic associated plants (with aerenchyma), bamboo, or celery.

3.6 Conclusions

This paper provides an explanation of the uses of Vietnamese diacritics and their importance to meaning and application in Vietnamese vernacular plant names. It is hoped that the compilation of Vietnamese food plants will be useful to those working in Vietnamese economic botany or ethnobotany to have a reference of the current scientific nomenclature and taxonomic groupings, the fully scribed Vietnamese names, and the

English and French equivalents. As the field grows, it is important that we strive to be accurate and unambiguous in our research and reports. Equally important, that a greater understanding of the food practices and culture can be learned and preserved through the active use of the Vietnamese language by those that are interested, Vietnamese or otherwise.

The list of Vietnamese food plants also serves to fill a gap in the literature regarding food plants used by Vietnamese immigrants. With the collection of many of the plants in this study from Hawai'i's Chinatown markets, the data serves as a preliminary checklist of plants available in Asian markets in the United States. This is a preliminary compilation of food plants. This working list will evolve as additional names are added to include other plant life forms (e.g. algae) and uses (e.g. medicinal), and to accommodate the dynamic nature of botanical nomenclature as our understanding of taxonomic groupings evolve.

An analysis of taxa used and that are salient to Vietnamese in Hawai'i compared with southern Vietnam reflects an evolution of the assemblage of food plants demonstrated by substitutions, insertions, and deletions of plant taxa. Replications are also evident as the Vietnamese in Hawai'i have access to many similar plant taxa as those in Vietnam, possibly due to the location of Hawai'i as a place where similar food plants can grow and where taxa are available due to the demands of food plants of other Asians in Hawai'i.

Some notable substitutions, deletions, and insertions of plant taxa demonstrate that the Vietnamese in Hawai'i have continued to make foods that are culturally

important even in the absence of needed plant taxa. Thus, this shows that the importance of the food is not in the species that are required, but rather the qualities of the plant that are important (e.g., crunchy, spongy aerenchyma of *Colocasia gigantea*) so that foods may be prepared or replicated to maintain Vietnamese culinary traditions.

CHAPTER 4

COMPARISON OF FOOD PLANT KNOWLEDGE BETWEEN URBAN VIETNAMESE LIVING IN VIETNAM AND IN HAWAI'I

4.1 Abstract of Published Manuscript

Ethnographic interviews using photographs of 10 traditional Vietnamese fruits and vegetables were used to compare the knowledge level and use of traditional food plants between Vietnamese in urban Biên Hòa, Vietnam, and in Honolulu, Hawai'i. In both communities, there was a positive correlation between age and knowledge (as measured by correct identification, and number of food uses for the plants). Vietnamese immigrants in Hawai'i listed more food uses than those in Vietnam due to adoption of multi ethnic foods found in Honolulu.

Published manuscript: Nguyen, M.T. 2003. Comparison of food plant knowledge between urban Vietnamese living in Vietnam and Hawai'i. *Economic Botany* 57(4):472–480. (Appendix H)

CHAPTER 5

ACCULTURATION OF FOOD PLANT KNOWLEDGE AMONG VIETNAMESE IN HAWAI'I

5.1 Introduction

Human interactions with plants have contributed significantly to the development of cultures (Balick and Cox 1996). Culture, however, is not genetic. Rather, it requires learning a language, skills, and pattern of reasoning that combine to provide a cultural worldview (Zent and Zent 2004). Its development is an individual process that must occur in each generation and is therefore dynamic and adaptive to new environments (Nagle 1994). Language plays a crucial role in the acquisition, accumulation, maintenance, and transmission of human knowledge concerning the natural environment and ways of interacting with it (Berlin 1992). Nettle and Romaine (2000) have argued that the survival of knowledge systems critical to global diversity and conservation are directly linked to linguistic diversity.

Changes in knowledge systems, including decreased use of native languages, has been documented in refugee and immigrant communities (Ghaffrarian 1998; Grivetti and Paquette 1978; Lanca *et al.* 1994; Marino *et al.* 2000). Social assimilation and socioeconomic status of Vietnamese during their resettlement in the United States after 1975 have been well studied (Barker 1977; Chung 1980; Ferguson 1979; Gum 1997; Ikeda 1988; Viola 1979; Yontz 1995). More recently, the second generation[1] has received attention due to the high numbers of individuals, their unique experiences straddling dual

[1] Children of Vietnamese refugees or themselves refugees, who have grown up largely or entirely in the U.S.

Vietnamese-American cultures, and position as future repository of Vietnamese cultural knowledge in the United States (Do 2002; Thai 1999; Zhou and Bankston III 1998). Few studies have focused on botanical knowledge of Vietnamese communities in the U.S. or the relationship between botanical knowledge and language (Airriess and Clawson 1994; Kuebel and Tucker 1988; Nguyen 2003; Owens 2003). My (Nguyen 2003) study not only investigated the botanical knowledge of a diasporic community, but also made a comparative analysis of a Vietnamese community in Vietnam to elicit the effect of migration on that knowledge.

Food traditions are a form of botanical traditional knowledge (Balick and Cox 1996). Though they are amongst the cultural traits most resistant to change (Kalcik 1984), acculturation of traditional food ways has been observed in Vietnamese populations. Acculturation among Vietnamese immigrants has been documented in loss of traditional knowledge of gardening (Airriess and Clawson 1994) and changes in food habits in the United States (Crane and Green 1980; Story and Harris 1989) and Australia (Marino *et al.* 2000). Language acculturation is an important concern among Vietnamese adults regarding learning the host country language (Gum 1997), and among second generation Vietnamese with regard to loosing knowledge of the Vietnamese language (Do 1999; Zhou and Bankston III 1998).

Vietnamese-Americans are concerned with the preservation of their culture and ethnic identity. The elder generation is particularly concerned with preservation and maintenance of cultural values and the language (Do 1999). While older Vietnamese people still prefer a traditional diet, many parents complain that their children eat poorly,

preferring western fast foods with few fruits and vegetables (Marino *et al.* 2000). This comes as no surprise since immigrant children tend to acculturate faster than older immigrants (Ghaffrarian 1998) and quickly adopt American standards (Pyke 2000).

Vietnamese adults in Hawai'i have expressed concern and lamentation about the perceived loss of Vietnamese cultural knowledge, including language, among the Vietnamese youth. With the large Vietnamese-American second generation reaching adulthood, their cultural values, including food choices, can have a significant effect on the biodiversity of ethnic markets in the United States.

As the large Vietnamese-American second generation reaches adulthood, acculturation of their cultural values, including food choices and ultimately their interactions with plants, may have a significant effect on the diversity of foods and food plants in ethnic markets and generally in the United States.

In my prior work (Nguyen 2003) I showed a positive correlation between age and the ability to identify a set of ten food plants by both the southern Vietnamese and those in Hawai'i. That study also showed that the Vietnamese in Hawai'i indicated more food uses for the ten plants than did the respondents in Vietnam. This is probably due to the adoption of culturally different food preparation methods or a higher standard of living in Hawai'i compared to that in Vietnam.

The objective of this paper is to compare and report on the knowledge of names of food plants between the Vietnamese in Hawai'i with a similar community in Vietnam. The data analyzed was from the original data set collected during the pilot study cited above (Nguyen 2003). A second objective of this analysis of language knowledge was to

address the common concern among Vietnamese parents and older relatives that the younger Vietnamese in Hawai'i (i.e., those who were born in Hawai'i or left Vietnam as young children) do not know or have forgotten much of the Vietnamese language and the culture that is tied to that knowledge.

5.2 Study period and sites

This research was conducted in Biên Hòa, Vietnam, during July 2000 and Honolulu, Hawai'i, from April 2000 through January 2001. The comparability of the two locations has been outlined in Chapter 1, section 1.8 (p. 11). In the remainder of this chapter, the more general and familiar location names of Vietnam and Hawai'i will be used to denote Biên Hòa and Honolulu, respectively.

5.3 Methods

This study was carried out using semi-structured interviews and a photographic card set of ten food plants. Using a prepared photographic card set ensured that interviewees in Vietnam and Hawai'i would receive the same control for the interviews. Plant photos are effective tools in ethnobotanical interviews (Nguyen 2003; Wester and Yongvanit 1995). Plants included (Table 5.1) were chosen based on their availability in both locations, a range of variety available, eating form, and prevalence in the cuisine. The plants photographed in the study were obtained from the produce markets of Chinatown, Honolulu. They were purchased, photographed and printed to make a set of ten 6.0 x 10.5 centimeters cards (Nguyen 2003). Due to using photos versus actual plants,

a replicate set of pictures were produced to make voucher specimens and are deposited in the University of Hawai'i at Mānoa Herbarium (HAW) (Bye 1986).

Table 5.1. Plant species used in photo cards for interviews; numbered as they appear in photo-card set. Species numbered 2, 3, and 9 used in analyses.

Botanical name	Family	Most common vernacular name (**Vietnamese**, English)
1) *Litchi sinensis* Sonn.	Sapindaceae	**vải**, litchee
2) *Mangifera indica* L.	Anacardiaceae	**xoài**, mango
3) *Musa acuminata* X *balbisiana* Colla.	Musaceae	**chuối**, banana
4) *Garcinia mangostana* L.	Guttiferae	**măng cụt**, mangosteen
5) *Perilla fructescens* (L.) Britton	Labiatae	**lá tiá tô**, perilla
6) *Piper lolot* C. de Candole	Piperaceae	**lá lốt**, betel leaf
7) *Nelumbo nucifera* Gaertn.	Nymphaeaceae	**củ sen**, lotus root
8) *Solanum melongena* L.	Solanaceae	**cà tím**, eggplant
9) *Capsicum annuum* L.	Solanaceae	**ớt**, chilies
10) *Phyllostachys* sp. Siebold and Zucc.	Poaceae	**măng**, bamboo shoots

The sample of Vietnamese people participating in this study was selected using a purposive sampling method (Bernard 2002). In purposive sampling, the purpose or characteristic(s) of informants (or communities) is decided beforehand, and then the group is identified. This sampling technique is often used in life history research and qualitative research on special populations (Bernard 2002). It is effective for my research because I want to interview Vietnamese immigrants and second generation Vietnamese. For example, I used purposive sampling to select a Vietnamese community from a local church in Hawai'i when I begin my research. Once the community was reached, the interviewees were selected using (1) convenience and (2) a snowball sampling methods (Bernard 2002). In convenience sampling, subjects that are available or easily accessible

are interviewed. For my work, this would include those members of the church that were willing to talk with me and be interviewed. Convenience sampling was often followed by or used in conjunction with snowball sampling. In snowball sampling subjects with particular attributes were identified, interviewed, and then asked to refer others Vietnamese immigrants or second-generation Vietnamese who would allow me to interview them. Those referrals were then contacted, and the process was repeated if possible. These sampling methods were also used to find interviewees in Vietnam.

Semi-structured interviews with 40 people in Vietnam and 33 people in Hawai'i were conducted after obtaining informed consent (Alexiades 1996). The informed consent statement was provided in Vietnamese and in English (Nguyen 2003). Demographic data were recorded, including: age, gender, hometown in Vietnam, and for Hawai'i based Vietnamese, the year and age when they left Vietnam. Each interviewee was shown the set of food plant photographs and asked a set of questions (Nguyen 2003). Pictures and questions were pre-tested in eight interviews with Vietnamese in Hawai'i. Responses were recorded in the language the interviewee used (Vietnamese, English, or both). When given consent, interviews were audio-recorded (Spradley 1979) using a hand held SONY tape-recorder with Maxell UR, Type 1 90-minute tapes.

5.4 Statistical Analysis

Although ten plants were used in the interviews, the data analyzed in this report were based on three species. The three species included in the data analyses to compare knowledge of plant names were *Mangifera indica* L., *Musa acuminata* X *balbisiana*

999Colla., and *Capsicum annuum* L. These three species were chosen because they were the plants that elicited the most number of plant names. The names given by the interviewees most often corresponded to different varieties of the plant that was known by the interviewee. In general, interviewees provided only one to a few names for the other seven plants not included in the analyses here. This also corresponds to those seven plants usually not being available in different varieties. The interviewees' response of providing different names as different varieties was a result of their interpretation of the following questions after being shown a picture of the plant: (1) "What do you call it?" and (2) "Do you have other names for this plant?" Interviewees were also asked: (3) "What do you use this plant for?" Previously, I analyzed the responses for questions (1) and (3) from all ten plants to test identification ability and use knowledge among the two Vietnamese groups (Nguyen 2003).

For the data analyses, the responses from interviewees were separated by location (Vietnam and Hawai'i) and within each location by age range represented by the age groups of 0-19 years old, 20-29 years old, 30-39 years old, 40-49 years old, and 50-69 years old. The 50-69 years old age group was combined because of the low sample size in separate 50-59 and 60-69 years old age groups. There were no interviewees from Vietnam in the 20-29 years old group, thus this age group from Hawai'i was not included in any analyses comparing the Vietnam versus Hawai'i groups overall.

Data were analyzed using the SPSS 7.5 for Windows Student Version graphing and statistical program. Two research objectives were addressed in the present set of analyses. The first objective addressed was whether location (Hawai'i versus Vietnam)

and age (0-19, 30-39, 40-49, 50-69) have an effect on the mean number of different names given for *M. indica, M. acuminata* X *balbisiana,* and *C. annuum.* In this first objective, the age group 20-29 was excluded from the analysis because there were no interviewees represented in that age group from Vietnam. This result was by chance.

The second research objective addressed was whether, for the Hawai'i sample, there was a difference in the mean number of names given in Vietnamese versus English (language), whether age (0-19, 20-29, 30-39, 40-49, 50-69) had an effect, and whether there was an interaction between language and age.

5.5 Results

Nguyen (2003) reports the inter- and intra-comparison of the ability of the Vietnamese in Vietnam and Hawai'i to identify and list uses for the ten plants in this study. Here we present results on the respondents' knowledge of plant variety names.

Two sets of analyses were conducted in order to address the research questions. First, a two-way between-subjects analysis of variance was conducted in order to examine the effects of location (Hawai'i versus Vietnam) and age (0-19, 30-39, 40-49, 50-69) on the number of different names given for *M. indica, M. acuminata* X *balbisiana,* and *C. annuum* (Figure 5.1). A significant main effect for location was found, such that the mean for Hawai'i (9.82) was significantly greater than the mean for Vietnam (6.78), $F(1,46) = 8.64$, $MSe = 13.91$, $p = .005$. There is also a significant main effect for age, $F(3,46) = 4.69$, $MSe = 13.91$, $p = .006$. Post-hoc analysis using Tukey's HSD from the mean for the 50-69 age group (11.55) was significantly greater than the mean for the 0-19

age group (5.0) and the 30-39 age group (6.91). No other comparisons were found to be significant. The location by age interaction was not found to be significant, $F(3,46) = 1.23$, $MSe = 13.91$, $p = .309$.

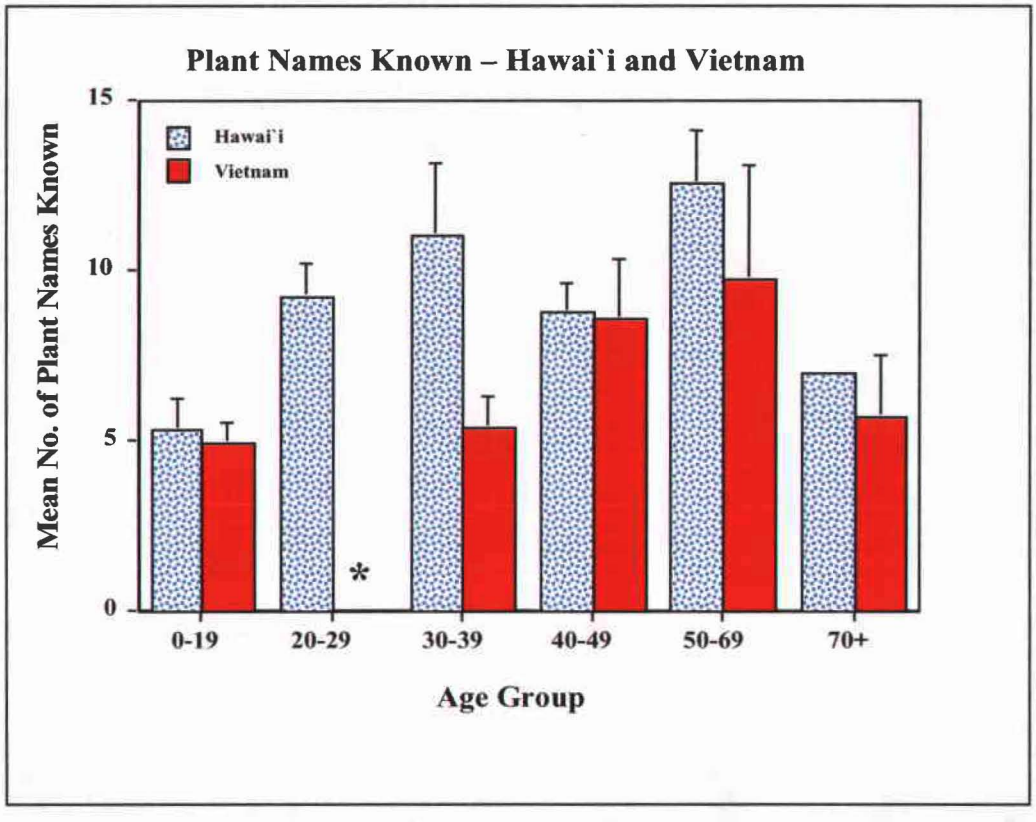

Figure 5.1. The mean number of plant names given by each age group from Hawai'i and Vietnam. * Indicates no data for the age group 20-29 from Vietnam.

Many interviewees from Hawai'i spoke both Vietnamese and English. Thus they provided plant names in both languages, while the Vietnam sample responded only in Vietnamese. The significant main effect for location could be due to the counting of English names in the Hawai'i sample. Therefore, the above data were reanalyzed using only the Vietnamese responses from the Hawai'i sample and the responses of the

Vietnam sample. For this analysis, there was no main effect for location. Therefore, the mean for Hawai'i (7.73) was not significantly greater than the mean for Vietnam (6.78), $F(1,46) = .92$, $MSe = 12.66$, $p = .342$. A significant main effect was still found for age, $F(3,46) = 6.55$, $MSe = 12.66$, $p = .001$. Post-hoc analysis using Tukey's HSD found the mean for the 50 to 69 age group (9.45) to be significantly greater than the mean for the age groups 0-19 (4.38) and 30-39 (5.18). Additionally, the mean for the 40-49 age group (8.89) was significantly greater than the mean for the 0-19 age group (4.38). No other comparisons were found to be significant. The location by age interaction was not found to be significant, $F(3,46) = .340$, $MSe = 12.66$, $p = .796$.

Second, a two-way repeated-measures analysis of variance was conducted on the Hawai'i sample data to examine the effects of language (within-subjects; English versus Vietnamese) and age (Between-subjects; 0-19, 20-29, 30-39, 40-49, 50-69) on the mean number of names given for *M. indica, M. acuminata* X *balbisiana,* and *C. annuum.* There was a significant main effect for language, such that the mean for Vietnamese (8.59) was significantly greater than the mean for English (1.03), $F(1,27) = 78.35$, $MSe = 7.15$, $p < .001$. There was also a significant main effect for age, $F(4,27) = 3.41$, $MSe = 2.39$, $p = .22$. Post-hoc analysis using Tukey's HSD found the mean for the 50-69 age group (6.29) to be significantly greater than the mean for the 0-19 age group (2.67). No other comparisons were found the significant. The location by age interaction was also found to be significant, $F(4,27) = 5.16$, $MSe = 7.15$, $p = .003$. Analysis of the simple-main effect using Tukey's HSD found that for the 0-19 age group, the mean number of names given in Vietnamese (2.67) was not significantly different than the mean number of

names given in English (2.67). For every other age group (20-29, 30-39, 40-49, 50-69), the mean number of names given in Vietnamese was significantly greater than mean number of names given in English (Table 5.2).

Table 5.2. Means of English and Vietnamese food plant names given by Vietnamese in Hawai'i. * Indicates a significant difference ($p < .05$) between mean quantity of English vs. Vietnamese means for that age group.

Age group	English	Vietnamese
0-19	2.67	2.67
20-29*	1.10	8.10
30-39*	1.67	9.33
40-49*	0.67	8.11
50-69*	0.43	12.14

5.6 Discussion

The first objective of this study was to determine if there would be a difference in the mean number of variety plant names given by Vietnamese in Hawai'i versus Vietnam (location) and if there was a difference among the age groups. When only Vietnamese plant variety names were included in the statistical analysis, there was no significant difference between the number of variety names provided by the Hawai'i and Vietnam Vietnamese. The use of both Vietnamese and English variety names by the Hawai'i group, independent of age, reflects their acculturation in the U.S. The significant difference between the knowledge of names by the youngest compared to the eldest group of Vietnamese (0-19 versus 50-69 age group), independent of whether they live in Vietnam or Hawai'i, maybe an artifact of the young age of the group. Differences in

ethnobotanical knowledge are related to age, and are functions of the normal learning process (Zent and Zent 2004).

The second objective was to determine if there was a difference of language use between the different age groups of the Vietnamese in Hawai'i to address the relationship between language knowledge versus cultural botanical knowledge. Overall (all age groups combined), the Vietnamese in Hawai'i used significantly more Vietnamese plant names than English (8.59 versus 1.03). This result, in addition to the lack of a significant difference for the number of plant names provided by the overall Vietnam and Hawai'i groups in the previous analysis, would suggest that the cultural botanical knowledge tested in this study is preserved in the diasporic Vietnamese community in Hawai'i.

When the Hawai'i group was analyzed separately, the youngest-age group (0-19 years old) listed significantly fewer Vietnamese names than the oldest-age group (50-69 years old) (2.67 and 12.14, respectively) (Figure 5.2).

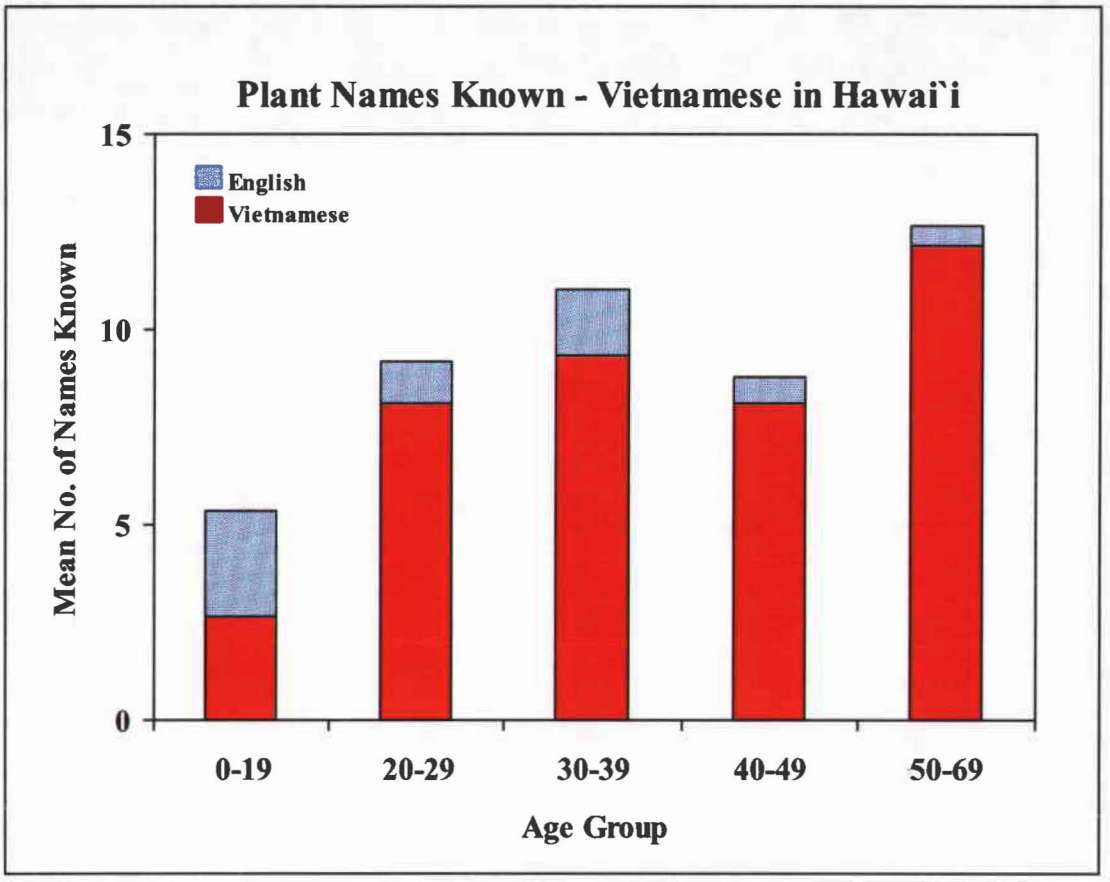

Figure 5.2. The mean number of plant names provided by Vietnamese in Hawai'i in English and Vietnamese for each age group. The difference between the mean numbers of Vietnamese plant names is significantly different between the 0-19 and 50-69 age groups.

On average, the 0-19 age group provided Vietnamese plant names as frequently as English names, while all of the older age groups listed significantly more Vietnamese plant names than English. Again, this may be an artifact of their young age as was also suggested for the result of the significant lesser knowledge of the 0-19 year age compared to the 50-69 year age groups. Considering that the means for English and Vietnamese food plant names are equal for the 0-19 year age group, and their higher proportional use of English plant names when compared to all other age groups in Hawai'i, there may be

continued erosion of Vietnamese botanical language knowledge (i.e., less knowledge of plant names).

Alternatively, due to the evolution of food ways with time and place, the intra-group differences found in this study may indicate the younger generation's shift in knowledge. For example, the food plants in this study are common in "Vietnamese" cuisine. The Vietnamese in Hawai'i live in an area unique for its ethnic and culinary diversity (Bonk 1993; Staples and Kristiansen 1999). The second generation Vietnamese growing up in this culturally diverse environment may be accumulating knowledge of food plants unique from that of their parents and the older members of the Vietnamese community. The differences observed in ethnobotanical knowledge may be reflective of their different cultural experiences (Nolan 2001; Spradley 1980).

Whether eroding or evolving, this acculturation of cultural knowledge among the younger Vietnamese will have effects on cultural and closely linked biological diversity (Hodel *et al.* 1999). During market surveys of Chinatown, Honolulu, I observed primarily older Vietnamese and other Asian shoppers. In a separate study interviewing college age Vietnamese at the University of Hawai'i, I found that most do not shop for Vietnamese food ingredients and have little to no participation in Vietnamese food preparation. One can extrapolate from the observations that the consumer demographics of the Asian markets will change with the decrease in shopping of first generation immigrants and other Asians as they age. This demographic change, coupled with the acculturation of botanical knowledge of the young Vietnamese may create a change in the range of products demanded and therefore sold in the Asian markets. Changes in demand and

supply at the markets will ultimately affect the diversity of Vietnamese food plants grown in the United States and abroad. These interrelated issues are worth attention due to the risks of crop pandemics as we increase our dependence on a narrower genetic base as a result of a decreased world culinary palette (Balick and Cox 1996).

5.7 Conclusion

This study statistically shows the knowledge of Vietnamese plant names (for a select group of food plants) of Vietnamese who have migrated from Vietnam and have come to live in Hawai'i is not different from their Vietnam-country counterparts. An intra-group analysis of the Hawai'i group, however, revealed significantly less use of Vietnamese plant names among the youngest participants coupled with a 50% frequency of English language use. This is different from the older community members who use significantly more Vietnamese than English plant names. Thus, the younger generation of Vietnamese in Hawai'i know fewer Vietnamese and use more English food plant names than the older Vietnamese. This change in knowledge may lead to a change in their food habits and demands and eventually changes in the food diversity of ethnic markets. The results found among the youngest age group of Vietnamese lend evidence to support a concern and belief among the older Vietnamese in the community of the acculturation of the youngest or "second generation" Vietnamese.

The differences in the knowledge observed reflect an evolution or change in the Vietnamese cultural knowledge of the second-generation Vietnamese-Americans. This is most likely due to their growing up in a cultural environment different from their parents

and older relatives. After consulting with community members, it was decided that a culturally informative (e.g., inclusion of Vietnamese-immigrant history) bi-lingual Vietnamese cookbook should be developed as a means of addressing concerns about this problem.

CHAPTER 6

BẠC HÀ (*COLOCASIA GIGANTEA* (BLUME) HOOK. F.) IN THE CULINARY HISTORY OF VIETNAMESE-AMERICANS

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6.1 Introduction

Bạc hà is the southern Vietnamese name for *Colocasia gigantea* (Blume) Hook. f. (Araceae). It is a key "traditional" ingredient in making a Vietnamese soup called **canh chua**, which literally means "sour soup" (Figure 6.1). This note describes the economic botany, the introduction to the United States, as well as the status and outlook of *C. gigantea* use based on research comparing food plant usage by Vietnamese people in Honolulu (Hawai'i) and Biên Hòa (Vietnam).

Figure 6.1 **Canh chua** example: **Canh chua cá hồng**, sour soup with red snapper. The aroid petiole is visible as the pale green, diagonally sliced, cylindrical pieces. From restaurant in Biên Hòa, Vietnam.

6.2 Folk Names and **Bạc Hà**

The folk name of **bạc hà** can cause confusion for the person attempting to determine the plant's scientific name. **Bạc hà** is the name for *C. gigantea* in southern Vietnam and Hawai'i as well as in other U.S. Vietnamese communities. This similarity is most likely due to the large numbers of South Vietnamese immigrants in the United States (Nguyen 1977). However, **bạc hà** has also been identified as *Alocasia odora* (Roxb.) K. Koch. in other studies from southern Vietnam (Hodel *et al.* 1999). In northern Vietnam, *C. gigantea* is called **dọc mùng** (Vialard-Goudou 1959), while the name **bạc hà** refers to a culinary mint: *Mentha arvensis* L. (Đỗ 1999; Nguyễn 1993) or *Mentha x pandiperita* L. (Phạm 2003).

Vietnamese cookbooks from the United States translate **bạc hà** as "taro stem" in **canh chua** recipes (Nguyen and Moriyama 2001; Pham 2001; Trieu 1998). Anatomically, it is not the stem, but rather the petiole that is eaten. The petioles extend from a thickened corm that is up to a meter or more in length. Moreover, "taro," which is derived from a Polynesian word, typically refers to *Colocasia esculenta* (L.) Schott (Abbott 1992; Govaerts and Frodin 2002; Zhu *et al.* 2000). The names of *C. gigantea*, in addition to its often sterile or fragmentary condition, have resulted in historical differences in the identification of this aroid (Nguyen 2005b).

6.3 Economic Botany

Colocasia gigantea is cultivated for the use of its petioles only (Matthews 2004; Nguyen 2005b; Nguyen 2000). The petiole is used as a vegetable to make **canh chua**.

Individual leaves are cut from standing plants at the base of the petiole just above the ground. In the Chinatown markets of Hawai'i, and other Asian markets in the United States, the aroid petiole is sold whole (ca. 1 meter long) or cut into smaller sections with the leaf blade completely removed (Figure 6.2A). In Biên Hòa markets, the petiole is sold whole and most of the leaf blade is roughly torn off except for a small portion so that its peltate characteristic is still visible (Figure 6.2B).

Figure 6.2. *Colocasia gigantea* petioles for sale at Vietnamese markets in: A) Chinatown, Honolulu, Hawai'i, with leaf blades completely removed, and B) Biên Hòa, Vietnam, with small portion of leaf blade remaining, showing its peltate characteristic.

Vendors and consumers I interviewed in Vietnam have different explanations for the purpose of the remaining leaf material, including: 1) positive identification as **bạc hà**, 2) aesthetics, and 3) extended freshness. To prepare *C. gigantea* for consumption, the epidermis of the petiole is peeled and the remaining petiole is sliced in diagonal cross-sections. The sections are then slightly blanched in soup, retaining their crisp texture (Figure 6.3). That the petiole is only slightly blanched and sometimes eaten raw demonstrates that it has very little, if any, acridity. Acridity is universal among aroids (Brown 1988), requiring plant material to be processed before it can be edible, usually by way of thorough cooking. Cultivated edible aroids (e.g., *C. esculenta*) require less processing than wild forms (Matthews 1998). *Colocasia gigantea*'s lack of acridity suggests its long history under human selection and cultivation.

Figure 6.3. *Colocasia gigantea* petiole is prepared by peeling off the epidermis in long strips and then slicing it in diagonal cross-sections.

Canh chua cá lóc, sour snakehead-mullet fish soup, is the most popular and symbolic traditional food of southern Vietnam (Sterling 2000). Plant ingredients used to make **canh chua cá lóc** provide its characteristic balance of sourness, sweetness, spiciness, and texture. The aroid petiole alone has no flavor but is valued for its crunchy texture and its quality of absorbing the broth. The petioles is made up of spongy aerenchyma, which is plant tissue consisting of many large intercellular spaces (Figure 6.4). This is a characteristic that is frequently found in semi-aquatic plants. The absorbtive quality of the petiole is probably due to the intercellular spaces.

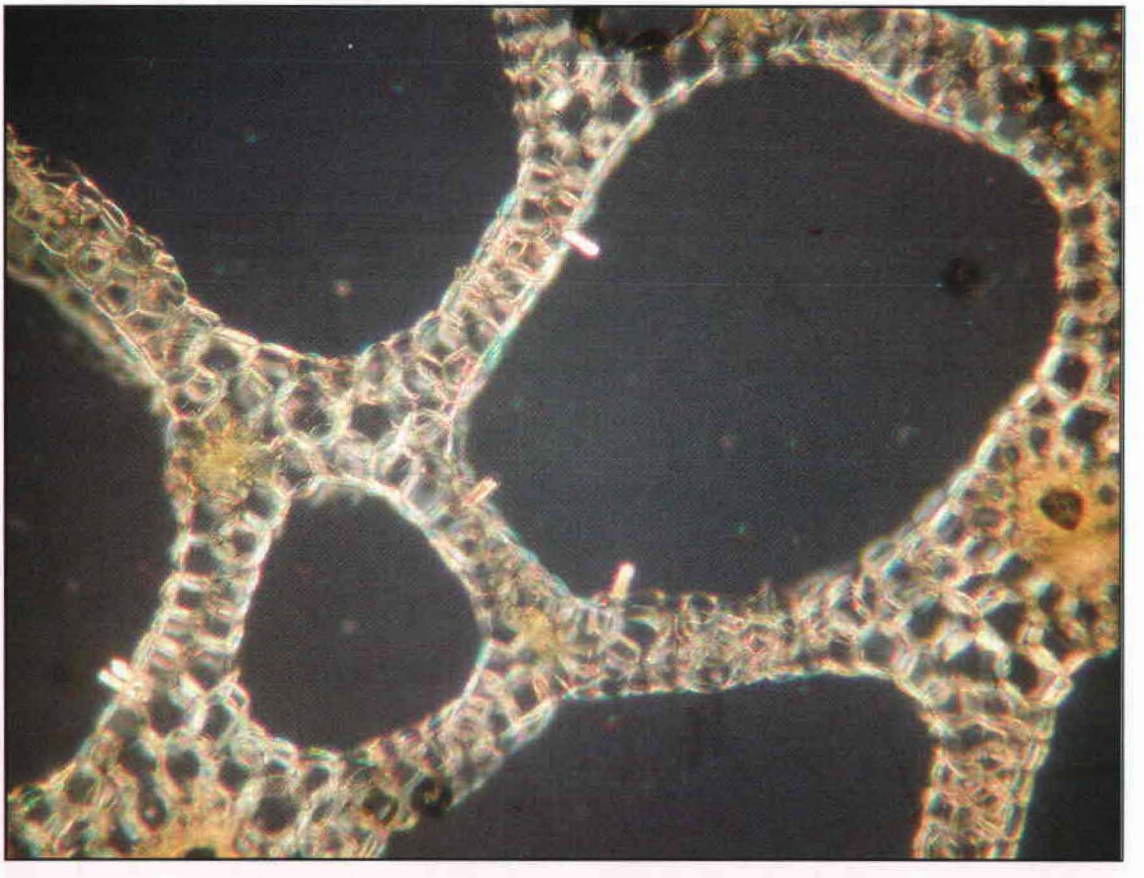

Figure 6.4. Aerenchyma of *Colocasia gigantea* petiole. This cross-section of the petiole is viewed using polarizing filters, which facilitates the glowing appearance of the cell walls. 25x magnification.

During the early years of Vietnamese resettlement in the United States, difficulties in obtaining the aroid petiole resulted in some cooks abandoning the making of **canh chua**. Alternatively, cooks substituted other plants (e.g., celery petioles (*Apium graveolens* [Miller] DC), bamboo shoots (possibly *Bambusa* sp. Schreber and *Phyllostachys* sp. Siebold and Zucc.) (Ngô and Zimmerman 1986; Routhier 1989) for **bạc hà**. These plants provided a texture similar to *C. gigantea*. Rhubarb (*Rhuem x hybridum* Murray) petioles have also been used. These provided texture plus sourness for some cooks (Dr. Claire Dang, personal communication 2004). Substitutions of the fish also came about because the traditional snakehead mullet (primarily, *Channa striata* [Bloch] and *C. maculata* [Lacepede; (Courtenay *et al.* 2004)]) was difficult to find. It is now common to use catfish (i.e., **canh chua cá bông lau**) and even shrimp (i.e., **canh chua tôm**). This illustrates how animal, as well as plant species, are used as substitutions for making traditional foods when native plants and animals are not available.

6.4 Vietnamese Introduction of *Colocasia gigantea* to Hawai'i

Vietnamese immigrants have been credited for the introduction and/or increased availability of 20 to 30 taxa of plants to the United States in their efforts have traditional Vietnamese foods (Kuebel and Tucker 1988). In Hawai'i, Mrs. Nguyễn Thị Nhơn, who is referred to as "Bà Nội" (grandmother from the father's side), is credited for the introduction of **bạc hà** (what the Vietnamese-Hawai'i community identifies as *C. gigantea*) to Hawai'i. Bà Nội is the matriarch of one of the Vietnamese-Hawaiian communities in which I have conducted research since 1999. Bà Nội was one of the first

refugees to come to Hawai'i before the fall of Saigon (April 1975) and the ensuing mass immigration of Vietnamese refugees to the United States. However, most of her children and their families were left in Vietnam.

In Hawai'i, Bà Nội recognized that the growing population of Vietnamese immigrants had a difficult time obtaining plants used in Vietnamese cuisine. Bà Nội set out to grow some of those plants including **bạc hà**. Except for **bạc hà**, the plants she grew were leafy, aromatic, culinary "herbs" that were selected not only because of their importance to the cuisine but also because they could be easily and covertly transported as seeds and later sown. **Bạc hà** is primarily propagated vegetatively by corms and was chosen only for its use in **canh chua**. The seeds and small **bạc hà** corms were hidden in baby milk bottles and brought back to Hawai'i through Bà Nội's military-family network. The cultural importance of **canh chua** is underscored by **bạc hà** being carried despite the different handling required and limited use of the petiole.

As the Vietnamese refugee population in Hawai'i and the continental United States continued to grow through the 1980s, so did Bà Nội's farming business, eventually including exports to California. Finally, she had saved enough money to provide sponsorship and passage by boat to bring the rest of her children and their families to Hawai'i.

Colocasia gigantea is indigenous to the Indo-Maylan region, but is now commercially cultivated in Hawai'i for local consumption and export to the continental United States (Figure 6.5). The petioles can be found in U.S.-Asian markets as well as

markets in other countries where Vietnamese immigrants have settled, including France (Nguyen 2005b) and Japan (Matthews 2004).

Figure 6.5. *Colocasia gigantea* (Bloom) Hook. f. field at Mr. Hung's Farm, O'ahu, Hawai'i. Large peltate leaves are visible. Insert: Three inflorescences at different stages of development from one leaf axil.

6.5 Plant Collection

Colocasia gigantea (Blume) Hook. f. was collected for voucher specimens to document its use by Vietnamese people in Honolulu (Hawai'i) and Biên Hòa (Vietnam). In Hawai'i, petioles were purchased from Vietnamese vendors in Honolulu's Chinatown markets (*M.T. Nguyen 102* HAW, *M.T. Nguyen 144* HAW), and plants collected from a

Vietnamese home garden (*M.T. Nguyen 313* HAW) as well as from a commercial Vietnamese farm (*M.T. Nguyen 114* HAW). The latter included flowering specimens used to determine the identification of **bạc hà** as *C. gigantea*. In Vietnam, petioles were purchased from the Biên Hòa city market (*M.T. Nguyen 204* HAW) and entire leaves were collected from a sterile, living **bạc hà** plant (*M.T. Nguyen 220* HAW).

6.6 *Colocasia gigantea* in the Hawaiian Flora

A review of surveys, checklists, and flora of Hawai'i suggest *C. gigantea* either was not present in Hawai'i before the Vietnamese introduction or it has been overlooked (St. John 1973; Staples and Herbst n.d.; Wagner, Herbst and Sohmer 1990). Although absent from the Hawaiian botanical literature, *C. gigantea* has been collected on the island of O'ahu (where Honolulu is located) since 1935. It was originally identified as *C. esculenta* (L.) Schott *G.P. Wilder s.n.* BISH! sheet 666211, *C. antiquorum* Schott var. *esculentum* (L.) Schott *F.R. Fosberg 11243* BISH!, *Colocasia* cv. "Zuiki" *K. Nagata 1040* BISH!, and *Alocasia macrorrhiza* (L.) Schott *T. Boyd s.n.* BISH! sheets 534735-534737. Their herbarium labels note the Japanese folk names or the use of *C. gigantea* for food by Japanese immigrants in Hawai'i. The Japanese living in Hawai'i used *C. gigantea* as a green vegetable accompanying sashimi (raw fish) for which the petiole is peeled and cut diagonally into slices that are placed under the fish (recorded on *A. macrorrhiza T. Boyd s.n.* BISH! sheets 534735-534737). These specimens show that *C. gigantea* and the use of its petiole for food was introduced by Japanese immigrants before the Vietnamese were established. The plant was present when Bà Nội arrived in Hawai'i

but she did not see it for sale in the markets nor did she find it growing wild, which prompted her to include it as one of the "baby bottle plants" brought back from Vietnam. I have lived in Hawai'i since 1999 and have never observed the use of *C. gigantea* in Japanese food. Even in Japan, the use of taro petioles (*C. gigantea* and other cultivars) is minor though widespread (Matthews 2004). It appears the culinary use of *C. gigantea* may be lost among the Japanese living in Hawai'i. One Japanese woman in her late 50s stated her grandfather used to eat it when she was a young child. This woman does not eat *C. gigantea* and acknowledged she probably would not recognize the plant that grew around her childhood home (Mrs. Gerry Ochikubo, personal communication 2004).

6.7 A Culinary Future for *Colocasia gigantea*?

The Japanese movement of *C. gigantea* to Hawai'i and its subsequent loss of usage knowledge by later Japanese generations may be a precedent for the Vietnamese communities. In this people-and-plants relationship, the continued knowledge and use of *C. gigantea* is directly linked to its culinary use in the traditional **canh chua** dish. In a survey of 15 Vietnamese food cookbooks published in the United States between 1986 and 2003, **canh chua** appears to retain its cultural value as evidenced by its inclusion in all but one of these cookbooks (Nguyen 2004). However, only three of these cookbooks specifically list "taro stem" (referring to the aroid petiole) as an ingredient in their **canh chua** recipes, while 11 use substitutes. In Hawai'i, knowledge of this food among the young Vietnamese-Americans shows signs of erosion as demonstrated by interviews during which I asked them to list "the food most associated with Vietnam." Only 11% of

Vietnamese-Americans between the ages of 18 and 29 living in Hawai'i named **canh chua** versus a 58% response from of the same age group interviewed in Vietnam. In 2004, one can still go to a Vietnamese restaurant in Hawai'i, order **canh chua**, and have it arrive at the table made with *C. gigantea* petioles. However, if the trend in the cookbooks and that observed from the interviews continues, this culinary use of C. gigantea may be lost. The knowledge and use of *C. gigantea* among Vietnamese-Americans may be maintained via *in situ* conservation with the preparation and promotion of **canh chua** specifically made using *C. gigantea* by home cooks, restaurants, and cookbook writers. Retelling Bà Nội's story of bringing the plants to the United States would teach younger Vietnamese-Americans about the history of **bạc hà** and may add cultural value for its continued use.

6.8 Conclusion

Bạc hà is the folk name used in southern Vietnam and by Vietnamese in the United States for *C. gigantea*, an aroid whose petiole is used almost exclusively in a Vietnamese soup called **canh chua**. Due to the cultural value of the soup and **bạc hà**'s importance for the authenticity of **canh chua**, **bạc hà** is one of the first Vietnamese food plants brought to the United States. Mrs. Nguyễn Thị Nhơn, or "Bà Nội," an early Vietnamese immigrant (pre-1975) to Hawai'i, made **bạc hà** and other food plants available to the growing Vietnamese population in the United States via a covert transfer of plant material from Vietnam. Once rare or even non-existent, it is now commercially cultivated in Hawai'i and available in many Asian food markets in the United States and

other countries where Vietnamese immigrants have settled. Ethnobotanical information on herbarium labels of *C. gigantea* specimens collected in Hawai'i before this study documented its pre-Vietnamese introduction although Japanese immigrants in Hawai'i have apparently abandoned its use as food. This underscores the value of documenting flora and ethnobotanical work with vouchers containing cultural information (e.g., vernacular names and uses). Interviews with Vietnamese and analysis of Vietnamese cookbooks in the United States show that knowledge of *C. gigantea* among Vietnamese-Americans may follow the similar path of abandonment apparent in the Japanese-Hawai'i community. The cultural and culinary history of this people-and-plants interaction may be conserved by promoting its use in culinary writing and actively practicing the making of **canh chua**, specifically with *C. gigantea.*

This account of *C. gigantea* is an excellent example of the movement of people and plants. In this case, the migration of people (Bà Nội and early Vietnamese refugees), was followed by the migration of an important food plant resource that meet their cultural alimentary needs. The commercial cultivation of *C. gigantea* provided the financial means to facilitate a later migration and reunion of families.

CHAPTER 7

COMMUNITY DYNAMICS AND FUNCTIONAL STABILITY: AN ECOLOGICAL ANALYSIS OF CULINARY KNOWLEDGE

7.1 Introduction

As ethnobiologists, we are ethically liable to return accessible and culturally relevant results of our research to the communities from which the data was gathered (Ethnobiology Working Group 2003). Giving back to the community is also an enjoyable thing to do. In response to recent affirmations of the importance to not only incorporate reciprocal returns in our work (Bridges 2004; Shanley and Laird 2002), but also to raise the discussion of these returns to the forefront of our projects (Prance 2004), this article describes the methodology used in designing a culturally informative cookbook that is the reciprocal return to the community where I worked. This paper also introduces a method for text analysis that utilizes an ecological community analysis framework to search for structure in the data and to identify key species contributing to the structure.

Since 1999, I have conducted ethnobotanical research with Vietnamese in Honolulu in order to understand the reconstruction of culinary practices in the Vietnamese diaspora in Hawai'i. The objectives of this study included: (1) to identity the assemblage of food plants used by Vietnamese in Hawai'i, including key plant species and substitutions for plants that were available in Vietnam and not found in Hawai'i or plants not used in Hawai'i, (2) to determine the nature and extent of acculturation of food plant knowledge or food ways among Vietnamese in Hawai'i compared to their

counterparts in Vietnam, and (3) to give back to the participating Vietnamese communities results from this study that are culturally valuable and practical.

The project was initiated with meetings held with members of the Vietnamese community in Honolulu. Within these meetings I described my research interests and solicited community concerns about cultural food plant knowledge and use, especially among the second-generation Vietnamese. Community members expressed lament for the low to lack of knowledge regarding (1) Vietnamese language, and (2) preparation of traditional Vietnamese foods. Second-generation Vietnamese also reported that they did not know how to prepare some of their favorite Vietnamese foods and that they would want a bilingual Vietnamese cookbook. Thus, it was agreed with the community adults and youth, that making a community Vietnamese cookbook would be a culturally relevant means for my giving back to the community.

7.1.1 Giving back - cookbooks

Cookbooks are a significant contribution to the community due to: (1) the strong correlation between ethnic foods and identity (Barer-Stein 1999; Kalcik 1984; Story and Harris 1989), thus promoting ethnic identity by promoting and perpetuating traditional ethnic foods and food customs, (2) their written format adds and affirms value to the cultural domain (Jamieson 1993; Wollf and Medin 2001), and (3) by writing them specifically for the local community, cookbooks can be used to promote local ethnobiological knowledge and practices (Shanley *et al.* 1998; Shanley *et al.* 1996).

With the project in mind, a question that arises for diasporic or migrant groups is how do you produce a cookbook for people that do not live in their culturally traditional landscape and where traditional food ingredients may not be available (Rozin 1973)? This question was examined by analyzing the assemblage of plant ingredients from recipes of a traditional food that has maintained a salient position in the food customs of Vietnamese-Americans.

7.2 Methods

7.2.1 Selecting a case study recipe: **canh chua cá lóc**

The recipe chosen for analysis is referred to as the case study recipe. The assemblage of plant ingredients from the case study recipe was analyzed to examine how the traditional food was being prepared in the U.S. The case study recipe was selected by purposive sampling, a method used when the purpose of informants (or other units of study) is decided beforehand, and then the group is identified (Bernard 2002). **Canh chua cá lóc**, in English "sweet-sour snake-head mullet soup," was purposively chosen for analysis based on the following three criteria: it is a traditional southern Vietnamese food, it is culturally significant and its authenticity depends on the inclusion of "indicator species". These criteria are further explained below.

(1) Tradition. It is regarded as a "traditional southern soup" (Ngô and Zimmerman 1986; Sterling 2000). This is relevant because most Vietnamese in the United States and Hawai'i are originally from southern Vietnam (Do 1999), and the food is familiar and regarded as "traditional" to them (Nguyen 2005a).

(2) Cultural value. Its inclusion in 14 of the 15 cookbooks published in the United States shows that it remains salient in the repertoire of Vietnamese food in the United States and is therefore worthy of analysis.

(3) Authenticity depends on indicator species. The food requires inclusion of indicator species to be authentic. An indicator species is a specific ingredient that serves to provide a particular characteristic to the food where its absence would result in the discontinuance of the food or a substantial change in the character of the food. Thus, **canh chua cá lóc** must include **bạc hà** (SV)[2], or **dọc mùng** (NV) [*Colocasia gigantea* (Blume) Hook. f.] and **ngò ơm** or **rau ơm** (SV), **rau ngổ** (NV) [*Limnophila chinensis subsp. aromatica* (Lam.) Yamazaki] (Routhier 1989). The inclusion of indicator species is botanically interesting and affirms the cultural value of **canh chua cá lóc** because this recipe was brought to, and is maintained in the U.S., even in the absence of or where it was difficult to find the indicator species.

7.2.2 Triangulation methods

To have a greater understanding of the preparation, structure and characteristics of **canh chua cá lóc**, I used a triangulation of methods (Martin 1995) that included:

(1) Interviews conducted to elicit ingredients used and other relevant cultural information.

(2) Participant observations to record ingredients used, methods of preparation, taste characteristics, and to practice cooking **canh chua cá lóc.**

(3) Cookbook recipe analysis (discussed in section 7.3).

[2] SV and NV are used to indicate that the word is used in southern or northern Vietnam, respectively.

Voucher specimens of plants used are deposited in the University of Hawai'i herbarium (HAW).

7.3 Cookbook Recipe Analysis

7.3.1 Data from cookbooks

Cookbooks and recipes are appropriate resources for data on cultural food habits. Writing on the ethnobiological history of Chinese foods, Simoons (1991) used English-language Chinese cookbooks to provide additional information on uses of plants in recipes and ways of cooking. He recognized that although the cookbooks were written for "Western readers" they were invaluable sources of information not available in other literature (Simoons 1991: xxii). Authors of ethnic cookbooks often substitute or simplify ingredients and methods of preparation because either the ingredients are difficult to obtain or it is felt that users will not invest the time or effort to prepare a dish in the traditional way (Brown and Mussell 1984). Thus, an analysis of ethnic cookbooks published over a period of time and surveying only ingredients present may reflect a linear acculturation of food habits (Goode *et al.* 1984). Linear acculturation has been used to describe the weakening of traditional ethnic food habits (includes plants and prepared foods) with each subsequent generation (cf. Marino *et al.* 2000; cf. Pyke 2000).

Individual ingredients have functions in recipes, which is a specific purpose or action for which it is used. In the analyses conducted here, function equals the taste quality (flavor or texture) the ingredient provides. For example, chili pepper (*Capsicum*

annuum L.) often functions to provide the "spicy" flavor to the prepared food. While ingredients can change, recipes persist over time.

Recipes are more complex than individual ingredients because, in addition to information on content, they emphasize the structure of the food. The food structure is the organization of parts (ingredients) as dominated by the character of the whole (the food made from the recipe). This is achieved by the recipe's instructions on how to prepare and organize (combine or segregate) the ingredients (Goode *et al.* 1984).

The structure of foods has been used to describe and define cultures (Lévi-Strauss 1966, Rozin 1973). The relationship between food and culture is significant because preparing, eating and sharing "traditional" foods is often a symbol of identity for the group (Kalcik 1984). While individual ingredients may be substituted, inserted or deleted, recipes used to construct foods to have their "traditional" structure are maintained within the cultural group (Goode *et al.* 1984).

Using the definitions of function and structure presented here, if specific ingredients change, but the presence and organization of required functions are maintained by ingredient substitutions with similar functions, then the structure of the food that is constructed with these different ingredients will be similar to the structure of the original food. This allows for the maintenance of cultural foods habits that are important to a cultural group.

7.3.2 Text selection (cookbooks and recipes)

Cookbooks were selected using purposive sampling. To compare the components of **canh chua cá lóc** in the United States versus Vietnam I purposely surveyed bookstores and libraries in Honolulu, Hawai'i and Biện Hòa, Vietnam. In both Honolulu and Biện Hòa, I surveyed books from a large retail bookstore in each location, with a specific section for cookbooks, and are located in high traffic urban areas. Both bookstores are comparable in that they also offer additional items for sale including, audio-visual media and stationary. An Internet search for Vietnamese cookbooks through the Amazon.com company revealed that most of the books in print were represented at the Honolulu survey site, Barnes and Nobel bookstore. The library surveyed in Honolulu was the University of Hawai'i at Mānoa, Hamilton Library. The library surveyed in Biên Hòa was the main city square public library. At the libraries I was able to sample cookbooks that were published in years preceding the cookbooks available at the bookstores. At both the bookstores and the libraries, cookbooks that included at least one recipe whose title included "**canh chua**," or for the English cookbooks "sweet and sour soup," "Vietnamese fisherman's soup," and "hot and sour soup," were purchased or the recipe information was recorded. The English recipes were confirmed to be representing **canh chua** by the accompanying explanations written by the cookbook authors. In addition to these soups prepared with fish, I expanded the sampling of recipes to include those soups prepared with other meats or tofu because it is now common to have substitutions of the traditional fish. In total, 18 recipes from 14 Vietnamese cookbooks published in United

States were compared with 31 recipes from 18 Vietnamese cookbooks published in Vietnam.

7.3.3 An ecological approach - searching for structure in community data

Cookbooks and their contents can be analyzed using ecological concepts. The type of ecological analysis used requires: (1) demarcating a location, (2) making a species survey, and (3) assigning a value to the units of interest (e.g., species) that will later be examined with analytical tools.

Cookbooks were demarcated by the publication location of United States or Vietnam. All of the cookbooks published in the United States represent a community (hereafter called the US community, and cookbooks from Vietnam, the VN community), one book from that community represents a site, and all of the plant ingredients of the **canh chua** recipe from that site represent the species found in that site (Figure 7.1). The same scheme was used for the VN community.

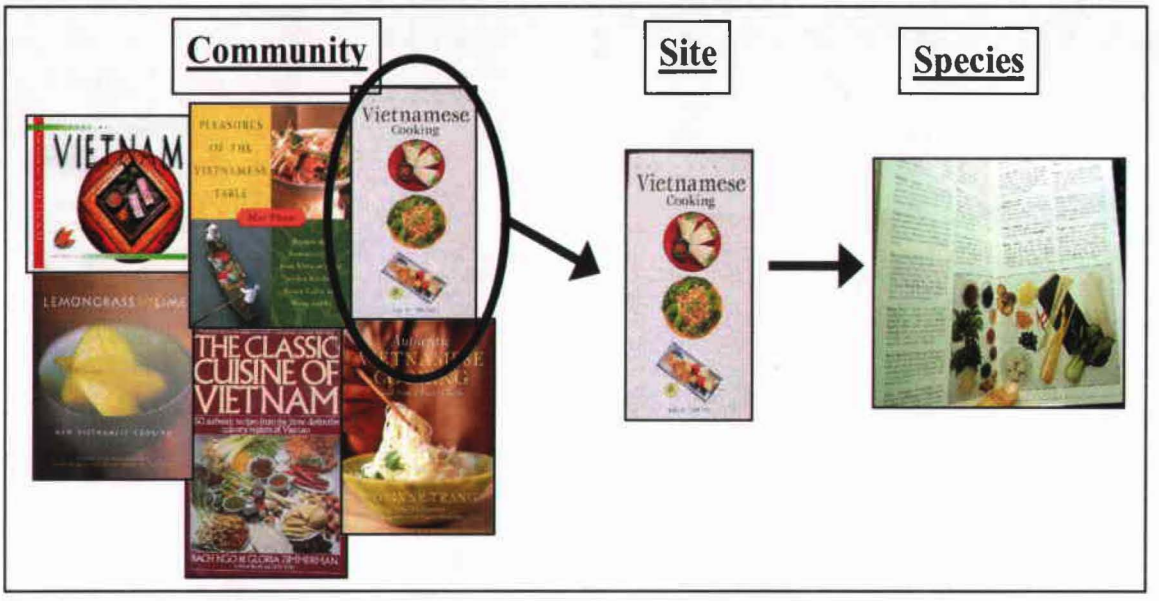

Figure 7.1. Ecological divisions for the US community of cookbooks.

Information from the **canh chua** recipes was recorded and arranged in two-way matrix tables. Recipe information included plant and meat ingredients, publication year and author. The presence or absence of species was recorded for each site. The percentage of occurrence for all the plant species was calculated. This data was used to compare the assemblage of plant species in the US and VN communities.

7.3.4 Designating plant functions

Canh chua cá lóc is noted and esteemed for having an overall structure that includes characteristic flavor qualities of spicy, sweet, sour (Routhier 1989; Trang 1999), and texture. This structure is achieved by the inclusion of ingredients that have functions of flavor or texture, or both.

Personal cultural experience, interviews, and participant observations have given me knowledge of the ingredients and their functions in constructing the overall structure of **canh chua cá lóc**. Using this knowledge base, I have circumscribed defined functions for plant ingredients that had the greatest constancy in the US and VN communities. Single functions were "spicy" = *Capsicum annuum* L., "sour" = *Tamarindus indica* L. and *Citrus* X *limon* (L.) Osb., "aromatic" = *Eryngium foetidum* L., *Mentha aquatica* L., *Ocimum basilicum* L., and "texture" = *Colocasia gigantea* (Blume) Hook. f. and *Vigna radiata* (L.) R. Wilczek. In addition to these, I also defined the following double functions: "sour-texture" = *Lycopersicon esculentum* Miller, "aromatic-allium" = *Allium cepa* L. cv. Aggregatum Group, *Allium fistulosum* L., and *Allium sativum* L., "aromatic-savory" = *Cymbopogon citratus* (DC) Stapf, *Zingiber officinale* Roscoe, *Curcuma longa* L., "aromatic-sour" = *Limnophila chinensis* subsp. *aromatica* (Lam.) Yamazaki, "aromatic-spicy" = *Piper nigrum* L., and "sweet-texture" = *Ananas comosus* (L.) Merr. These were color coded and then used to reanalyze the data on species constancy for the US and VN communities. The analyses based on functions were limited to species present in at least 30% of the recipes.

7.4 Results and Discussion

7.4.1 Plant species assemblages in **canh chua**

The survey included thirty-one recipes from 17 Vietnam cookbooks (Appendix I) (Gia Chánh 2000; Kim 2003; Lê 2002; Ngọc 2003; Nguyễn 2003b; Nguyễn 1983; 1987; 1989; 1990; Nguyễn 1980; Quỳnh 2000; Triệu 1983; 2003; Triệu and Nguyễn 2001;

Triệu *et al.* 2002; Văn 1984; Võ and Nguyễn 2003) and 18 recipes from 14 American cookbooks (Appendix J) (Ang 1996; Duong and Kiesel 1991; Hsiung 1997; Ngô and Zimmerman 1986; Nguyen and Moriyama 2001; Nhan and Sox 2003; Pham 1996; 2001; Routhier 1989; Sterling 2000; Tran 2000; Tran 1990; Trang 1999; Trieu 1998). A total of forty-two species were present in the two communities. Of those the VN community has 36 versus 28 species present in the US community. Table 7.1 includes species represented at the ten highest constancies (most of them above 30% occurrence). The species present in the two communities were not identical. However 66% of the species in the VN community were also present in the US community. There were 14 species present in the VN community not in the US community, and 6 in the US community not present in the VN community. The plants that were most constant for the VN community are also plants that I have observed to be the basic essentials for making **canh chua**. The observation in the US community of more than one species occupying the same occurrence percentage (50, 39, 28, and 18%) suggests that the species within those ranks share similar importance, and as will be explored later with functions, that these species fulfill similar functions for **canh chua**.

Table 7.1. Ten most constant plant species by percentage of occurrence in **canh chua** recipes from VN and US communities. Some cases have more than one species represented at the same percentage of occurrence.

Plant species in **canh chua** recipes			
VN community		US community	
%	Species	%	Species
84	• *Capsicum annuum* L.	89	• *Lycopersicon esculentum* Miller
81	• *Limnophila chinensis* subsp. *aromatica* (Lam.) Yamazaki	83	• *Capsicum annuum* L.
74	• *Tamarindus indica* L.	72	• *Ananas comosus* (L.) Merr.
71	• *Lycopersicon esculentum* Miller	67	• *Tamarindus. indica* L. • *Vigna radiata* (L.) R. Wilczek
58	• *Colocasia gigantea* (Blume) Hook. f.	50	• *Allium fistulosum* L. • *Citrus* X *aurantiifolia* (Christm.) Swingle • *Piper nigrum* L.
52	• *Eryngium foetidum* L.	39	• *Allium sativum* L. • *Allium cepa* L. cv. Aggregatum Group • *Limnophila chinensis* subsp. *aromatica* (Lam.) Yamazaki
48	• *Vigna radiata* (L.) R. Wilczek	33	• *Mentha aquatica* L.
42	• *Ananas comosus* (L.) Merr.	28	• *Coriandrum sativum* L. • *Cymbopogon citratus* (DC) Stapf • *Ocimum basilicum* L.
35	• *Ocimum basilicum* L.	18	• *Colocasia gigantea* (Blume) Hook. f. • bamboo[a] • fungi[b]
19	• *Allium cepa* L. cv. Cepa Group	11	• *Citrus hystrix* DC

[a] Young shoots of unspecified bamboo species.
[b] Unspecified fungus species.

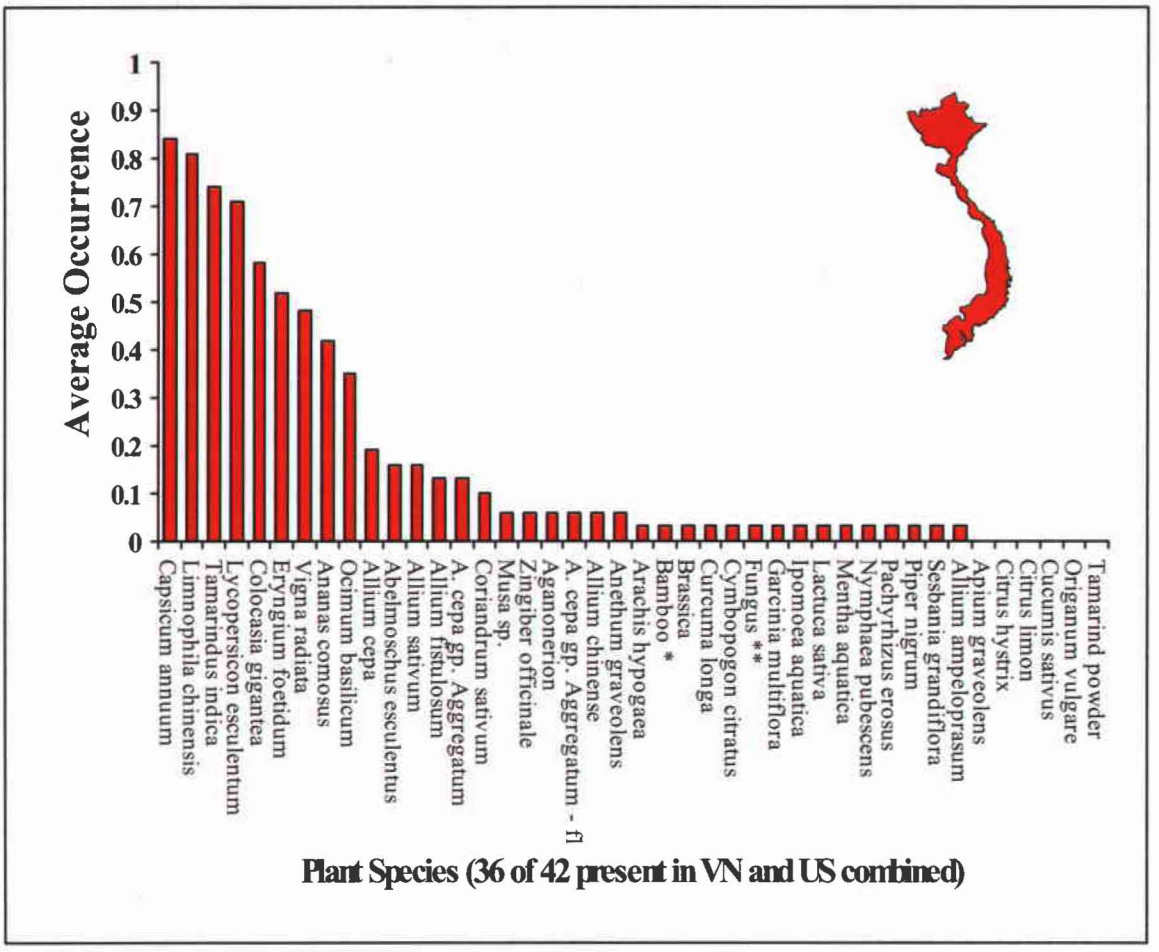

Figure 7.2. Plant species in **canh chua** recipes from the VN community by order of constancy. The map of Vietnam is used here and in subsequent figures as a reminder for the community the data represents. (* Young shoots of unspecified bamboo species. ** Unspecified fungus species.)

Figure 7.2 displays the species most constant in the recipes from the VN community. The x-axis includes all the 42 species in the order of their constancy from highest to lowest. The Vietnam data shows that although there is a high diversity of species, only 9 or 21% are present in at least 30% of the sites. By contrast, 58% of the species are present in only one or two sites.

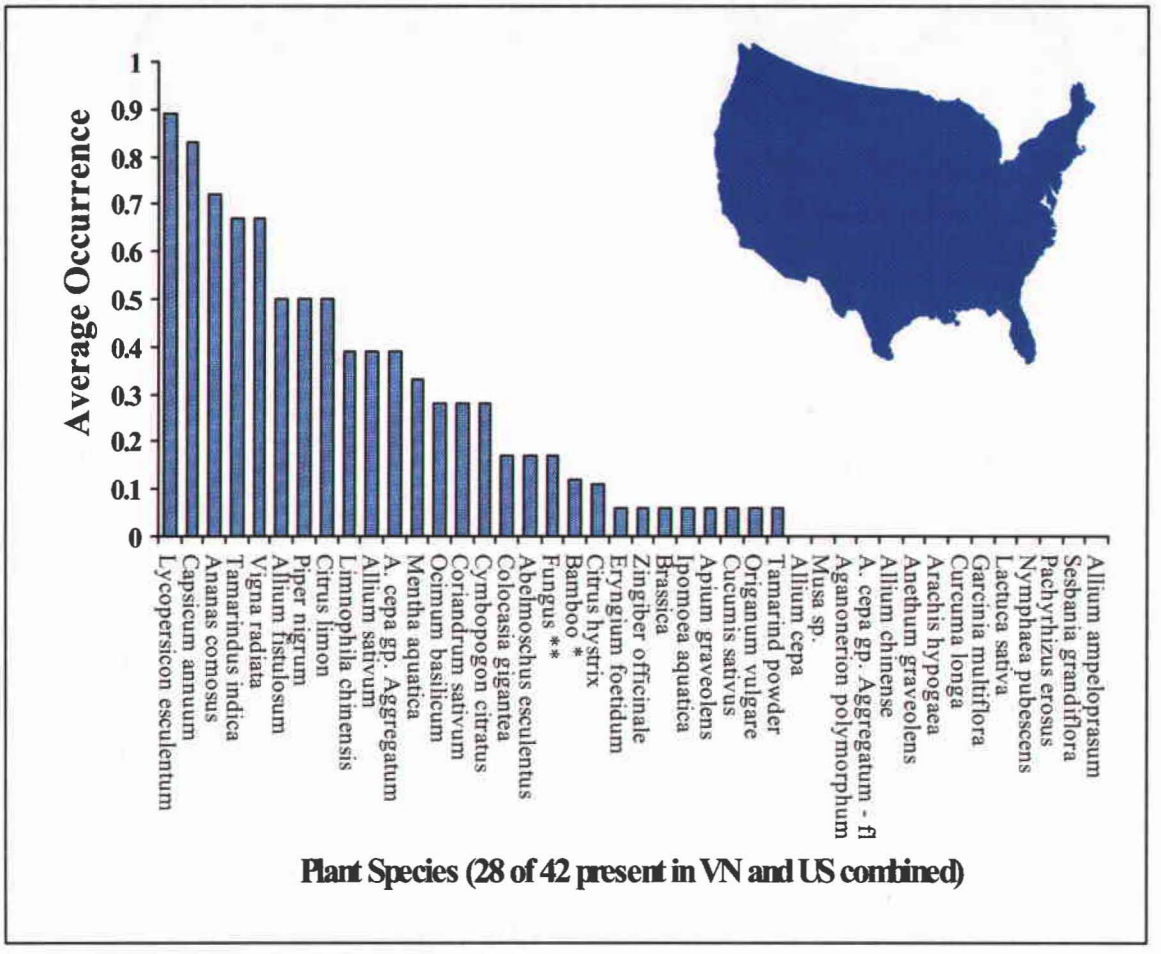

Figure 7.3. Plant species in **canh chua** recipes from the US community by order of constancy. Similar to use of the Vietnam map in Figure 7.2, the map of the United States is provided here and in subsequent figures as a reminder of the community the data represents. (* Young shoots of unspecified bamboo species. ** Unspecified fungus species.)

Figure 7.3 displays the species in the recipes from the US community. There are 28 species in the US community, compared to 36 in the VN community. In addition, the species along the x-axis appear in the order corresponding to their constancy in the US community and this is different from that found for VN community (Figure 7.2). These results demonstrate that the species used in **canh chua** in the US community is a smaller

and different assemblage of food plants compared to the Vietnam assemblage. However, the two communities do share a suite of species essential to and commonly used for **canh chua** including, *Capsicum annuum, Limnophila chinensis* subsp. *aromatica, T. indica, Lycopersicon esculentum, Colocasia gigantea, V. radiate, Ananas comosus,* and *O. basilicum.* A noticeable difference is the increase in the occurrence of *Allium* species in the US community. The trends observed in the VN and US communities are now further discussed in terms of their functions in **canh chua**.

7.4.2 Analysis by function

Comparing the most commonly occurring plant species viewed by there functions we see there is great overall similarity between the importance of functions in the US and VN communities. The "spicy" function, served by *Capsicum annuum,* maintains its important function in **canh chua,** with 84% and 83% occurrence in US and VN communities, respectively (Figure 7.4). While the percentages are comparable, *C. annuum* is the second most frequent species in the US community compared to being most frequent in the VN community. In the US community, most salient species is *Lycopersicon esculentum* (89%), and serves a "sour-texture" function. Sourness provided by *T. indica* L. is highly represented and maintains relatively the same position in constancy from the VN (74%) to the US (72%) communities. For the US community, sourness is also frequently supplied by *Citrus* X *limon* (L.) Osb. (50%).

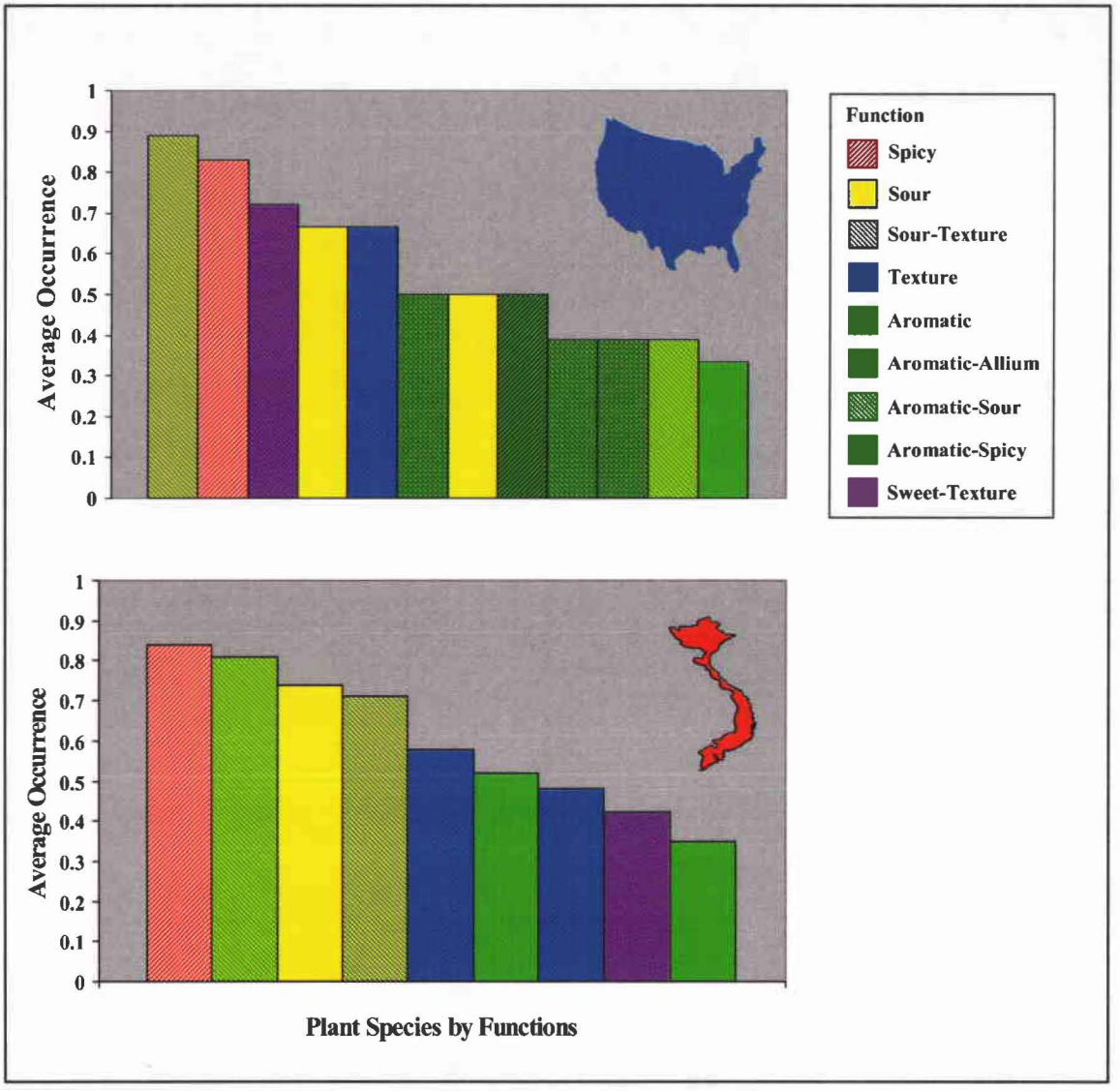

Figure 7.4. The most constant plant species (at least 30% average occurrence, see Table 7.1) viewed by functions for the US and VN communities. The legend shows the color codes for the functions. Some functions are represented by more than one species.

There are also some noteworthy differences. The "sour-texture" function, represented by *Ananas comosus*, occurs at 72% for the US compared to 42% for Vietnam. Previously, *A. comosus* was an expensive fruit in Vietnam, and was not traditionally used for **canh chua**. Its constancy is dramatically higher in the United States

and could suggest the different socio-economic condition of culinary writers in addition to differences in tastes.

By contrast, the function of "aromatic-sour," provided by *L. chinensis* subsp. *aromatica* and esteemed as the "scent of **canh chua**," shows a dramatic decrease in constancy from the VN (81%) to the US (39%) communities. *Limnophila chinensis* subsp. *aromatica* is one of two "indicator species" traditionally used for this soup (Routhier 1989). When Vietnamese first resettled in the United States this herb was non-existent or very rare. This lead many cooks to substitute it with other aromatic herbs or, in some cases, abandon the making of **canh chua** entirely. Vietnamese immigrants have played a role in increasing its occurrence in the United States, but it remains relatively rare compared with the other aromatics.

In the VN community, another "aromatic," *Eryngium foetidum* (52%) is commonly paired with *L. chinensis* subsp. *aromatica*. But it is rarely used in the US books (6%). *Ocimum basilicum* (35%) is another "aromatic" used to supplement the soup in Vietnam. In the US community, *L. chinensis* subsp. *aromatica* is often substituted with the "aromatics," *Mentha sp.* (33%), *Coriandrum sativum* (28%), and *Ocimum basilicum* (28%). Other aromatics have taken a more important role in the US community. "Aromatic-allium," represented by *Allium fistulosum* (50%), *A. cepa* cv. Aggregatum Group (39%), and *A. sativum* (39%), and "aromatic-spicy," represented by *Piper nigrum* (50%) are present in the top plant functions. The increase of "aromatic-allium" may reflect a change in the style of preparing **canh chua** in the United States. The lack of "aromatic-spicy," specifically, *P. nigrum*, may reflect a sampling problem. *Piper nigrum*

is often not included in the "ingredients" list for the Vietnam recipes as it is in the US recipes. However, it may appear in the preparation instructions of the dish. For example, it may be used to marinade the fish with other ingredients prior to cooking the fish (Gia 2001).

While the indicator species, *L. chinensis* subsp. *aromatica,* functions to provide the "scent of **canh chua**," the other indicator of authenticity, *Colocasia gigantea*, functions to provide the "texture." As with *L. chinensis* subsp. *aromatica*, *C. gigantea* was and remains relatively rare in the US community (17% versus 58% occurrence in VN community). The "texture" function, however, is high in constancy (67%) for the US community. This supports my hypothesis that the "texture" function, though seldom mentioned, is important to the structure of **canh chua**. The texture function in the US community is provided by *Vigna radiata* (67%). *Vigna radiata* also occurs as one of the top plant species for VN community (48%) (see Table 7.1). That its constancy increases from the VN to the US community suggests that it is a substitute for *C. gigantea.* However, it only partially substitutes for the "texture" function of *C. gigantea.* This is supported by the increase in constancy of other "texture" species. These include "sour-texture" provided by *Lycopersicon esculentum* and "sweet-texture" provided by *A. comosus*.

7.4.3 Maintenance of functions

By knowing which functions are important in VN community, it is possible to compare the diversity of plants fulfilling those functions in the US community to see if

they are maintained for making **canh chua**. Figure 7.5 displays the plant diversity per function included in the **canh chua** recipes from the US and VN communities. The number of species serving the function is totaled and compared between the US and VN communities. An overview of the functions shows that all the recipe functions in the VN community are maintained in US community as well. Upon closer examination, it can be see that half of the functions are provided by individual species in both cases. The "spicy" function is a good example of this because it is supplied only by *C. annuum* in both cases. Other examples include "sour-texture" by *Lycopersicon esculentum*, "sweet-texture" by *A. comosus,* and "aromatic-sour" by *L. chinensis* subsp. *aromatica.* The remaining functions are due to two or more species.

There is a high diversity of plants serving the "texture" function in the US and VN communities (eight and 13 species, respectively). This high diversity demonstrates that, (1) the function of "texture" can be fulfilled by many plants, and (2) it is another affirmation for the importance of "texture" in **canh chua**. Additionally, six of those texture plants from the VN community are among the 14 plants not present in the US community.

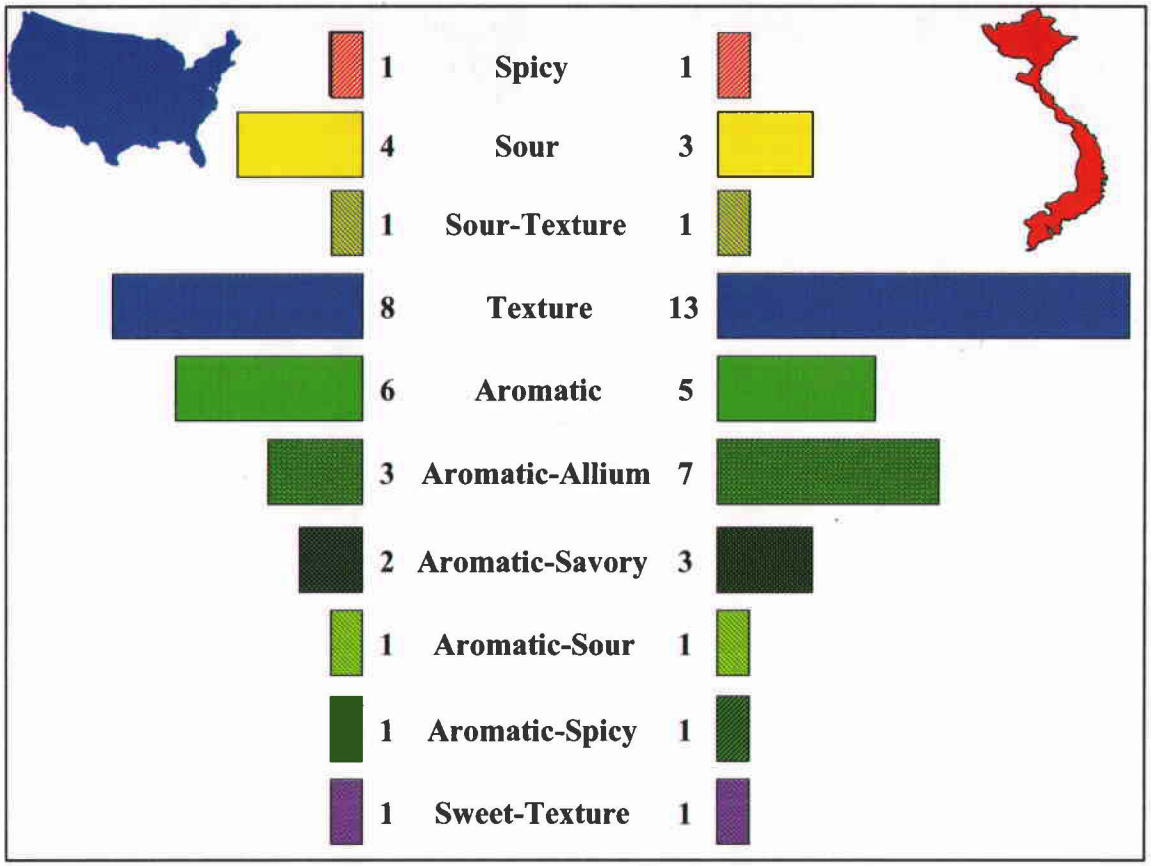

Figure 7.5. Plant diversity per function in the **canh chua** recipes from the US and VN communities. Numbers represent the total number of species serving the function in each community. The species included in the functions are not identical in both communities.

Overall, we can see that the diversity of plants used to make **canh chua** in the US community is lower, but all of the functions are maintained. There are also species present in the assemblage for the US community that are not present in the VN community and *vice-versa*. Thus we have a dynamic community of food plants that functionally maintain the making, and thus, the structure of **canh chua**.

7.4.4 Indicator species

This functions approach also can be used to identify or confirm indicator species by comparing "constancy of function" data with the "plant diversity per function" data (Figure 7.6). For example, the function of "aromatic-sour" is very important to the structure of **canh chua,** as indicated by its high constancy in the communities, yet the function is maintained by only one species. This suggests that the species is critical to the structure of **canh chua**. In this analysis, "aromatic-sour" is represented by *L. chinensis* subsp. *aromatica.* This "functions" comparison confirms the cultural description of *L. chinensis* subsp. *aromatica* being "essential" to authentic **canh chua**, and lends weight to the Vietnamese folk description of this aromatic plant as providing the key "scent of **canh chua**."

One could also identify *Capsicum annuum* as an indicator species critical to the structure of **canh chua**. *Capsicum annuum* is the only species supplying the highest occurring function of "spicy" in the Vietnam recipes. However, *C. annuum* does not have the cultural saliency in this particular recipe as does *L. chinensis* subsp. *aromatica.* This may be due to *C. annuum* being nearly ubiquitous in many foods and eaten as a condiment with many meals in Vietnam. In contrast, *L. chinensis* subsp. *aromatica,* like *Colocasia gigantea* are nearly exclusively used for making **canh chua**. As *L. chinensis* subsp. *aromatica* appears to be an essential ingredient in **canh chua**, it seems likely that *C. annuum* is an essential ingredient in Vietnamese cooking. A different survey analyzing the number of recipes that include *Capsicum annuum, L. chinensis* subsp. *aromatica,* and *Colocasia gigantea* needs to be conducted to test this hypothesis.

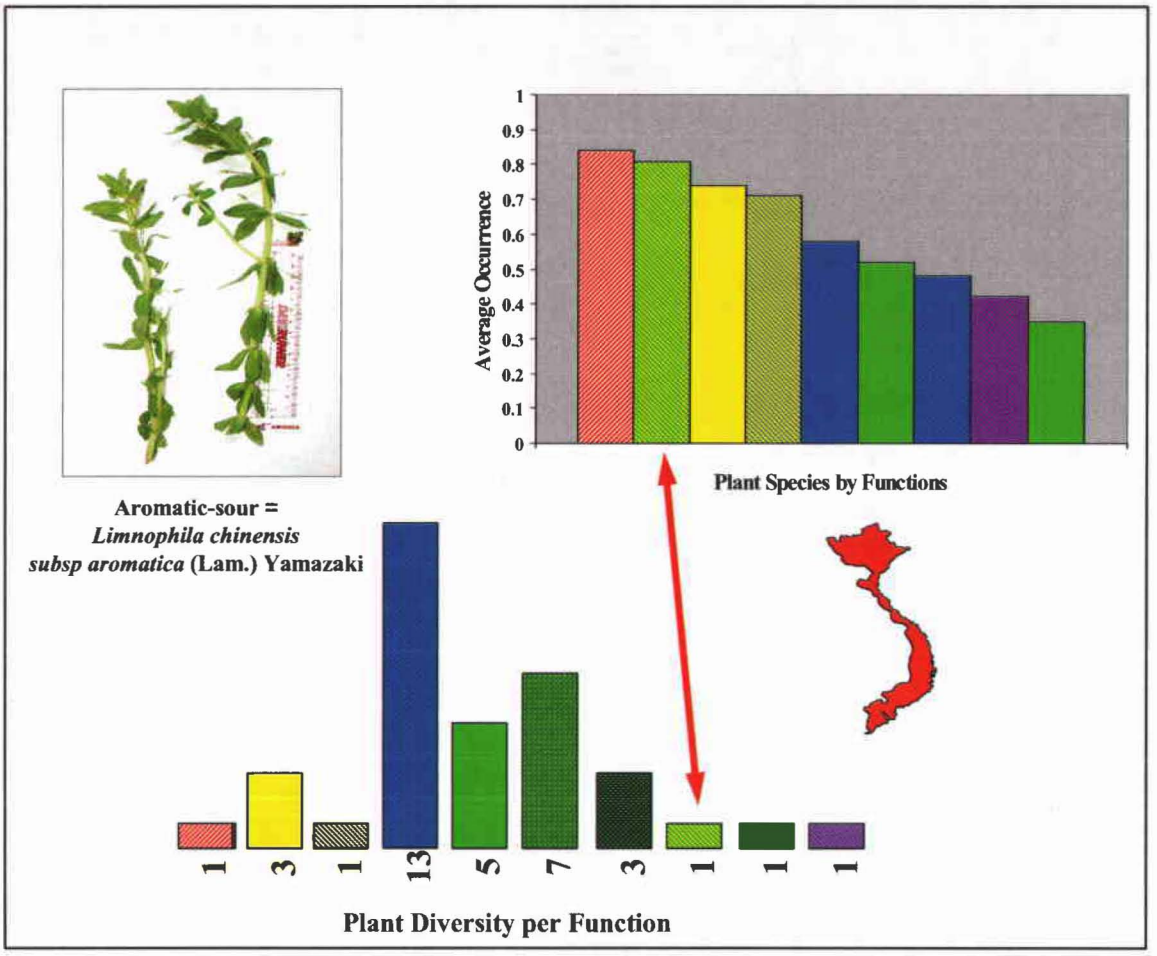

Figure 7.6. Confirming or identifying indicator species by comparing "plant species by function" with "plant diversity per function" data. The example identifies *Limnophila chinensis* subsp. *aromatica* as an indicator species because it is the only species in the recipes used for the function of "aromatic-sour" that has a very high constancy in recipes.

7.5 Conclusion

This is a case study of how an important culture-defining recipe has been adapted by a dislocated group of people. Hopefully it demonstrates how critical traditional aspects of the dish were retained so that its structure was maintained while its ingredients were necessarily altered. Furthermore, it provides a model of how future studies of this kind should be conducted.

Analyzing the data from a functions model perspective, I identified plant alternatives, substitutions, and indicator species used in this food. Although there are indicator species that are critical for authenticity, plant substitutions fulfilling the same function can be used to maintain the overall structure of a dish even in the absence of some "indicator species."

These analyses showed that the making of **canh chua** in the United States is a dynamic process, characterized by changes in the assemblage of plant ingredients used in the recipes. This is analogous to the ecological process of "community dynamics," which describes the ongoing process of growth, change, and development of communities of organisms, as well as the interactions of those factors. In the case of **canh chua**, while some of the plant ingredients have been substituted, increased or decreased in usage, the taste functions required for the food on are maintained. With the functions maintained, the structure of the food, defined as the overall character of the food and the food itself may be reconstructed so that **canh chua** can be experienced and maintained in the United States. Thus recognizing community dynamics and functional stability, the cultural food ways are maintained in diaspora communities. My work supports the hypothesis that the cultural experience of the food transcends time and location, even in the absence of authentic elements, and is important for people far from their traditional homes (Sutton 2001).

In conclusion, it is hoped that the findings from these analyses and the methodologies explored may be applied to the analyses of other culturally important foods. Moreover, these analyses may be beneficial to the construction of a cookbook of

Vietnamese (and other cultures) foods that is culturally historical, bilingual, and botanically informative. As a contribution back to the Vietnamese communities, I hope that it may promote and perpetuate Vietnamese cultural and culinary knowledge.

CHAPTER 8

CONCLUSION

8.1 Introduction

This dissertation is an ethnobotanical study that documents and analyzes the natural and social components in the reconstruction of culinary practices of the Vietnamese diaspora in Hawai'i. The basic approach was a comparative study of Vietnamese in Honolulu, Hawai'i and Biên Hòa, Vietnam. The objectives of the dissertation were: (1) to identify and analyze the assemblage of food plants used by Vietnamese in Hawai'i compared with that used in Biên Hòa, Vietnam, (2) to document the extent of acculturation in food plant knowledge of the Vietnamese in Honolulu compared to their counterparts in Vietnam, (3) to identify key species used for substitutions of plants not available to Vietnamese in the United States; and (4) to analyze how those substitutions are important in the reconstruction of traditional Vietnamese foods in the United States.

8.2 Summary of Results

8.2.1 The assemblage of Vietnamese food plants

Over 200 species of food plants are used by the Vietnamese (Chapter 3). These taxa were analyzed to determine relevant comparisons between Vietnamese in Hawai'i and southern Vietnam. Apparent changes in food plant usage from a foundation in Vietnam to a modified diet in Hawai'i are noted. The changes reflect an evolution of the assemblage of food plants and are demonstrated by substitutions, insertions, and deletions

of plant taxa. Exact replications do occur as the Vietnamese in Hawai'i have access to many of the same plant taxa as those in Vietnam. This is due, to the natural and social climates of Hawai'i. As a sub-tropical location, many food plants used in Vietnam are cultivated in Hawai'i. Socially, Hawai'i's food supply has been affected by the food habits of a large Asian immigrant population with a long history of culinary introductions into Hawai'i. The dynamic assemblage of plant taxa used for foods reflects increased communication and trade between Vietnamese in Hawai'i (and the U.S.) and Vietnam, increased income of the communities in the U.S. to afford more expensive imports, and the development of processed plants products.

In documenting the traditional and adopted food plants, I have provided the current scientific and vernacular botanical nomenclature and taxonomic groupings with the hope that it will contribute towards the building of a strong foundation for the science of Vietnamese ethnobotany.

8.2.2 Acculturation of food plant knowledge in Hawai'i

A comparison of ethnobotanical knowledge of food plants between Vietnamese in Hawai'i and Vietnam was conducted to test whether Vietnamese immigrants and those born outside of Vietnam would have less knowledge of food plants compared to people still living in Vietnam. This was measured by a subject's ability to identify 10 Southeast Asian fruits and vegetables, and the number of food uses known for the same 10 plants (Chapter 4). The results showed a positive correlation between age and knowledge. Vietnamese in Hawai'i listed more food uses than those in Vietnam. This appears to be

due to acculturation by adoption of culturally diverse food uses in Hawai'i coupled with a higher levels of disposable income due to the generally better economic situation of the Vietnamese in the U.S.

A comparison of plant names was used to test the knowledge of Vietnamese botanical language among Vietnamese in Hawai'i, particularly, the second-generation Vietnamese. Knowledge of Vietnamese plant names also showed a positive correlation with age of respondents (Chapter 5). Among the Vietnamese in Hawai'i acculturation of both the knowledge of plant names and the knowledge of Vietnamese language was documented in the younger Vietnamese (18-30 year olds). This result supports a loss of traditional Vietnamese cultural knowledge among the second-generation Vietnamese in Hawai'i. The acculturation may actually reflect an evolution in contemporary Vietnamese cultural knowledge among the second-generation Vietnamese-Americans growing up in a cultural environment different from their elders. The results also showed that emigration affected food plant knowledge. Those who left Vietnam as adults, versus those who were younger or born in the U.S., knew more names and uses for food plants.

8.2.3 Food plant substitutions, insertions, and deletions

Originally presented as one of four separate objectives, it is now clear that the food plants salient to the Vietnamese in both Hawai'i and Vietnam comprise an assemblage of plants constituted through the processes of substitutions, insertions and deletions of taxa (Chapter 3). The taxa include the base set of those indigenous to Southeast Asia, which has been enhanced by those inserted by foreign and local interests,

and substituted plants or those that have become comparatively less desirable or available, and those that have been deleted from use in new environments.

A notable example is **bạc hà** (*Colocasia gigantea* (Blume) Hook. f.) (Araceae). This plant is used in the Vietnamese soup, **canh chua,** as a vegetable (Chapter 6). *Colocasia gigantea* is an important example illustrating the interactions between people and plants. These interactions are demonstrated by, (1) its role in the movement of people and plants resulting from the Vietnam-United States War, (2) its function in creating the structure of a traditional food, and (3) its taxonomic history underscoring the role of good, culturally informative, voucher specimens.

8.2.4 Functional stability of a traditional Vietnamese food

The reconstruction of a traditional food was analyzed by comparing recipes from Vietnamese cookbooks published in the United States and Vietnam (Chapter 7). **Canh chua cá lóc** was used as a case study. The analysis was based on the assemblage of plant species used in the food, not only as species, but also as functions. The functions are defined as taste qualities of the species. This functional model demonstrated that the retention of taste qualities is significant to the reconstruction of the food. The taste qualities combined make up the structure of the food itself. Retaining the structure of the food perpetuates the cultural 'experience' and qualities of the food. These qualities include the memories of the events involved in sharing food and the consumption experience or 'taste sensations' (e.g., the importance of a food texture in **canh chua**). This personal and cultural context transcends time and space, and is more important than

the exact replication of the food. It is these qualities that are especially valued by people far from their traditional homes (Sutton 2001).

This study showed that the making of **canh chua** has been a process that has changed during the relatively brief time it has evolved in the US. There have been changes in the assemblage of plant ingredients while the basic functions and structure have been maintained. As a result the experience of **canh chua** has remained essentially unchanged for residents in United States. This understanding, and the botanical and Vietnamese community results, will be utilized for the construction of a cookbook of Vietnamese foods. This cookbook will be culturally historical, bilingual, and botanically informative with the hope of promoting and perpetuating Vietnamese cultural and culinary knowledge.

8.3 Implications for Future Research

This dissertation began from an initial desire to understand how the Vietnamese diaspora in Hawai'i was reconstructing their culinary traditions in their new home. In carrying out studies to answer the question, whether in Hawai'i or in Vietnam, my work involved documenting and analyzing the units or 'commodities' (i.e., plants, food products, texts) and the Vietnamese community using these commodities in their everyday lives and celebrations.

In summary, Vietnamese culinary knowledge was being actively practiced wherever there was a community of people identifying themselves as of Vietnamese. The reconstruction of culinary practices in the Vietnamese diaspora shows a community of

people and plants that are dynamic by location and generation, but where the 'Vietnamese culture', recreated and adjusted to the new place and time, continues to exist.

The work conducted for this dissertation contributed to updating the antiquated and abbreviated information regarding both Vietnamese diaspora ethnobotany and Asian markets in the U.S. Research could be expanded to include additional Vietnamese and other Asian American communities and markets in the U.S. The data gleaned would contribute to a more complete understanding of the ways of food functions with these cultural groups, their effects on the local and national diversity of cultivated plants, and ideally, the results would be applicable to cultural interests and needs.

The study of *Colocasia gigantea* demonstrated it as a subject for future research that may contribute to the understanding of culturally driven conservation and genetic diversity of edible aroids (Araceae). Aroids have been selected, cultivated, and carried by cultural groups to new home areas around the world. Thus, they are an ideal model for testing hypotheses regarding the movement of people, genetic diversity in food plants, and the preservation and dynamics of cultural and culinary knowledge. In addition to preservation, aroids are also a model for analyzing the development of new varieties which preserve important cultural values such as taste, texture, etc. but are better adapted to the local environmental conditions found in the new locale of the immigrants.

Ethnobiological studies are replete with work documenting the uses of plants by cultural groups for subsistence. The documentation may include plants used for food, medicine, building, and other human needs. Our uses of plants are not generally isolated

but rather there have been suites of plants that are employed together to provide the structure of the event (i.e., for food, medicine, building). Thus, future ethnobiological studies should include documentation and understanding of the function of the plant, or other significant aspect of the cultural event. Recognizing a model of stability by functional or structural rules amidst community dynamics may provide greater understandings of people-plant interactions that would be beneficial to humanity as they are applied to addressing current issues and planning for future programs, especially applied to diasporic communities.

APPENDIX A

PUBLISHED MANUSCRIPT OF CHAPTER 2

Nguyen, M. T. 2005. Cultivated plant collections from market places. *Ethnobotany Research and Applications* [online]. vol. 3, no 1, Pp. 5-15. Available from World Wide Web: <http://www.ethnobotanyjournal.org/vol3/I547-3465-03-005.pdf>. ISSN 1547-3465.

The publication occupies the following pages 109-119 of this dissertation.

Cultivated Plant Collections from Market Places

My Lien Thi Nguyen

Abstract

The study of cultivated plants from markets places can reveal interesting information on the interactions and relationships between people and plants. Despite this, cultivated plants are often overlooked and not vouchered in ethnobotanical studies. This article was written for Ethnobotany Research and Applications to reaffirm and to reach a wider audience of colleagues, via an electronic journal, the importance and proper conventions for the collection, maintenance, and use of voucher specimens, particularly for cultivated plants. A case study with *Colocasia gigantea* (Blume) Hook. f. is presented to help illustrate these points.

Bộ sưu tập các loại rau được trồng thông qua thu thập tại các chợ. Sự nghiên cứu về các loại cây trồng dùng làm rau bán tại chợ có thể cho chúng ta những thông tin thú vị về mối quan hệ và sự tương tác giữa con người và thực vật. Mặc dù vậy, các nhà khoa học thường xem nhẹ việc thụ thập những loại cây đã được trồng trọt để làm mẫu vật cho các cuộc nghiên cứu thực vật học dân tộc. Báo cáo này được viết cho tập Ethnobotany Research and Applications (Sự nghiên cứu và ứng dụng thực vật học dận tộc) để khảng định và thông tin đến được tới nhiều đồng nghiệp và bạn đọc thông qua một tập san điện tử về tầm quan trọng và các bước hợp lý cho thu thập, duy trì, và cách sử dụng những mẫu thực vật, đặc biệt cho các loại cây trồng. Tôi có đưa ra ở đây một nghiên cứu về trường hợp cây Colocasia gigantea (Blume) Hook. f. để minh hoạ cho vấn đề được nêu ở trên.

Les collections de plantes cultivé des marchés. L'étude de plantes cultivé des marchés peut révéler intéressant l'information sur les interactions et les relations entre les gens et les plantes. Malgré ceci, les plantes cultivé sont souvent négligées et pas recueillies dans les études d'ethnobotanique. Cet article a été écrit pour la Recherche et les Applications d'Ethnobotanique pour réaffirmer et atteindre un auditoire plus large de collègues, via un journal électronique, l'importance et les conventions correctes pour la collecte, l'entretien, et l'usage de spécimens de certificat, particulièrement pour les plantes cultivé. Une étude de cas avec *Colocasia gigantea* (Blume) Hook. f. est présentée pour aider illustre ces points.

Introduction

Marketplaces found in many cities and towns are rich sources of ethnobotanical information. They are places of intensive interaction between people (vendors and consumers) and people and plants. Marketplaces are readily accessible and cost effective places for fieldwork, providing qualitative and quantitative data concerning cultural, social and economic aspects of a plant's usage (Bye & Linares 1983, Cunningham 2001, Martin 1992).

Working in Mexico, Whitaker and Cutler (1966) recognized the value of markets "as vital botanical records of the history of useful plants in a region." Their comparisons of cultivated *Cucurbita* L. from markets with samples excavated from caves demonstrated changes in form and abundance of cultivars. They attributed this to a relationship between the changes in plant cultivars and cultural

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conditions, including the relationships and movements of human cultures. Observing the early effects of globalization on the area they called on the need for carefully documented collections and records of markets.

Influenced by Whitaker and Cutler (1966), Johnson and Johnson (1976) analyzed data from surveys of two rural markets near Benin, Nigeria. They found that indigenous African food species were absent or had been replaced with introduced 'globally' marketed species. For example, the indigenous West African rice species, *Oryza glaberrima* Steudel, was largely replaced by *O. sativa* L.

More market studies have shown the historical changes in food supply. van den Berg (1984) surveyed and collected vouchers of plants from the Ver-o-Peso market in Balém, Brazil. van den Berg recognized five distinct sections of the market: 1) handicrafts, 2) medicine and magic plants, 3) horticultural and ornamentals, 4) fruits, and 5) vegetable and root crops. Over an 18 year period, van den Berg saw an overall 50% decline of plant species due to cultural migration and modernization. However, there was an increase in variety and quantity in the vegetable and root crop markets reflecting the horticultural and market-gardening practices of recent Japanese immigrants to Northern Brazil.

Before Whitaker and Cutler called attention to market places, Asian immigrants in the U.S. were recognized for introducing new food species. Food plant diversity in the state of Hawai'i has been diversified with the immigration of Asians since 1852. Chung and Ripperton (1929) reported plants locally cultivated and sold in the markets that are indigenous to the "Orient [that] has been gradually accumulated in Hawaii, where they are considered unique botanically and valuable dietetically." Miller (1933) discussed specifically "Japanese" food plants and plant-products, including algal species and soybean (*Glycine max* (L.) Merr.) products not covered by Chung and Ripperton (1929).

Porterfield (1951) described Chinese "vegetable foods" and food plants collected from the Chinatown markets of New York City before World War II. He recognized the lack of information regarding metropolitan Chinatown markets, but noted that their great diversity has "excited the curiosity of those looking for exotic foods." The purpose of these studies was to provide nutritional and use information, including recipes (Chung & Ripperton 1929, Miller 1933), on the plants so that they could be better known and incorporated into local diets. Miller (1933) hoped his bulletin would promote *in-situ* conservation of "racial foods" among younger Japanese. Work currently being conducted at the University of Hawai'i and New York Botanical Garden should provide interesting updated information regarding the dynamics of the food plant species and ethnic communities in those markets since these initial surveys.

The market studies discussed above and others (Bye 1986, Mertz *et al.* 2001, Williams *et al.* 2000) have drawn interesting conclusions and new questions regarding the interactions and relationships between people and plants. However, many market studies lack in scientific rigor by not making voucher collections of the plants listed or described. There is an even greater bias against the collection of "common cultivated plants." In such studies, it appears that common cultivated plants are just that, common, their identification known, and therefore, not worthy of a voucher collection.

As reviewed above, cultivated plants do reveal interesting ethnobotanical information. These are often the plants that have been introduced into the culture. It is these plants that are important to collect and record as they document historical patterns of plant introductions and dynamics in cultural foodways (e.g., changes in diet). As an example, my herbarium research on Vietnamese food plants used during the early French colonization of Vietnam has shown that many plants that were probably commonly eaten were not collected, though many were described in the concurrent French-Indochina literature as being newly introduced and incorporated into local agricultural systems (Crevost & Lemarié 1917). Interestingly, the absence, as well as the presence of species represented by vouchers in herbaria and referenced in the literature can suggest motivations of plant collectors and their sponsors at the time. For example, the purpose of French botanists surveying the new colonies was for the exploration for new and better tropical economic plants (Lanessan 1886, Lecomte 1908-42).

Furthermore, not collecting vouchers may be due to the challenges presented by collecting food plants in market places. Plants found as fruits can seem daunting for making vouchers (e.g., gourds [*Cucurbita* sp.] [Figure 1]). More often, food plants are found in juvenile or sterile condition or only the edible portion is available, making their identification difficult (Lee *et al.* 1982, Nguyen n.d., Williams *et al.* 2000). However, voucher specimens are an essential part of market and ethnobotanical studies (see Box 1).
In addition to the value of a voucher specimen, the Association of Systematics Collections goes on to say that

Box 1. The value of the voucher specimen. (Lee *et al.* 1982:5)

The Association of Systematics Collections (ASC) states: "A voucher specimen is one which physically and permanently documents data in an archival report by: (i) verifying the identity of the organism(s) used in the study; and, (ii) by so doing, ensures that a study which otherwise could not be repeated can be accurately reviewed or reassessed."

Figure 1. Gourd and other "vegetable" fruits vendor. Biên Hòa Market, Biên Hòa City, Việtnam.

"the extreme importance of voucher specimens has been overlooked far too long," and that the scientific objectivity and accuracy of a project are seriously compromised when they are necessary for documentation (see Box 2 and 3), yet not collected and appropriately maintained. So critical is the issue, that they called for ALL scientific societies or publishers responsible for scientific journals to publish instructions for the criteria used to decide whether vouchers are necessary, and in those cases where they are necessary, to refuse publication of papers that do not note deposition of voucher material in a suitable repository (Lee *et al.* 1982:11).

There are many books describing ethnobotanical methodology, including conducting market studies and making voucher specimens (Alexiades 1996, Cotton 1996, Cunningham 2001, Martin 1995). I recommend reviewing each one as they individually provide valuable nuances. Martin (1995) provides good descriptions for making voucher collections and includes a copy of a survey form used in an ethnobotanical market study (Martin 1995:194). Cunningham (2001) goes beyond the traditional survey and addresses the analysis of market systems and networks in Africa. For ethnobotanical work in market places, Bye and Linares (1983) provide detailed methodologies (Box 4) for the collection of voucher specimens in a market survey specifically addressing the inherent challenges associated with market plants. Additionally, Bye's (1986) thorough discourse of voucher specimens in ethnobiological studies provides details not only for collecting but also for citing them in publications.

Despite the available literature citing the value, acquisition, and use of voucher specimens, they remain overlooked in many ethnobiological studies, particularly where cultivated plants are involved. Part of building the strength and rigor of ethnobiological sciences is to establish, and to follow established conventions for our work. This is a pivotal time to reaffirm foundational elements for biological studies. With a focus on cultivated plants from market places, I highlight here some important methods for the collection, management, use, and citation of voucher specimens. I provide a case study from my research to help illustrate these points. It is hoped this article in *Ethnobotany Research and Applications* may be more accessible to our colleagues as an electronic journal than per-

Box 2. Voucher specimen requirements in order to fulfill their function. (Lee *et al.* 1982:7)

1. Have recognized diagnostic characteristics that are appropriate to the level of identification in the report (see Box 3).
2. Be preserved in good condition and according to acceptable practice.
3. Be thoroughly documented with field and/or other relevant reports.
4. Be maintained in good condition and be readily accessible in a suitable repository institution(s).

Box 3. Forms of voucher specimens. (Lee *et al.* 1982:6-7)

1. The actual organism (part or whole) of research.
2. A sample of one or more individuals from a population being studied, observed, or treated.
3. A representation of the organism(s) or its characteristics (e.g., sound recordings, photographs, fossils, etc.) in the research. However, these are usually not adequate as a substitute for voucher specimens and should be used only when the organism themselves are impractical or illegal to collect.
4. An associated specimen that is biologically or functionally related (e.g., seeds, pollen preparations, stomach contents, etc.) to the study organism. The basic evidence studied by the ethnobiologist may not be the standard materials used by taxonomists (e.g., flowers). In these cases a voucher specimen of the organism should be prepared, in addition to an appropriate preparation for the associated specimen. These are deposited and cross referenced between the voucher and the associated specimen (see Bye 1986).
5. A corroborative specimen. A collection of a previously collected voucher specimen that is at a different time or stage of life cycle that provides additional data. For example, Bye and Linares (1983) collected plants from the farms or fields of the same population where the original market specimen originated. They also collected additional material when the specimens were fragments or parts (e.g., seeds, stems, and roots), using them as "propagation specimens" to produce more taxonomically important parts that then served as corroborative specimens.

Box 4. Market survey methodology used by Bye and Linares (1983). For greater detail see that article and also Alexiades (1996) and Martin (1995).

1. Go to the market early in the morning and on a regular schedule. Arriving early enables you to make collections and access vendors before the market becomes very busy with shoppers. Regular visits enable you to observe changes in offerings (e.g., seasonal fruits).

2. Interview and record the vendor about the plant, including:
   a) plant name(s),
   b) purpose(s) and use(s),
   c) preparation(s),
   d) qualities (e.g., "hot", "cold", flavor, etc.),
   e) source area,
   f) gathered or cultivated,
   g) plant community and habitat or origin,
   h) price of the unit sold, and
   i) type of vendor (e.g., resale vendor, collector-vendor, etc.).

3. Plant documentation and collection.
   a) Plants are purchased.
   b) Original vouchers prepared.
      1. Herbarium specimens: material that can be pressed in a standard plant press.
      2. Case specimens: bulky material that is dried or placed in liquid preservative†.
   c) Propagation specimens: for specimens that are seeds, stems, and roots, additional material is purchased to propagate specimens for the collection of important identification characteristics (e.g., flowers).
   d) Photographs taken of the specimens.

4. Field visits to places where products are derived to collect corroborative specimens and record additional ethnobotanical and ecological data.

5. Identification of specimens using flora literature, comparison with identified voucher specimens in herbaria, or with the assistance of an expert.

6. Labeling of voucher specimens.

7. Deposition of vouchers, photographs and notes in the appropriate herbaria.

† I recommend thinly slicing bulky material and sun or air drying to remove excess water followed by pressing in a standard plant press (Figure 2). In this way herbarium specimens can be prepared rather than making case specimens that require additional maintenance.

haps the earlier printed articles by which this article was inspired (cf. Bye 1986).

The Case Study: *Colocasia gigantea* (Blume) Hook. f. (Araceae) in the market.

Food plants identified by Vietnamese participants in a survey conducted in Hawai'i were collected from the Chinatown markets in Honolulu, Hawai'i. *Colocasia gigantea* was included in the market collection. *Colocasia gigantea* is cultivated for the use of its petioles as an essential, traditional ingredient in making a Vietnamese soup called **canh chua** (Nguyen n.d.). In the Chinatown markets of Hawai'i, and other Asian markets internationally, the aroid petiole is sold whole or cut into smaller sections with the leaf blade completely removed (Figure 3).

Identification of specimens

The identification of the aroid is complicated by the lack of fertile specimens in cultivation, fragmentary condition in market settings, reference by different regional vernacular names, and reference by different scientific names.

While dictionaries or checklists can be useful resource materials, they should not be used to simply match folk names to a scientific name for identification (Mead 1970). Regional differences in local names can make this a frustrating exercise. Incorrect or questionable determinations may be perpetuated through authors employing this method and publishing the names in their works. Specimens should be identified using available floristic literature, comparison with specimens already determined and deposited in herbaria, or by a taxonomic specialist (Bye & Linares 1983).

Figure 2. Bulky specimens sliced and being sun dried to remove excess water prior to pressing in a standard plant press.

Figure 3. *Colocasia gigantea* petioles for sale in Asian grocery store located in Chinatown, Paris, France.

Colocasia gigantea is referred to as bạc hà, in southern Vietnam and by Vietnamese speakers in the U.S. In northern Vietnam, it is called **dọc mùng**, while **bạc hà** refers to a culinary mint herb: *Mentha arvensis* L. or *Mentha x pandiperita* L. Many plant species have multiple regional names resulting from Vietnam's geographic and political northern, central, and southern divisions. Folk names, however, included on voucher specimens are important for, and should be included in, ethnobiological collections (Bye 1986). In many cases while examining *C. gigantea* vouchers, the combination of a physical specimen that included the folk names and uses provided data for cross-referencing with cultural representatives and literature sources and the opportunity to learn historical information not found in printed literature (Figure 4) (also see Nguyen n.d.).

Figure 4. Voucher specimen of *Colocasia gigantea* collected in Hawai'i in 1935 (original citation: *Colocasia esculenta* (L.) Schott *G.P. Wilder s.n.* BISH! sheet 666211). The original label includes the Japanese folk name and information on food usage. This specimen has been re-evaluated and re-determined from *C. esculenta* to *C. gigantea*, an important scientific work that may not have been possible if it was recorded with a photograph only.

Beyond the Market

Identification of sterile plants or plant parts may require tracing their path to the market back to the area of production (i.e., commercial farm, home garden, 'wild' collection sites). This usually requires that the researcher has established a rapport with the vendor, delivery person, farmer or gardener in order to ask to see the plants at the farm or in the person's garden.

From my research, only the petiole of *C. gigantea* was reported and observed as being used for food and sold in Honolulu's Chinatown markets. All of the specimens I examined in home gardens in Hawai'i were sterile (Figure 5). The identification of this aroid in many literature sources (Hodel *et al.* 1999, Matthews 2004, Nguyen 2000, Phạm 2000) is divided between *Alocasia odora* (Roxb.) K. Koch and *C. gigantea*. Working through a network that included a vendor of *C. gigantea* and a restaurateur, I was introduced to a Vietnamese farmer from whom I collected flowering specimens of *C. gigantea* for identification during a visit to his commercial farm.

Photographing Specimens

With digital photography and the Internet, now, more than ever, the method of photographing voucher specimens and having them accessible should be encouraged for any work where they are included (Flaster 2004). It is a cost effective method for research and education, via

Figure 5. *Colocasia gigantea* in Mai Thị Hụê's home garden in Hawai'i. Note its usual sterile condition in cultivation.

sharing information for comparative work with colleagues, checking identifications or learning the plants. In the study of *C. gigantea*, I was able to send my digital images of the plant habit and gynoecium to experts in the U.S. and Asia for identification. The carefully prepared images were sufficient for a quick identification and response. Although a photograph cannot entirely replace the physical specimen in the herbarium, it was a satisfactory alternative to the traditional mailing of the herbarium sheets that would have required a much greater output of resources for the experts and me.

Using photographs as vouchers, in addition to collecting specimens, and depositing them in herbaria is common (Nguyen 2003, Pemberton & Lee 1996, Porterfield Jr. 1951). Others have used digital photography exclusively to record species in a study (Hodel *et al.* 1999). This is not recommended because a photograph, while convenient for sharing information, does not provide the level of information available from the real plant. Information that can be used to verify the identity of the plant, review or reassess a study, or provide material for additional studies (e.g., anatomical, chemical, molecular).

Deposition of Voucher Specimens

Voucher specimens need to be deposited, maintained properly, and available to researchers. Often collections of cultivated plants do not fit the criteria for acceptable specimens by curators because they are sterile or consist of fragments. For the best assurance that your collections are adequate and will be accepted, or at least some of the specimens will be acceptable, it is best to establish contact with the primary repository before you begin your work to understand their current curatorial practices (Bye 1986). If you will be working in a location for several years, you could concentrate on finding better specimens after the initial collection (Martin 1995). If no institutions will accept your vouchers, you can share them with interested colleagues.

Due to the importance of vouchers in biological studies, it is essential to:

1. deposit your original or corroborative voucher specimens in a proper repository,
2. link them with your associated specimens, and
3. have duplicates of the specimens available to share with others.

Citation of voucher specimens

The proper citation (Box 5a) of voucher specimens (see Box 5b for examples) links the physical evidence of the organism with the research publication. The citation of the voucher includes the scientific name of the specimen at the most accurate taxonomic level possible. Infraspecific taxa (e.g., subspecies, variety, cultivar, etc.) are included if known. Refer to the International Code of Botanical Nomenclature (Greuter *et al.* 2000) and the International Code of Nomenclature for Cultivated Plants (Brickell *et al.* 2004) for more information on the citation for plant names.

Conclusions

Market places are important areas to study the interactions and relationships between people and plants. Cultivated plants from markets can be used in studies to better understand the food history of a community(ies) or region. The collection of voucher specimens, including those of cultivated plants, is an essential element of ethnobiological studies.

Even with the challenges and biases against market collections and those of cultivated plants, it is essential that the scientific community of ethnobiologists, authors, and publishers of scientific literature understand the importance and proper conventions for the collection, maintenance, and use of voucher specimens.

My experience with the collection of cultivated plants in market places, and in particular to the food plant, *Colocasia gigantea*, underscored for me the need to document floristic and ethnobotanical work with good voucher

Box 5a. Items in a voucher citation. (Council of Biology Editors Style Manual Committee 1994)

1. Scientific name of the specimen (*Genus species* Authority).

2. Collector name(s) and number(s). Like the generic name, specific and subspecific epithets, are *italicized* or underlined.

3. Herbarium identifier (full name, or if available for major institutions, the code designation cited according to the abbreviation system of Index Herbariorum (Holmgren *et al.* 1990).

4. If the author of the study examined the specimen, an exclamation mark (!) after the herbarium identifier. This designation (!) also gives the study more credibility because the researcher actually saw the physical specimen!

Box 5b. Voucher citation examples.

1. *Colocasia gigantea* (Blume) Hook. f. *M.T. Nguyen 114* HAW

   The herbarium specimen of taro (*Colocasia gigantea* (Blume) Hook. f.), was collected by M.T. Nguyen, this is the collector's 114th voucher and is deposited at the herbarium of the University of Hawai'i at Mānoa that is officially recognized as HAW.

2. *Colocasia antiquorum* Schott var. *esculentum* (L.) Schott *F.R. Fosberg 11243* BISH!

   This was F.R. Fosberg's 11243rd voucher specimen and is deposited at the herbarium of the Bishop Museum in Honolulu, Hawai'i officially recognized as BISH. The example ends with the exclamation point (!) designating that it was examined by the author of the study.

3. *Colocasia antiquorum* Schott var. *esculentum* (L.) Schott *F.R. Fosberg s.n.* BISH! sheet 115605

   This was also collected by F.R. Fosberg but was not assigned a voucher number (*s.n.* = *sans nombre*, without number). The herbarium of the Bishop Museum, the repository institution, however, has given it an institutional number identifying the sheet as 115605. This number is usually entered into a database or other information retrieval system at the institution.

specimens that include the vernacular names and cultural uses.

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APPENDIX B

VIETNAMESE TERMS FOR PLANT FORM AND STRUCTURE UTILIZED

Vietnamese terms[a]	English Explanations
• bông (SV), hoa (NV)	• flower
• cải	• cabbage groups; often Brassicaceae generic
• cây	• generic for "a plant" or tree; often used as a generic for food plants with erect vegetative parts
• cộng	• petiole or stem
• củ	• bulb, root, tuber, or rhizome
• đậu	• bean; often Fabaceae generic
• hột (SV), hạt (NV)	• seed, grain
• lá	• leaf
• nấm	• fungus
• ngó	• shoot of aquatic plant
• rau[b]	• "vegetable" or vegetative, sterile, often leafy food plant
• rong	• algae
• trái (SV), quả (NV)	• fruit

[a] Only those discussed in this manuscript.
[b] I include in the checklist the form "rau t" as an abbreviation for **rau thơm**, referring to plants with aromatic (**thơm**) vegetative parts used as condiments.

APPENDIX C

INFORMED CONSENT HANDOUT – ENGLISH VERSION

Informed Consent Handout Nguyen Thi My Lien

Question:
Are you 18 years of age or older? (If yes, then continue.)
Question:
Would you be willing to let me read a statement about my research interests? (If yes, then read the following.)

Statement:
I am a research student from the University of Hawai'i. I am also Vietnamese. I was born in Bien Hoa and came to America in 1975 when I was five years old with my mother and my brother. I grew up in America (New York State). At the University of Hawaii I am studying Vietnamese culture and use of plants. I am gathering this type of information through interviews with men & women from different generations within each family.

Question:
Would you be willing to participate in this research and allow me to interview you about food plants? A summary of the research will be written in English and Vietnamese; I will give you a copy. Would you be willing to allow me to publish the results of these studies? I will receive no money for the results of this work.

Statement:
If at any time during the course of my research, I ask you questions or ask you to do something that you do not feel is appropriate or makes you feel uncomfortable, please let me know and we will not continue. I want to be respectful of your personal and cultural views.

[Following completion of the survey] Question:
May I visit with you again to conduct the second part of the survey? (If yes, then arrange for a convenient time to return.)

Contact information:
If you have any questions about this research or need to contact me, please reach me at 944-6167.

If you cannot obtain satisfactory answers to your questions or have comments or complaints about your treatment in this study, contact: Committee on Human Studies, University of Hawai'i, 2540 Maile Way, Honolulu, HI 96822. Phone: (808) 956-5007.

APPENDIX D

INFORMED CONSENT HANDOUT – VIETNAMESE VERSION

Thông tin về sự nghiên cứu cho xin thuận. Nguyễn Thị Mỹ Liên

Câu hỏi
Bạn có trẻ nhất là 18 tuổi không? (Thế thì tiếp tục.)
Câu hỏi
Bạn có bằng long cho tôi đọc mấy câu thông tin về sự nghiên cứu của tôi không? (Thế thì tiếp tục.)

Lời tuyên bố:
Tôi là một tiến sĩ học ở trường đại học Hạ Uy Di. Tôi là người Việt. Tôi sinh tại Biên Hoà và rời khỏi Việt Nam trong năm 1975 khi tôi năm tuổi với mẹ và em trai của tôi. Tôi lớn lên ở Mỹ (New York). Ở trường đại học Hạ Uy Di tôi học về phong tục tập quán và cách sử dụng rau cải và trái cây của người Việt. Tôi thu thập tài liệu này bằng cách phỏng vấn những phụ nữ và nam giới ở các lứa tuổi khác nhau.

Câu hỏi:
Bạn có sẵn long tham dự trong sự nghiên cứu này và cho tôi phỏng vấn bạn về rau cải không?
Một bản tóm tắt của sự nghiên cứu này sẽ được viết trong tiếng Mỹ và tiếng Việt; tôi sẽ gởi bạn một bản sao. Bạn có sẵn long cho phép tôi dược đăng trình kết quả của sự học tập này không? Tôi không nhận dược tiền cho những kết quả này.

Lời tuyên bố:
Bất cứ lúc nào trong sự học tập của tôi, nếu tôi hỏi bạn những câu hỏi nào hoặc nhờ bạn làm điều gì bạn không cảm thấy đứng đắn hoặc làm bạn thấy khó chịu, xin cho tôi biết, tôi sẽ ngừng lại. Tôi muốn tôn trọng cái nhìn cá nhân và cái nhìn văn hóa riêng của bạn.

Câu hỏi:
Bạn có bằng long cho tôi gặp lại cho phỏng vấn tiệp tục không? Nếu đươc, xin bạn gọi Mỹ Liên : 944-6167.

Thông tin đến gặp:
Nếu bạn có những câu hỏi về sự nghiên cứu này hoạc cần đến gặp tôi, gọi điện 944-6167.
Nếu bạn không được vừa ý hoạc có những phàn năn về sự nghiên cứu này, gọi điện: Committee on Human Studies, University of Hawai'i, 2540 Maile Way, Honolulu, HI 96822. (808) 956-5007.

APPENDIX E

PRIMARY RESEARCH QUESTIONNAIRE – ENGLISH VERSION

Questionnaire on the food customs and habits of Vietnamese in Honolulu, Hawai'i and Biên Hòa, Vietnam.

Person # _____

A. Demographics:

1. Age:
2. Gender:

Female	Male

3. Home language:
4. Other languages spoken:
5. Place you lived growing up or spent most of your life: write name and circle regions:

	Northern	Southern	Urban	Rural

6. If born in Viet Nam, what year did you leave Vietnam?
7. Age when left Viet Nam:
8. Number of years living in Hawai'i:
9. Other places lived after leaving Vietnam:
10. Occupation in Vietnam:
11. Occupation in Hawai'i:

B. Food plants and habits:

1. What is your favorite food?

2. Please list all the vegetables/leafy greens you can think of.

3. Please list all the fruits you can think of.

4. Please list all the spices and other ingredients for foods you can think of.

5. List the meals (dishes) you associate most with Vietnam.

---

6. Do you cook?

Yes	No

7. Do you cook Vietnamese food?

Never	Rarely	sometimes	often	everyday

8. Does someone else cook Vietnamese food for you? If so, who?

9. If you cook Vietnamese food:

a) What do you cook most often?

b) How did you learn to cook Vietnamese food?

c) Who do you cook for?

d) Do you teach anyone how to cook Vietnamese food? If so, who? If not, why?

10. Where do you get vegetables for Vietnamese food?

Chinatown	American store	Vietnamese friend	Home garden	Friend's garden	other

11. Where do you get fruits for Vietnamese food?

Chinatown	American store	Vietnamese friend	Home garden	Friend's garden	other

12. Where do you get other ingredients for Vietnamese food?

Chinatown	American store	Vietnamese friend	Home garden	Friend's garden	other

13. Which location is most important for you to get Vietnamese food stuffs?

Chinatown	American store	Vietnamese friend	Home garden	Friend's garden	other

14. What is the reason for your choice?

15. How do you know how to select ingredients for Vietnamese food?

16. Do you show anyone how to shop for ingredients for Vietnamese food? If so, who?

---

17. Do you use Vietnamese cookbooks?

Yes	No

18. If yes, why?

19. If yes, cookbooks in which language?

Vietnamese	English	French	Other

20. If no, why?

21. Do you think Vietnamese cookbooks are important for Vietnamese community?

Not Imp.	Little Imp.	Neutral	Important	Very Imp.

22. Would you want to participate in making a Vietnamese cookbook? If yes, in Vietnamese or English?

Yes (Vietnamese)	Yes (English)	No

23. Would you want a Vietnamese food cookbook? If yes, in Vietnamese or English?

Yes (Vietnamese)	Yes (English)	No

APPENDIX F

PRIMARY RESEARCH QUESTIONNAIRE – VIETNAMESE VERSION

Những câu hỏi về phong tục tập quán thức ăn của người Việt tại Honolulu, Hawai'i, và Biên Hòa, Việt nam.

Số ngươi _____

A. Dan số:

1. Tuổi :
2. Giới:

Nữ	Nam

3. Ngôn ngữ thường nói ở nhà:
4. Ngôn ngữ khác ngôn ngữ trên:
5. Nơi lớn lên : Viết tên và đánh vòng tròn

	Miền Bắc	Miền Nam	Thành phố	Vùng quê

6. Năm rời khỏi Việt Nam (VN):
7. Tuổi khi rời khỏi VN.:
8. Ở Hawai'i (HI) bao lâu?:
9. Những chỗ ở khác sau khi rời khỏi VN.:
10. Việc làm ở VN.:
11. Việc làm tại HI.:

B. Phong tục tập quán thức ăn:

1. Thức ăn bạn thích nhất là gì?

2. Xin bạn viết tất cả các loại rau mà bạn nghĩ tới.

3. Xin bạn viết tất cả các thứ trái cây mà bạn nghĩ tới.

4. Xin bạn viết tất cả các đồ gia vị và nguyên liệu nghĩ tới.

5. Món ăn mà bạn nghĩ tới Việt Nam nhất là gì.

---

6. Bạn có nấu ăn không?

Có	Không

7. Bạn có nấu đồ ănViệt không?

Không	Ít khi	Thỉnh thoảng	Thường	Hằng ngày

8. Bạn có ai nấu đồ ănViệt cho bạn không? Ai nấu?

9. Nếu bạn nấu đồ ănViệt::

a) Đồ ăn bạn thường nấu nhất là gì?

b) Tại sao bạn biết nấu?

c) Bạn thường nấu cho ai?

d) Bạn có dạy ai nấu đồ ănViệt không? Dạy ai? Nếu không có dạy ai, tại sao?

10. Bạn thường kiếm rau cho thức ăn Việt ở đâu?

Chợ tàu	Chợ mỹ	Bạn người Việt	Vườn ở nhà	Vườn của bạn	Chỗ khác

11. Bạn thường kiếm trái cây cho thức ăn Việt ở đâu?

Chợ tàu	Chợ mỹ	Bạn người Việt	Vườn ở nhà	Vườn của bạn	Chỗ khác

12. Bạn thường kiếm gia vị cho thức ăn Việt ở đâu?

Chợ tàu	Chợ mỹ	Bạn người Việt	Vườn ở nhà	Vườn của bạn	Chỗ khác

13. Nơi nào quan trọng nhất để bạn có được nguyên liệu Việt?

Chợ tàu	Chợ mỹ	Bạn người Việt	Vườn ở nhà	Vườn của bạn	Chỗ khác

14. Lý do bạn lựa chọn nơi đó?

15. Tại sao bạn biết lựa chọn những nguyên liệu cho thức ăn Việt?

16. Bạn có chỉ ai đi chợ mua những nguyên liệu đó không? Chỉ ai?

---

17. Bạn có dùng những sách chỉ nấu thức ăn Việt không?

Có	Không

18. Nếu có, tại sao?

19. Nếu có, ngôn ngữ của những sách đó.

Việt	Anh	Pháp	Khác:

20. Nếu không dùng, tại sao?

21. Bạn có nghĩ những sách đó quan trọng cho cộng đồng người Việt không?

Không	Ít thôi	Trung lập	Quan trọng	Rất là quan trọng

22. Bạn có muốn đống góp vào việc làm sách học nấu ăn Việt cho cộng đồng người Việt ở Hawai'i không? Nếu muốn, ngôn ngữ tiếng Việt hoặc tiếng Anh?

Muốn (Việt)	Muốn (Anh)	Không

23. Bạn có muốn một cuốn sách học nấu ăn Việt không? Nếu muốn, ngôn ngữ tiếng Việt hoặc tiếng Anh?

Muốn (Việt)	Muốn (Anh)	Không

APPENDIX G

VIETNAMESE FOOD PLANTS WITH VIETNAMESE, ENGLISH, AND FRENCH NAMES

TAXON[a]	Form[b]	Vietnamese[c]	English[d]	French
ALISMATACEAE				
Limnocharis flava (L.) Buchenau	rau	kèo nèo	-	-
ALLIACEAE				
Allium ampeloprasum L. cv. Porrum Gr.	cây	tỏi tây	leek	poireau
Allium cepa L. cv. Aggregatum Gr.	củ	hành ta	shallot	echalotte
"	bông	bông hành	onion flower	-
Allium cepa L. cv. Cepa Gr.	củ	hành tây	onion (bulbs)	oignon
Allium chinense G. Don. f.	củ	củ kiệu	-	-
Allium fistulosum L.	rau t	'hành lá'	green onion, spring onion	ciboule
Allium sativum L.	củ	tỏi	garlic	ail
Allium tuberosum Rottler ex. Sprengl	rau t	'hẹ'	Chinese chives	ail odorant
"	bông	bông hẹ	Chinese chives flowers	-
AMARANTHACEAE				
Amaranthus tricolor L.	rau	rau dền	amaranth	amarante
Amaranthus tricolor L. cv. Splendens	rau	rau dền lua	red amaranth	brède de Madagascar
Beta vulgaris subsp. *vulgaris* L.	củ	dền, dền tím Đà Lạt	beet	betterave
Spinacia oleracea L.	cải	bó xôi (SV)	spinach	épinard
"		'rau dềnh mỹ' (HI)		
ANACARDIACEAE				
Anacardium occidentale L.	hột	điều	cashew nut	noix de caju; anacarde
Mangifera indica L.	trái	xoài	mango	manguier
Spondias cytherea Sonn.	trái	cóc, vì (HI)	hog plum	pomme cythère
Annona muricata L.	trái	mãng cầu xiêm	soursop	corossol

Annona squamosa L.	trái	mãng cầu ta	custard apple, sweet sop	pomme-cannell
APIACEAE				
Anethum graveolens L.	lá	thì là	dill leaves, fennel	fenouil bâtard
Apium graveolens L. var. *dulce* (Miller) DC	rau	cần tâu, cần tây	celery	céleri
Centella asiatica (L.) Urban	rau	rau má	pennywort	-
Coriandrum sativum L.	rau t	'ngò' (SV)	cilantro	coriandre
"		rau mùi (NV)		
Daucus carota L.	củ	cà rốt	carrot	carotte
Eryngium foetidum L.	rau t	'ngò gai' (SV)	thorny coriander	panicaut fétide
"		'mùi tau' (NV)		
Oenanthe javanica DC	rau	cần nước/ta, ngò tàu	Chinese celery	persil séri
APOCYNACEAE				
Aganonerion polymorphum Pierre ex Spire	rau	rau dang (SV)	-	-
"		rau vang (NV)		
ARACEAE				
Colocasia esculenta (L.) Schott	củ	khoai môn (SV)	taro	taro
"		khoai sọ (NV)		
cv. Bun Long	củ	khoai môn tầu/cao	Chinese taro	taro
Colocasia gigantea (Blume) Hook. f.	cộng	bạc hà (SV)	taro petiole	kane thuon
"		dọc mùng (NV)		
ARACACEAE				
Areca catechu L.	trái	cau	betel nut	aréquier
Arenga pinnata (Wurmb.) Merr.	cây	đoát, bụng báng	sugar palm	palmier à sucre
Borassus flabellifer L.	cây	thốt lốt	palmyra palm (sugar)	palmier à sucre
Cocos nucifera L.	trái	dừa	coconut	cocotier
ASPARAGACEAE				
Asparagus officinalis L.	rau	măng tây	asparagas	apserge
ASPHODELACEAE				
Aloe vera (L.) Burm. f.	cây	cây đam, nha đam	aloe vera	-

ASTERACEAE				
Chrysanthemum coronarium L.	rau	tần ô (SV)	chrysanthemum greens	chrysanth. des Jardins
"		cải cúc (NV)		
Cynara scolymus L.	bông	a-ti-sô	artichoke	artichaut
Lactuca sativa L. cv.	rau	xà lách búp (SV)	lettuce (round cv.)	laitue
"		diếp (NV)		
cv.	rau	xà lách gài (SV)	lettuce (long cv.)	laitue
BASELLACEAE				
Basella rubra L.	rau	mồng tơi	Malabar spinach	epinard de Malabar
BIGNONIACEAE				
Cresentia cujete L.	trái	đào tiên	calabash tree	calebrassier
BIXACEAE				
Bixa orellana L.	hột	điều đỏ/nhuộm	anatto seeds	rocouyer
BRASSICACEAE				
Brassica juncea (L.) Czerniak	cải	cải sạy (SV)	mustard cabbage	moutarde indienne
"		'rau cải' (NV)		
cv.	cải	cải bẹ xanh	mustard cabbage (small)	-
Brassica oleracea L.				
cv. Acephala Gr.	cải	cải rỗ	collard	chou cavalier
cv. Alboglabra Gr.	cải	cải dung/nhúng	Chinese kale	chou chinois
cv. Botrytis Gr.	cải	'bông cải', súp lơ	cauliflower	chou-fleur
cv.	cải	'bông cải xanh'	broccoli	-
cv. Capitata Gr.	cải	'bắp cải'	cabbage	chou
cv. Gongylodes Gr.	cải	su-hào	kohlrabi	chou-rave
Brassica rapa L. cv. Chinensis Gr.	cải	cải bẹ-trắng	bok choy (narrow petiole)	chou chinois blanc
cv.	cải	cải thìa	bok choy (broad petiole)	chou chinois
cv.	cải	cải ngọt	choy sum	-
cv. Pekinensis Gr.	cải	cải bắc thảo/bắp dài	Chinese cabbage, won bak	-
Raphanus sativus Bailey cv. Longipinnatus	củ	củ cải trắng	daikon	radis-navet

Rorippa nasturtium-aquaticum (L.) Hayek	cải	cải xaong/soong	watercress	cresson de fontaine
"		xà lách son		
BROMELIACEAE				
Ananas comosus (L.) Merr.	trái	khóm, thơm (SV)	pineapple	ananas
"		dứa (NV)		
CACTACEAE				
Hylocereus undatus (Haw.) Britton & Rose	trái	than long, tường liên	dragon fruit	oeil de dragon
CARICACEAE				
Carica papaya L.	trái	đu đủ, đu đủ xanh	papaya, green papaya	papayer
CLUSIACEAE				
Calophyllum sp. L.	trái	mù-u	Alexander laurel wood	laurier d'Alexandrie
Garcinia mangostana L.	trái	măng cụt	mangosteen	mangoustanier
CONVOLVULACEAE				
Ipomoea batatas (L.) Lamk.	củ	khoai lang	sweet potato	patate douce
"	rau	rau lang/lang đỏ	sweet potato leaves/red lvs	patate douce
Ipomoea aquatica Forrsk cv.	rau	rau muống (hột)	water spinach (seed, land)	liseron d'eau
cv.	rau	rau muống (ruong)	water spinach (paddy)	liseron d'eau
CUCURBITACEAE				
Benincasa hispida (Thunb.) Cogn.	trái	bí đao, bí	white gourd, winter melon	courge
Citrullus lanatus (Thunb.) Matsum & Nakai	trái	dưa hấu, dưa đỏ	watermelon	pastèque
"	trái	dưa hương/hấu non	watermelon (very young)	pastèque
Coccinia grandis (L.) Voigt.	lá	bình bát, bát	-	-
Cucumis melo L. subsp *melo* L.				
cv. Reticulatus Gr.	trái	dưa gang tây	canteloupe	-
Cucumis sativus L.	trái	dưa chuột/leo	cucumber	concumbre
Cucumis sativus (Thunb.) Mak cv. Conomon	trái	dưa gang	melon, yellow-white stripe	melon
Cucurbita maxima Duchesne ex Lam.	bông	bông bí	pumpkin blossoms	courge pepon
Cucurbita moschata Duchesne ex Poir.	trái	bí rợ	pumpkin (Japanese)	giraumon
Cucurbita pepo L.	trái	bí đỏ	pumpkin	courgette

subsp. *pepo* cv. Zucchini Gr.	trái	bầu tây	zucchini	-
Lagenaria siceraria (Mollina) Standley	trái	bầu	bottle gourd	courge bouteille
"	lá	lá bầu	bottle gourd leaves	-
Luffa acutangula (L.) Roxb.	trái	mướp khía	ridged gourd, sing-kwa	papengaye
Luffa aegyptiaca Miller	trái	mướp hương	sponge gourd, loofah	eponge végétale
Momordica charantia L.	trái	khổ qua(SV)	bitter melon, balsam pear	margose amère
"		mướp đắng(NV)		
Momordica cochinchinensis (Lour.) Sprengel	trái	gấc	-	muricie
Sechium edule (Jacq.) Swartz	trái	su su, chu chu	chayote	cheyotte
Trichosanthes cucumerina L.	trái	mướp tây	snake gourd	serpent végétal
Zehneria indica (Lour.) Keyr.	trái	chùm thắng/trắng	-	-
DIOSCOREACEAE				
Dioscorea alata L.	củ	khoai mơ/tím	yam (purple inside)	igname
Dioscorea esculenta (Roxb.) Prain & Burkh	củ	khoai từ	yam (lesser -)	-
Dioscorea kratica Prain & Burkh	củ	khoai mọi	yam cv.	-
EBANACEAE				
Diospyros kaki L.f.	trái	hồng	persimmin	kaki
EUPHORBIACEAE				
Manihot esculenta Crantz	củ	khoai mì	cassava	manioc
Phyllanthus acidis (L.) Skeels.	trái	chùm ruột	otaheite gooseberry	groseille-étoile
Sauropus androgynus (L.) Merr.	rau	bồ ngót	-	-
FABACEAE				
Arachis hypogaea L.	đậu	đậu phộng (SV)	peanut	archide
"		'đỗ lạc' (NV)		
Erythrina variegata L.	lá	vông nem	Indian coral tree	-
Glycine max (L.) Merr.	đậu	đậu nành	soy bean	soya
Neptunia prostrata (Lam.) Baillon	rau	rau ngúc/ngút	neptunia	neptunie potagère
Pachyrhizus erosus (L.) Urban.	củ	củ sắn (SV)	yambean tuber	dolique bulbeuse
"		củ đậu (NV)		

Phaseolus vulgaris L.	đậu	đậu ve/cô ve	French bean	haricot vert
Pisum sativum L.	đậu	đậu petit pois/hòa lan	pea	petit pois
Pisum sativum L. var. *macrocarpon* Serr.	đậu	đậu tí bo	snap peas (podded)	petit pois
Psophocarpus tetragonolobus (L.) DC	đậu	đậu rồng	winged bean	pois carre
Pueraria montana (Lour.) Merr.				
var. *lobata* (Willd.) Maesen & S. Almeida	củ	cát căn (SV)	kudzu	koudzou
"		sắn dây (NV)		
Sesbania grandiflora (L.) Pers.	bông	bông so đũa	sesban	sesbanie
Sesbania sesban (L.) Merr.	bông	bông điên điển	Indian sesbania	-
Tamarindus indica L.	trái	me (chua)	tamarind (sour)	tamarinier
"	trái	me (ngọt)	tamarind (sweet)	tamarinier
"	lá	lá me	tamarind leaf shoots	-
Vicia faba L.	đậu	đậu tâu-kê/răng-ngựa	broad bean	fève
Vigna angularis (Willd.) Ohwi & Phashi	đậu	đậu đỏ, đậu đen	adzuki beans (red, black)	doliques (pourpre, noir)
Vigna radiata (L.) R. Wilczek	đậu	đậu xanh	mung bean	haricot mungo
"	rau	giá	mung bean sprouts	-
Vigna unguiculata (L.) Walp.				
subsp. *sequipedalis* (L.) Verdc.	đậu	đậu đũa	yard long beans	dolique asperge
Vigna unguiculata (L.) Walp.	đậu	đậu trắng	cowpeas (black-eyed peas)	doliques blanc
HEMEROCALLIDACEAE				
Hemerocallis fulva (L.) L.	bông	kim châm (SV)	lily buds	hémérocalle
"		'hoa hiên' (NV)		
ILLICIACEAE				
Illicium verum Hook f.	bông	đai hồi thật, mác hồi	Chinese star anise	anis étoilée
"		bong phở (HI)		
IRIACEAE				
Eleutherine subaphylla Herbert	củ	sâm đại hành, tỏi đỏ	red garlic	-
LAMIACEAE				
Elsholtzia ciliata (Thunb.) Hylander	rau t	'kinh giới'	Vietnamese perilla	-

Mentha aquatica L.	rau t	'húng lũi'	creeping or water mint	menthe
Mentha arvensis L.	rau t	'húng cây'	corn-mint	menthe
Ocimum basilicum L.	rau t	'húng quế', 'rau quế'	Asian/Thai basil	basilic
"	hột	hột é	Asian/Thai basil seeds	graines de basilic
Perilla fructescens (L.) Britton.	rau t	'lá tiá tô'	perilla, chiso	pérille
Plectranthus amboinicus (Lour.) Sprengel	lá	lá cân dày	plectranthus	aromate des Javanais
LAURACEAE				
Cinnamomum aromaticum Nees	cây	quế đơn	Chinese cinnamon	cannelle de Chine
LYTHRACEAE				
Punica granatum L.	trái	lưu	pomegranate	grenadier
MALPIGHIACEAE				
Malpighia glabra L.	trái	sơ ri	Barbados cherry	moureiller
MALVACEAE				
Abelmoschus esculentus (L.) Moench	đậu	đậu bắp	okra	gombo
Corchorus olitorius L.	rau	rau đây/bố/đai	Jew's mallow, Tossa Jute	corète potagère jute
Durio zibethinus Murray	trái	sầu riêng	durian	durion
Muntingia calabura L.	trái	trái trứng cá, mật sâm	calabura, jamaica cherry	-
Theobroma cacao L.	cây	ca-cao	ca-cao tree	cacaoyer
MARANTACEAE				
Maranta arundinaceae L.	củ	huỳnh tinh, bình tinh	West Indies arrowroot	arrow-root
MELIACEAE				
Lansium domesticum Corr. Serr.	trái	bòn bon	langsat	rambai
MENISPERMACEAE				
Cyclea peltata (Lamk.)Hook f. & Thomson	lá	sâm nam, dây sâm	-	-
MORACEAE				
Artocarpus altilis (Z.) Fosb.	trái	xa kê	breadfruit	arbre-à-pain
Artocarpus heterophyllus Lamk.	trái	mít (ước, ráo)	jackfruit (wet & dry cvs.)	jacquier
Artocarpus integer (Thunb.) Merr.	trái	mít tố nữ	champedak	jacquier champeden
MORINGACEAE				

Moringa oleifera Lam.	trái	chùm-ngây	moringa, horse-radish tree	noix de baha
MUSACEAE				
Musa sp. L.	bông	'bắp chuối' (SV)	banana blossom	banane
"		'hoa chuối' (NV)		
cv.	trái	chuối chát	banana, astringent cv.	banane-astringente
cv.	trái	chuối chà bột	banana cv.	banane cv.
cv.	trái	chuối sắp	banana, cooking cv.	banane cv.
Musa acuminata X *balbisiana* Colla.	trái	chuối cau (SV)	banana, lady finger cv.	banane-arec
"		chuối ngự (NV)		
cv.	trái	chuối sự	banana, angled cv.	banane cv.
cv.	trái	chuối già (SV)	banana, large-green cv.	banane-digestible
"		chuối tiêu (NV)		
Musa balbisiana Colla.	trái	chuối hột	banana, seeded cv.	banane cv.
Musa X *paradisiaca* L.	trái	chuối pom	banana, apple cv.	banane-pomme
MYRTACEAE				
Psidium guajava L.	trái	ổi	guava	goyavier
Syzigium aromaticum (L.) Merr. & Perry	bông	đinh hương	clove	clou de girofle
Syzygium samarangense				
(Blume) Merr. & Perry	trái	mận	water apple	jamerose
NELUMBONACEAE				
Nelumbo nucifera Gaertner	củ	củ sen	lotus root	rhizomes de lotus
"	hột	hột sen	lotus seeds	graines de lotus
"	lá	lá sen	lotus leaf	feuille de lotus
"	ngó	ngó sen	lotus shoot	
Nymphaea pubescens Willd.	bông	bông súng	night lotus	nénephar
OXALIDACEAE				
Averrhoa carambola L.	trái	khế	star fruit, carambola	carambolier
Oxalis sp. L.	lá	me đất	sorrel	surelle
PANDANACEAE				

Pandanus amaryllifolius Roxb.	lá	lá dứa, dứa thơm	scented pandanus	-
PASSIFLORACEAE				
Passiflora edulis Sims.	trái	chùm bao trứng	passion fruit	grenadille
PEDALIACEAE				
Sesamum orientale L.	hột	mè (SV)	sesame seeds	sésame
"		vùng (NV)		
PIPERACEAE				
Peperomia pellucida (L.) Kunth.	rau	càng cua	peperomia	-
Piper betle L.	lá	trầu	betel leaf	bétel
Piper lolot C DC	lá	lá lốt	lolot leaf	poivre lolot
Piper nigrum L.	hột	tiêu	pepper	poivier
PLANTAGINACEAE				
Plantago major L.	lá	mã đày	plantain	plantain des oiseaux
POACEAE				
Bambusa spp. Schreb.	cây	măng tre	bamboo shoots (species)	pousses de bambou
Gigantochloa spp. Kurz.	cây	măng tre	bamboo shoots (species)	pousses de bambou
Phyllostachys spp. Siebold & Zucc.	cây	măng tre	bamboo shoots (species)	pousses de bambou
Coix lacryma-jobi L.	hột	bô bô	Job's tears	larmes de job
Cymbopogon citratus (DC) Stapf	cây	sả	lemon grass	citronelle
Oryza sativa L.	cây	lúa	paddy rice	riz
"	hột	gạo	rice (dehusked)	riz
Oryza sativa L. cv. *glutinous*	cây	lúa nếp	paddy glutinous rice	riz gluant
"	hột	gạo nếp	glutinous rice (dehusked)	riz gluant
Saccharum officinarum L.	cây	mía	sugar cane	canne à sucre
Triticum sp. L.	cây	lúa-mì	wheat	blé
Zea mays L.	trái	bắp (SV)	corn	Mais, blé d'Amérique
"		ngô (NV)		
POLYGONACEAE				
Persicaria odorata (Lour.) Soják	rau t	rau răm	Vietnamese mint	renouée, persicaires

ROSACEAE				
Fragaria ananassa (Duchesne) Duchesne	trái	dâu, dâu tây/Đà Lạt	strawberry	frasier
Malus domestica Borkh.	trái	pom, táo tây	apple	pommier
Pyrus communis L.	trái	lê	pear	poirier
Pyrus pyrifolia (Burmf.) Nakai	trái	lê trung quốc	Chinese pear	poitier de chine
RUTACEAE				
Citrofortunella microcarpa (Bunge) Wijnands	trái	tắc	kimquat	calamondin
Coffea sp. L.	hột	cà-phê	coffee	café
Morinda citrifolia L.	trái	nhàu	Indian mulberry	motinde
Paederia scandens (Lour.) Merr.	lá	lá mơ/thui đít	-	-
Aegle marmelos (L.) Corr. Serr.	trái	bầu nâu, mấm	Indian bael fruit	oranger du Malabar
Citrus hystrix DC	lá	lá chanh	kaffir lime leaves	-
Citrus maxima (Burm.) Merr.	trái	bưởi	pomelo	pamplemousse
Citrus reticulata Blanco	trái	quít xiêm	tangerine (Thailand cv.)	mandarinier
Citrus sinensis (L.) Osbeck	trái	cam	sweet orange	oranger
Citrus X *nobilis* Lour.	trái	cam sành	king orange	roi-de-siam
Citrus X *aurantiifolia* (Christm.) Swingle	trái	chanh	lime	limettier
Citrus X *limon* (L.) Osb.	trái	chanh tây	lemon	citron
SAPINDACEAE				
Dimocarpus longan Lour.	trái	nhãn (-tiêu/da bò)	longan (cvs.)	longanier
Litchi chinensis Sonn.	trái	vải	litchi	ltchi
Nephelium lappaceum L.	trái	chôm chôm	rambutan	litchi chevelu
SAPOTACEAE				
Chrysophyllum cainito L.	trái	vú sữa	star apple	cainitier
Manilkaria zapota (L.) P. Royen	trái	xa bô chê	sapotillo	sapotillier
Pouteria campechiana (Kunth) Baehni	trái	trái trứng gà	egg fruit, canistel	-
SAURURACEAE				
Houttuynia cordata Thunb.	rau t	'giấp cá'	lizard's tail herb	-
SCROPHULARIACEAE				

Bacopa monnieri (L.) Wettst.	rau	rau đắng	water hyssop	-
Limnophila chinensis				
subsp. *aromatica* (Lam.) Yamazaki	rau t	'ngò om', 'rau om'	rice paddy herb	-
SOLANACEAE				
Capsicum annuum var. *annuum* L.				
cv. *Grossum* Gr.	trái	ớt ngọt/Đà Lạt	sweet peppers	poivre rouge/vert
cvs. *Conoides, Fasciculatum, Longum* Gr.	trái	ớt	chili peppers	piment
Lycium chinensis Miller	cây	câu khởi/ky	matrimony vine	lyciet
Lycopersicon esculentum Miller	trái	cà chua/tô mách	tomato	tomate
Solanum melongena L.	trái	cà dái dê, cà tím	eggplant (purple)	aubergine
Solanum torvum Swartze	trái	cà pháo	pea or Thai eggplant	aubergine viêtnamienne
Solanum tuberosum L.	củ	khoai tây/Đà lật	white potato, red potato	pomme de terre
THEACEAE				
Camelia sinensis (L.) Kuntze	lá	trà (xanh) (SV)	tea (green)	théier
"		ché (NV)		
VITACEAE				
Vitis sp. L.	trái	nho	grapes	vigne
ZINGIBERACEAE				
Alpinia galanga (L.) Swartze	củ	riềng nếp	galanga (larger)	galanga (grand)
Alpinia officinarum Hance	củ	riềng	galanga	galanga (petit)
Curcuma longa L.	củ	nghệ	turmeric	safron des Indes
Zingiber officinale Roscoe	củ	gừng	ginger	zingembre
FUNGI				
AURICULARIACEAE				
Auricularia auricula TJV	nấm	nấm mèo (SV)	tree-ear fungus	champignons cv.
"		mộc nhĩ (NV)		
PLEUROTACEAE				
Lentinus edodes (Berk.) Singer	nấm	nấm đông cô	shitake mushroom	champignons cv.
PLUTEACEAE				

Volvariella volvacea Singer & Wasser	nấm	nấm rơm	straw mushroom	champignons cv.

[a] A " = the same species is used in a different form and/or with a different vernacular name.
"cv." or "cvs." = a different cultivar of that species.
"Gr." = Group. This term is applied to names of cultivars.

[b] Form = plant form or structure utilized, or type of use, and the generic rank of the Vietnamese vernacular name. For example, *Limnocharis flava*, has the form **rau** and the specific name **keo neo**. The Vietnamese binomial is then **rau keo neo**, but the plant can be referred to by only the specific **keo neo**. Where form and Vietnamese name must be used together to refer to the plant, the form name is repeated in the Vietnamese name listing (e.g., form: **bông**, Vietnamese: **bông hành**, must be used together to mean onion flowers). See Appendix B for explanation of form terms.

[c] Vernacular name differences by region denote by: "NV" = northern Vietnam, "SV" = southern Vietnam, "HI" = Hawai'i.
Names surrounded by 'single quotes' are used as is without attachment of a form term.
Names appearing with a slash '/' = either names occur with first name (e.g., **cần nước/ta** = plant is called **cần nước** or **cần ta**).

[d] " - " = no English or French name found in the references used.

APPENDIX H

PUBLISHED MANUSCRIPT OF CHAPTER 4

Nguyen, M.T. 2003. Comparison of food plant knowledge between urban Vietnamese living in Vietnam and Hawai'i. *Economic Botany* 57(4):472–480.

The publication occupies the following pages 142-150 of this dissertation.

COMPARISON OF FOOD PLANT KNOWLEDGE BETWEEN URBAN VIETNAMESE LIVING IN VIETNAM AND IN HAWAI'I

MY LIEN T. NGUYEN

Nguyen, M.T. (Department of Botany, University of Hawaii, 3190 Maile Way, Honolulu, HI, 96822; Email: mylien@hawaii.edu). COMPARISON OF FOOD PLANT KNOWLEDGE BETWEEN URBAN VIETNAMESE LIVING IN VIETNAM AND IN HAWAI'I. *Economic Botany 57(4):472–480, 2003.* *Ethnographic interviews using photographs of 10 traditional Vietnamese fruits and vegetables were used to compare the knowledge level and use of traditional food plants between Vietnamese in urban Bien Hoa, Vietnam, and in Honolulu, Hawai'i. In both communities, there was a positive correlation between age and knowledge (as measured by correct identification, and number of food uses for the plants). Vietnamese immigrants in Hawai'i listed more food uses than those in Vietnam due to adoption of multi ethnic foods found in Honolulu.*

So sánh sự hiểu biết về rau quả của người Việt sống ở thành phố ở Việt Nam và Hạ Uy Di. Cách phỏng vấn dùng những tấm hình về mười loại rau quả truyền thống của người Việt cho so sánh sự hiểu biết và cách dùng về thức ăn thực vật truyền thống của người Việt ở thành phố Biên Hoà, Việt Nam và Honolulu, Hạ Uy Di. Cả hai cộng đồng người có tuổi có nhiều sự hiểu biết hơn người trẻ tuổi (đo lường nhận ra và boa nhiêu cách dùng cho thực vật). Người nhập cư Việt ở Hạ Uy Di biết những thức ăn cách dùng nhiều hơn người sống ở Việt Nam vì chưng tiếp thu thêm được những thức ăn của các văn hóa ở Honolulu.

Key Words: urban ethnobotany; immigrants; Vietnamese; Hawai'i; fruits; vegetables; food plant knowledge; plant photographs.

On May 3, 1975, I escaped from Vietnam with my mother, younger brother, and my uncle. Saigon had fallen. Since 1975, approximately 600 000 Vietnamese refugees have likewise immigrated to the United States.

Though I was raised in upstate New York, growing up with my mother, I spoke, ate, and lived Vietnamese at home (as much as one can in a transplanted culture). As culture is not genetic, but rather learned and personalized (McClatchey 1999), I now understand how significant that was as an immigrant child to developing my traditional Vietnamese knowledge. However, though many fresh herbs and vegetables used in our cooking were available in the Asian food stores of upstate New York, most of the fruits were not, i.e., *Litchi sinensis* Sonn. and *Garcinia mangostana* L. Thus, my experience of Vietnamese or Southeast Asian fruits was usually from canned or processed sources. That all changed when I moved to Honolulu to attend the University of Hawai'i. Visiting the produce markets of Honolulu's Chinatown district, I saw for the first time, the fruits I grew up eating from cans being sold fresh in all their glorious shapes and colors. Furthermore, although it is called "Chinatown," I saw a large presence of Vietnamese shoppers and vendors and repeatedly found myself conversing with them in Vietnamese. They have educated me about the names and uses of many of the plants—often being able to give only the Vietnamese names. After living and shopping in this community since August 1999, I have come to understand that it is a common perception among residents of Honolulu that the Vietnamese have displaced many Chinese vendors and have made many Vietnamese herbs and vegetables available where once they were not. In fact, Kuebel and Tucker (1988) credit the Vietnamese for introduction or increased availability of twenty to thirty taxa of plants to the United States.

Persistence of traditional foods is a powerful symbol in the maintenance of ethnic identity and cultures (Kalick 1978). Modernization of traditional cultures results in the modification of indigenous knowledge systems as people move away from traditional ways and adopt foreign

ideals (Balick and Cox 1996). Indigenous knowledge includes knowledge of traditional foods. In the wake of unprecedented world development, careful yet expeditious studies of indigenous knowledge are imperative to biological and cultural diversity (Cox 1997). This is crucial in Vietnam due to the new market opportunities and the people's desire for culturally foreign items. It is an equally important issue among populations that have immigrated from their home countries. This has been investigated for Iranian (Ghaffrarian 1998), Korean and Vietnamese immigrants in the United States (Pyke 2000), Portuguese immigrants in Canada (Lanca et al. 1994), and Vietnamese immigrants in Australia (Marino, Stuart, and Minas 2000). The process of acculturation reduces traditional cultural traits such as usage of ethnic foods (Airriess and Clawson 1994).

Although ethnic food traditions are among the cultural traits most resistant to change (Airriess and Clawson 1994; Kalick 1978), acculturation still affects the Vietnamese in the United States. While older Vietnamese people still prefer a traditional diet, many parents complain that their children eat poorly, preferring western fast foods with few fruits and vegetables (Internet site "ethnomed"). Immigrant children acculturate faster than older immigrants (Ghaffrarian 1998) and quickly adopt American standards (Pyke 2000).

What is a traditional Vietnamese food plant? For example, *Capsicum fructescens* L., is native to the Americas, but since its introduction to Southeast Asia, it has become incorporated into and now is an indispensable ingredient in Vietnamese, and many other Southeast Asian cuisines. Without the chili, there would be no *nuớc chấm,* the fermented fish sauce and chili blend that is as ubiquitous as rice in Vietnamese cuisine. Thus, in this investigation, I define traditional Vietnamese food plants as those my mother introduced to me as a young child as being Vietnamese and which are characteristically found in Vietnamese food and cookbooks.

Ethnobotanical issues in Vietnam are understudied, yet needed (Donovan et al. 1997). There have been few studies of the Vietnamese in Hawai'i (Barker 1977; Ferguson 1979; Nguyen 1977). Although these studies investigate some social status variables of the Vietnamese immigrants in Hawai'i, there are no ethnobotanical discussions. In fact, there have been no exhaustive surveys of plants used by the Vietnamese community in Hawai'i, nor of those available in the markets of Chinatown. Reports on Asian food plant use in Hawai'i are available for individual plants (Staples and Woolliams 1996), as brief accounts in popular local newspapers (Kendrick 1999), telecasts (KHET 1999), tourist guides (Carter 1988), and in ethnic culinary guides (Bonk 1993; Staples and Kristiansen 1999). More extensive surveys of Chinese and Japanese utilization of food plants in Hawai'i have been completed but are outdated (Chung and Ripperton 1929; Miller 1933). In view of the changes to Vietnamese traditional knowledge, I compared current food plant knowledge within and between urban Vietnamese living in Vietnam with those in Hawai'i. Knowledge was measured as the ability to identify and list uses of fruits and vegetables that are used in traditional Vietnamese cuisine. Additionally, the effect of immigration on knowledge was analyzed for the Vietnamese in Hawai'i.

Study Sites

This research was conducted in Bien Hoa, Vietnam during July 2000 and Honolulu, Hawai'i, from April 2000 through January 2001. Bien Hoa is in southern Vietnam, approximately 30 kilometers north of Ho Chi Minh City (formerly Saigon). Many Vietnamese that immigrated to the United Stated, including those in Honolulu, are originally from southern Vietnam (Nguyen 1977).

In 1975, the Vietnamese population in Hawai'i increased from almost none to over 2500 (Nguyen 1977). According to 2000 population census, there were approximately 7900 Vietnamese people living in Hawai'i (U.S. Census Bureau 2001), the majority residing in Honolulu (ca. 6000).

Many Vietnamese have expressed the importance of the availability of Vietnamese food plants to their well being and satisfaction of living in Hawai'i. The Asian markets offer a source for traditional vegetables (Hutton 1996). Besides the Chinatown markets, many food plants that are used in Vietnamese cuisine are sold in Honolulu's mainstream commercial and farmer's produce markets, and grown in home and community gardens (Staples and Kristiansen 1999).

Methodology

In order to have identical plants used for the interviews in Vietnam and Hawai'i, rather than

RECEIVED AS FOLLOWS

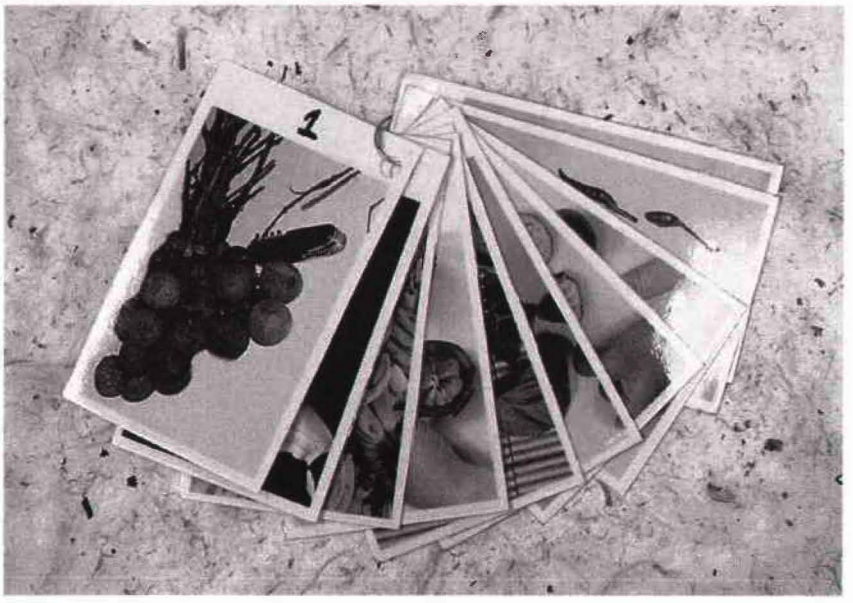

Fig. 1. Food plant photo card set used for interviews.

using fresh specimens, a plant photo card set was produced (Fig. 1). Only ten fruits and vegetables (Table 1) were used to prevent interviewee fatigue and loss of interest, much as ten plants were also used in a photo card set for a study in Thailand by Wester and Yongvanit (1995). The following criteria were used to choose the plants: 1) Availability in both study sites; 2) Example with many varieties (i.e., *Musa* sp.), to compare ability to name varieties; 3) Inclusion of leafy vegetables (*Perilla* sp., *Piper* sp.); 4) Plants usually seen cut or processed, rather than whole (*Phyllostachys* sp.); 5) Very common and less common (based on observed availability in Chinatown, Honolulu, produce markets). Additionally, Vietnamese cookbooks (Ngo and Zimmerman 1979; Trieu 1998) and tropical fruit and vegetable books (Eiseman 1988; Hutton 1996) were used to check the plant use and availability in the two sites.

Plants used in the study were found in the produce markets of Chinatown, Honolulu, and photographed using a SONY Cyber-shot 3.3 megapixel digital camera. Some plants were photographed whole, while others were cut in cross or long section to display different views (Fig. 2). The picture set was produced by printing the photographs on a Hewlett Packard (HP) DeskJet

TABLE 1. PLANT SPECIES USED IN PHOTO CARDS FOR INTERVIEWS.

Botanical name	Family	Vernacular name (Vietnamese, English)
Litchi sinensis Sonn.	Sapindaceae	vải, litchee
Mangifera indica L.	Anacardiaceae	xoài, mango
Musa acuminata Colla × *balbisiana* Colla	Musaceae	chuối, banana
Garcinia mangostana L.	Guttiferae	măng cụt, mangosteen
Perilla frutescens (L.) Britton	Labiatae	lá tía tô, perilla
Piper lolot C. DC.	Piperaceae	lá lốt, betel leaf
Nelumbo nucifera Gaertn.	Nymphaeaceae	củsen, lotus root
Solanum melongena L.	Solanaceae	cà tím, eggplant
Capsicum frutescens L.	Solanaceae	ớt, chilies
Phyllostachys sp.	Poaceae	măng, bamboo shoots

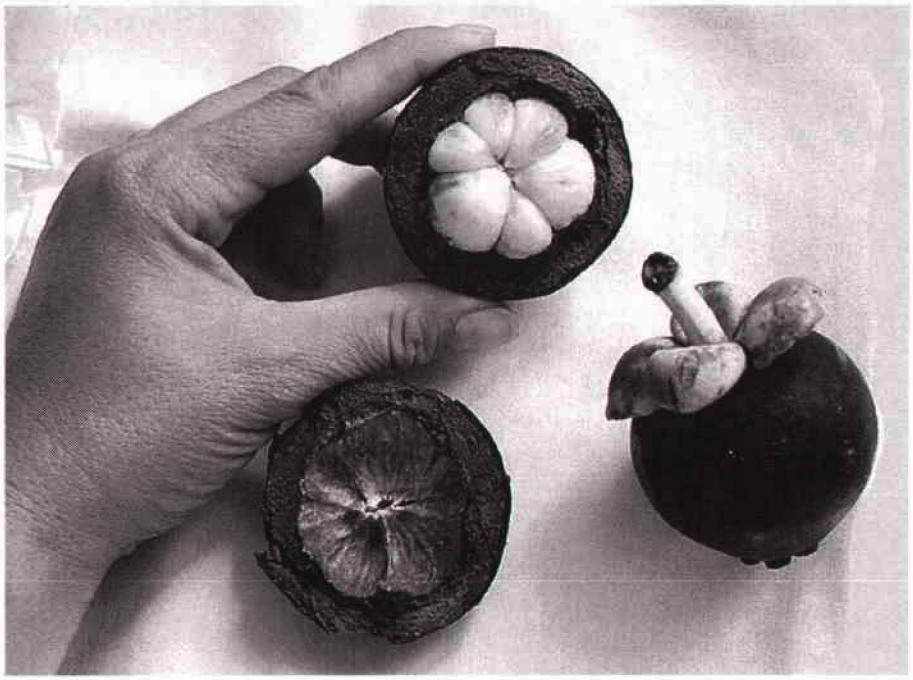

Fig. 2. Photo card example showing fruit of *Garcinia mangosteen* (cross section) to display different views.

932C printer, using HP premium photo glossy paper, to 5.5 cm. × 9.0 cm. size, on a picture card of 6.0 cm × 10.5 cm size, numbered 1 through 10, laminated, hole punched, and attached with a ring. Due to the nature of specimens used in this study (photographs as opposed to actual specimens), food plant pictures were printed to produce herbarium specimens and are deposited in the herbarium of the University of Hawai'i at Manoa (HAW).

Informed consent (Alexiades 1996) was obtained prior to all interviews using an informed consent statement that was provided in Vietnamese and in English (Appendix). Structured plant interviews were conducted in Vietnam and Hawai'i with informants introduced through family, friends, referrals by those previously interviewed, or solicited randomly through the University of Hawai'i telephone directory. The age and sex of all informants were recorded. For Vietnamese immigrants in Hawai'i, the name of the area where they originally lived in Vietnam, and the year and their age when they left Vietnam was recorded. With consent, interviews (Spradley 1979) were recorded on audiotape using a hand held SONY tape-recorder with Maxell UR, Type 1 90 minute tapes. Each interviewee was shown the standard set of food plant photographs and asked a set of questions pertaining to each plant. Responses were recorded in Vietnamese or English depending on the language used by the interviewee. Questions and pictures were tested in trial interviews with eight Vietnamese from Hawaii. These data are not included in the final analysis.

Responses for plant identification were determined to be correct if the interviewee gave either the Vietnamese or English common name, including different variety name(s), for the plant. These names were cross-checked in various plant and food books (Eiseman 1988; Hutton 1996; Nguyen 1993; Staples and Kristiansen 1999; Trieu 1998). Interview data were analyzed using the SPSS 7.5 for Windows Student Version graphing and statistical program.

Results

The results represent interview data from 40 people in Vietnam and 33 people in Hawai'i. Interviewees were grouped by age range for data analysis. There were no interviewees between the ages of 20–29 from Vietnam. Results of cor-

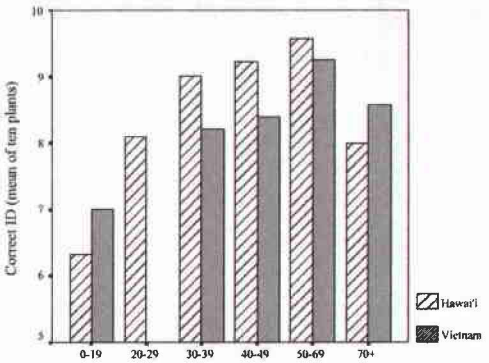

Fig. 3. Correct plant identification by age groups of Hawaii versus Vietnam-based interviewees.

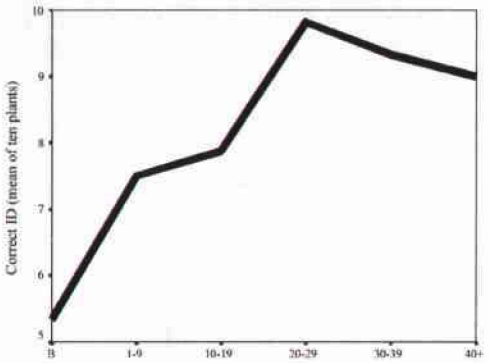

Fig. 5. Ability of Vietnamese in Hawaii to identify plants versus their age at the time they left Vietnam.

rect plant identification by age group are shown in Fig. 3. Data from Hawai'i and Vietnam show a positive correlation between age and ability to correctly identify the plants, excluding the oldest age group 70+.

Figure 4 displays results showing number of food uses identified by age group. Interviewees from Hawai'i identified a greater number of food uses for the plants than persons in the Vietnam group. In general, the correlation between age and plant usage is similar to that observed for age and plant identification, except for high number of responses from persons between 40–49 from Vietnam.

For Vietnamese immigrants in Hawai'i, Fig. 5 displays the relationship between the age when the interviewee left Vietnam and the number of plants they identified correctly. The arrival age category of "B" denotes interviewees born in Hawai'i. Persons who immigrated to the United States as adults (greater than age 20) most correctly identified the plants compared with those who were born in the U.S. or immigrated as children or teenagers.

Figure 6 shows the relationship between the percentage of life spent by the interviewee in the United States and their ability to identify the plants. In this comparison, persons who lived less than 30% of their lives in the United States could identify almost all ten plants. This average dropped progressively as the percentage of life spent in the United States increased.

Fig. 4. Number of food uses identified by age groups of Hawaii versus Vietnam-based interviewees.

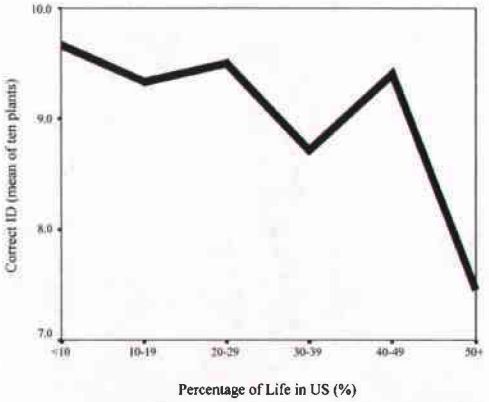

Fig. 6. Ability of Vietnamese in Hawaii to identify plants versus the percentage of life lived in the United States. Greater percentage = longer residence in the U.S.

Discussion

Selection of Plants

Due to the subjective nature of the plant selection used in this study it is likely that a different researcher would produce a different set of food plants. Informants from different regions of Vietnam or the United States might discuss different plants familiar or important to them in their unique environment. The list of plants used in this study is not exhaustive of those deemed important to Vietnamese cuisine, but it is a starting point.

Plant Knowledge in Bien Hoa, Vietnam

The results show that the level of traditional food plant knowledge among Vietnamese in Bien Hoa varies regarding ability to identify and recall uses of the plants. Persons in the age group 50–69 correctly identified all ten plants most often. This group also identified the highest number of varieties for *Musa acuminata* × *balbisiana, Mangifera indica, Capsicum fructescens,* and *Phyllostachys* sp. However, individuals in the age group 40–49 identified the highest number of uses for each plant. Two factors could contribute to this. Firstly, persons in the 40–49 age group most often had families for which they prepared meals. Thus, they are practicing their knowledge and perhaps actively acquiring new knowledge. Secondly, this group includes men and women who participated in wars in Vietnam and Cambodia. During these wars, poverty, survival in the jungles, and a lack of food forced them to learn more uses for food plants that were available. It is interesting to note that the eldest age group did not have the greatest knowledge. This could be due to their inactivity in acquiring and preparing foods as seniors in households. Additionally, there were individuals in this group who had difficulty identifying the plants on the photo cards due to poor eye sight.

Plant Knowledge in Honolulu, Hawai'i

Similar to the results in Vietnam, persons 50–69 years old in Hawai'i scored highest in plant identification. This group also provided the greatest number of uses for the plants. The age group 30–39 year old reported fewer food uses than the younger 18–29 year olds. This differs from the Vietnam data, which showed the group younger than 30 years old reporting fewer food uses.

Immigration and Traditional Knowledge

It is interesting to note that the Vietnamese in Hawai'i reported a greater number of food uses over the group in Vietnam. Based on literature describing acculturation among immigrants, this was an unexpected result. The Hawai'i group reported uses that were seldom mentioned in Vietnam. In particular were food uses of pickling, drying, and making of desserts. This illustrates that the Vietnamese in Hawai'i have retained food uses similar to those in Vietnam (traditional) and have adopted new uses they encountered in Hawai'i. Adoption of new food habits was also observed by Story and Harris (1989) among Cambodian and Hmong immigrants and by Grivetti and Paquette (1978) among Chinese immigrants. Alternatively, the Vietnamese in Hawai'i may have added a greater variety of uses as their standard of living improved, known as income elasticity of demand in economic theory (Kohler 1990).

It has been shown that acculturation is greater in younger versus older immigrants (Ghaffrarian 1998; Marino et al. 2000). The results comparing the ability to identify plants versus the age at leaving Vietnam indicate that persons who left Vietnam when they were adults (> age 20) had obtained enough knowledge of the food plants in Vietnam to identify the plants more correctly than those who immigrated in their youth (Fig. 5). The data also suggests that the younger Vietnamese show greater acculturation, as defined by their lower correct identification means.

Acculturation is positively correlated with the amount of time an individual has been exposed to the host country's customs and habits, increased acculturation being proportional to the increased time in host country (Marino, Stuart, and Minas 2000). Rather than length of residence in the United States, the percentage of the interviewee's life spent in the United States was computed to take into account their different ages at the beginning of residence in the United States. In this case, the comparison of percentage of life spent in the United States vs. correct plant identification (Fig. 6), suggests that the longer the Vietnamese has lived in the United States, the lower their ability to identify the food plants.

Conclusions

This study illustrates a positive correlation between age and the ability to identify a group of

fruits and vegetables among southern Vietnamese who live in Bien Hoa, Vietnam and those who immigrated to Honolulu, Hawai'i. The results are surprising in that the Vietnamese in Hawai'i list more food uses for the given plants than those in Vietnam. This is possibly due to adoption of different cultural influences or greater availability of choices as a result of a higher standard of living. Airriess and Clawson (1994) and Pyke (2000) point to immigration as a contributing factor for a decrease in traditional food plant knowledge and acculturation. However, due to the negative connotation of acculturation, in this study of the Vietnamese immigrants in Hawai'i, I reject this conclusion and the term acculturation. Instead, the Vietnamese immigrants in Hawai'i have demonstrated an adoption (Story and Harris 1989) and continuity of their culture to a new environment; particularly in Hawai'i, where one finds blending of traditional knowledge from many ethnicities and cultures including Asian, Pacific, and American.

I believe this study has shown the use of plant photographs to be applicable in plant identification interviews when a control plant group is needed between distant study groups. In future studies, the use of a magnifying glass (or larger pictures) for those elders in Vietnam with poor eyesight would be helpful. Furthermore, as people are more accustomed to seeing and holding fresh plant material, instead of pictures of food plants, the use of fresh plants may generate different results.

Given that urban ethnobotany is often supported by the community because it maintains and gives value to cultural ties (Balick et al. 2000), an extensive survey of plants used by the Vietnamese community and available in Chinatown would contribute to the conservation of traditional knowledge not only of the Vietnamese, but also of other ethnic groups in Honolulu. This work also has applications for in situ conservation of food plants within their cultural environmental setting (Miller 1933, Wester and Yongvanit 1995).

Acknowledgments

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APPENDIX

INFORMED CONSENT STATEMENT (VIETNAMESE):

Tôi là một tiến sĩ học ở trường đại học Hạ Uy Di muốn tìm hiểu về cách sự dụng rau cải và trái cây của người Việt Nam. Tôi hiện đang làm việc tại tiểu bang Hạ Uy Di và Việt Nam để nghiên cứu về cây trái cùng những cách dùng thuần túy. Tôi muốn học hỏi về sự hiểu biết của ông bà về rau cải và trái cây, tên gọi, cách dùng cùng những ý nghĩa liên hệ. Tôi đang thu thập tài liệu này bằng cách phỏng vấn những phụ nữ và nam giới ở các lứa tuổi khác nhau.

Những câu hỏi tôi sẽ hỏi bao gồm:

1. Lịch sử cá nhân:
   - Ông bà được bao nhiêu tuổi?
   - Ông bà đã lớn lên tại đâu?
   - Ông bà rời khỏi Việt Nam lúc nào?
2. Tôi sẽ đưa ông bà xem những tấm hình của các loại trái cây và sẽ hỏi:
   - Ông bà gọi nó là gí?
   - Ông bà có biết tên gọi nào khác của nó không?
   - Ông bà sử dụng rau/trái này để làm gì?

Tôi xin phép dược phỏng vấn ông bà về rau cải và cách dùng để làm thực phẩm trong gia đình. Ông bà có sẵn long cho phép tôi dược đăng trình kết quả của sự học tập này không?

Bất cứ lúc nào trong sự học tập của tôi, nếu tôi hỏi ông bà những câu hỏi nào hoặc nhờ ông bà làm điều gì ông bà không cảm thấy đứng đắn hoặc làm ông bà thấy khó chịu, xin cho tôi biết, tôi sẽ ngừng lại. Tôi muốn tôn trọng *cái nhìn cá nhân* và *cái nhìn văn hóa* riêng của ông bà, và tôi biết là tôi có thể không hiểu dược những vấn đề đó.

INFORMED CONSENT STATEMENT (CONTINUED) (ENGLISH)

I am a graduate student from the University of Hawai'i with interest in Vietnamese uses of plants. I am working in Hawai'i and Viet Nam on studies of food plants and other cultural uses of plants. I am interested in learning about your knowledge of fruits and vegetables, what you call (name) it, the way you use it and other meanings about it. I am gathering this type of information through interviews with women and men of different ages.

The kinds of questions I would be asking about include:

1. Your background:
   - How old are you?
   - Where did you live in Viet Nam? (for Honolulu interviewies)
   - When did you leave Viet Nam? (for Honolulu interviewies)

2. I will show you pictures of fruits/vegetables and ask you:
   - What do you call it?
   - Do you have other names for it?
   - What is it used for?

May I have permission to interview you about food plants and the usage of these plants in your family? Would you be willing to allow me to publish the results of these studies?

If at any time during the course of my research, I ask you questions or ask you to do something that you do not feel is appropriate or makes you feel uncomfortable, please let me know and I will stop. I want to be respectful of your personal and cultural views and recognize that I may not understand them.

RECEIVED AS FOLLOWS

APPENDIX I

US COMMUNITY – SPECIES IN CANH CHUA RECIPES

Book/Recip No	U1	U2	U3a	U3b	U4a	U4b	U5	U6a	U6b	U7	U8	U9	U10a	U10b	U11	U12	U13	U14		
Book	Ngô and Zimmerman 1	Ang 1996	Pham 1996	Pham 1996	Hsiung 1997	Hsiung 1997	Trieu 1998	Trang 1999	Trang 1999	Sterling 2000	Nguyen and Moriyama	Tran 1990	Duong and Kiesel 1991	Duong and Kiesel 1991	Nhan and Sox 2003	Routhier 1989	Tran 2000	Pham 2001	Sum	Average Occurrence
Fish	1	1	1	0	1	0	1	1	0	1	1	1	1	0	1	0	0	0	11	
Shrimp	0	0	1	0	1	1	0	0	1	0	0	0	0	1	0	1	1	1	8	
Mollusks	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	
Chicken	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	2	
Vegetarian	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	
Abelmoschus esculentus	0	0	0	0	0	0	1	0	0	0	1	0	1	0	0	0	0	0	3	0.17
Aganonerion polymorphum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Allium ampeloprasum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Allium cepa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Allium cepa cv. Aggregatum Gr.	0	0	1	1	1	0	1	0	0	1	0	0	0	0	0	1	0	1	7	0.39
Allium cepa cv. Aggregatum Gr. - fl	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Allium chinense	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Allium fistulosum	1	1	0	0	0	0	0	0	1	1	0	0	1	1	1	1	1	0	9	0.50
Allium sativum	0	0	1	1	1	0	0	0	0	1	0	0	0	0	0	1	1	1	7	0.39
Ananas comosus	1	1	1	1	0	0	1	1	0	1	1	1	0	0	1	1	1	1	13	0.72
Anethum graveolens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Apium graveolens	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0.06
Arachis hypogaea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Bamboo *	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	3	0.17
Brassica	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.06
Capsicum annuum	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	15	0.83
Citrus hystrix	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	2	0.11
Citrus limon	0	1	1	1	0	1	0	0	1	1	0	1	0	1	0	0	0	1	9	0.50
Colocasia gigantea	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	1	3	0.17
Coriandrum sativum	1	0	0	0	1	1	1	0	0	1	0	0	0	0	0	0	0	0	5	0.28
Cucumis sativus	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0.06
Curcuma longa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Cymbopogon citratus	0	0	0	0	0	1	0	0	1	1	0	0	0	1	0	1	0	0	5	0.28
Eryngium foetidum	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0.06
Fungus **	0	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0	3	0.17
Garcinia multiflora	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Ipomoea aquatica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0.06
Lactuca sativa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Limnophila chinensis	0	0	1	1	0	0	1	0	0	0	0	0	1	0	1	0	1	1	7	0.39
Lycopersicon esculentum	0	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	16	0.89
Mentha aquatica	0	1	0	0	0	0	1	0	0	1	1	0	0	0	1	1	0	0	6	0.33
Musa sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Nymphaea pubescens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Ocimum basilicum	0	0	1	1	0	0	0	1	1	0	0	0	0	0	0	0	0	1	5	0.28
Origanum vulgare	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0.06
Pachyrhizus erosus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Piper nigrum	1	0	0	0	1	1	1	1	1	0	0	0	1	1	0	1	0	0	9	0.50
Sesbania grandiflora	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Tamarind powder	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0.06
Tamarindus indica	0	0	1	1	1	0	1	1	0	1	1	0	1	0	1	1	1	1	12	0.67
Vigna radiata	0	0	1	1	0	0	1	0	1	1	1	1	1	1	1	1	0	1	12	0.67
Zingiber officinale	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0.06

* Young shoots of unspecified bamboo species. ** Unspecified fungus species.

APPENDIX J

VN COMMUNITY – SPECIES IN CANH CHUA RECIPES

Book/recipeNo.	1	2	3a	3b	3c	3d	3e	3f	3g	4	5a	5b	6a	7	8	9	10a	12	13	14b	15a	15c	15d	18a	18b	18e	19a	19b	20a	20b	20c		
Book	Nguyễn 2003	Triệu et al. 2002	Triệu and Nguyễn 2001	Triệu and Nguyễn 2001	Triệu and Nguyễn 2001	Triệu and Nguyễn 2001	Triệu and Nguyễn 2001	Triệu and Nguyễn 2001	Triệu and Nguyễn 2001	Triệu 2003	Gia Chánh 2000	Gia Chánh 2000	Kim 2003	Văn 1984	Nguyễn 1989	Nguyễn 1987	Triệu 1983	Ngọc 2003	Lê 2002	Võ and Nguyễn 2003	Quỳnh 2000	Quỳnh 2000	Quỳnh 2000	Nguyễn 1968/80	Nguyễn 1968/80	Nguyễn 1968/80	Nguyễn 1983	Nguyễn 1983	Nguyễn 1990	Nguyễn 1990	Nguyễn 1990	Sum	Average Occurrence
Fish	1	0	1	1	0	1	1	0	0	1	1	0	1	1	1	1	0	1	0	0	1	1	1	0	0	1	1	0	1	0	0	18	
Shrimp	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	
Mollusk	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	3	
Chicken	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	
Vegetarian	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	4	
Abelmoschus esculentus	1	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	5	0.16
Aganonerion polymorphum	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	0.06
Allium ampeloprasum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0.03
Allium cepa	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	1	0	0	0	0	0	0	6	0.19
Allium cepa cv. Aggregatum Gr.	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	0	0	0	4	0.13
Allium cepa cv. Aggregatum Gr. - fl	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0.06
Allium chinense	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	0.06
Allium fistulosum	0	0	0	1	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0.13
Allium sativum	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	5	0.16
Ananas comosus	1	0	1	1	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	1	0	1	1	1	1	1	13	0.42
Anethum graveolens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0.06
Apium graveolens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Arachis hypogaea	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.03
Bamboo *	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.03
Brassica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.03
Capsicum annuum	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1	1	1	1	1	26	0.84
Citrus hystrix	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Citrus limon	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00

Book/recipeNo.	1	2	3a	3b	3c	3d	3e	3f	3g	4	5a	5b	6a	7	8	9	10a	12	13	14b	15a	15c	15d	18a	18b	18e	19a	19b	20a	20b	20c	Sum	Ave O
Colocasia gigantea	1	0	1	1	0	1	0	0	0	1	1	1	1	1	1	1	0	1	1	1	0	0	0	1	0	1	1	0	1	0	0	18	0.58
Coriandrum sativum	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0.10
Cucumis sativus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Curcuma longa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.03
Cymbopogon citratus	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.03
Eryngium foetidum	1	1	1	1	1	1	1	1	1	1	0	0	1	1	0	0	0	0	1	1	0	1	1	0	0	0	0	0	0	0	0	16	0.52
Fungus **	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0.03
Garcinia multiflora	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.03
Ipomoea aquatica	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.03
Lactuca sativa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.03
Limnophila chinensis	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	0	0	1	0	0	0	1	1	1	1	1	1	1	1	25	0.81
Lycopersicon esculentum	0	1	1	1	0	1	0	0	0	1	1	1	1	1	1	1	1	1	0	1	0	0	0	1	1	1	1	1	1	1	1	22	0.71
Mentha aquatica	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.03
Musa sp.	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	0.06
Nymphaea pubescens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0.03
Ocimum basilicum	0	0	1	1	1	1	1	1	1	0	0	0	0	1	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	11	0.35
Origanum vulgare	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Pachyrhizus erosus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0.03
Piper nigrum	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0.03
Sesbania grandiflora	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0.03
Tamarind powder	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Tamarindus indica	1	1	1	1	1	1	0	1	0	1	1	0	0	1	1	1	1	0	0	1	0	1	1	1	0	1	1	1	1	1	1	23	0.74
Vigna radiata	1	0	1	1	0	1	0	0	0	1	0	0	1	1	1	1	0	0	0	1	0	0	0	0	0	0	1	1	1	1	1	15	0.48
Zingiber officinale	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	0.06

* Young shoots of unspecified bamboo species. ** Unspecified fungus species.

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