PART1 : FINDING THE TRAIL

著者(英)	Peter J. Matthews
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In this part, I explain how I came to be interested in taro as a subject of historical research, linking childhood experiences to later academic development (Chapter One). Two early notes written as part of initial research on taro are reproduced to simultaneously illustrate development of a field work methodology, and introduce the historical subject.

Chapter Two reproduces a note in which I solicited information from readers, while explaining how taro sites could be recorded using the archaeological site record format advocated by the New Zealand Archaeological Association (Matthews 1982a).

Chapter Three reproduces a first report of observations of taro in the Bay of Islands (Matthews 1982b), and raises questions that were addressed by the research described in Part 2.

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On the Trail of Taro: An Exploration of Natural and Cultural History
Peter J. Matthews

Chapter One
Introduction (Some Help From the Ancestors)

In living plants we can discover that our ancestors are still with us, insofar as the plants were part of their lives, and remain part of ours. I say this from personal experience, as my grandfather was a farmer and gardener who grew up within a mixed European and Māori community in northern New Zealand. He grew taro in his own garden in Auckland, and passed on knowledge of the plant as a food to my father, who subsequently introduced the plant to me. I never met my grandfather, but could know him through the garden he made, a large garden that completely surrounded my childhood home.

My own interest in plants began with a natural childhood curiosity in the home garden, the many plants and animals living there, and the people who had been there before me. I lived — and came to life — in that garden, spending much of my time caring for birds and other animals, climbing trees, doing garden work, building and using huts. I could always find refuge there in moments of stress. The garden was also our main source of ammunition, in the form of fruits and nuts, for mostly friendly street wars conducted with the children of neighbouring families. When we excavated new space for an apartment under our 1920s house, we found stone tools left behind by the Māori who had cleared forest and gardened there before us[1)] (Notes in this volume appear at chapter ends).

As an undergraduate at the University of Auckland, New Zealand, I naturally gravitated to archaeology, botany, and zoology, and especially the more outdoor aspects of these subjects. My studies were led by a more-or-less subconscious wish to see the past, or to travel in time, and more consciously by a wish to explore New Zealand as extensively as I could with limited funds. As a student volunteer on archaeological digs, I enjoyed wonderful opportunities for low-cost travel in time and space.

Ethnobotany was not a subject taught to biology students at my university in the early 1980s, so I learned mainly by doing, with considerable trial and error. The work of previous writers was inspirational. I explored a wide range of literature that in various ways gave insight into natural and cultural history. Perhaps one of the biggest lessons I learned was the importance of open communication with many different kinds of people, inside and outside the university. In my own repeated experience, wide reading and open communication are a powerful combination for discovering unexpected clues and research directions. Serendipity does not happen by chance alone. Through reading, I learned about my research ancestors, who have usually thought ‘my’ thoughts long before me. I discovered the importance of following ideas to their original sources to learn what previous authors actually said, in their own words, in order to understand a subject better.

If anything I have done can be said to be original, it is probably because I have followed existing trails, cross-trails, and faint markings with a definite purpose, but not too much concern about the ultimate destination. Deliberately losing oneself in a forest is perhaps the quickest way to learn what a forest is.

1.1 Writing as a Method

In the academic world generally, there is too much emphasis on writing and publishing as an outcome, after research has been done, rather than as a means of engagement with the work and with other people. Despite the many new opportunities provided by the Internet and electronic media, research writing and publishing remain a bottleneck (Matthews 2004a) in the entire scientific project of the modern world. The following paragraphs and two chapters indicate, among other matters, how writing can be used as a method, for research purposes.

An important impetus for my work on taro, *Colocasia esculenta* (L.) Schott, came from an essay assignment for a course on Pacific Islands prehistory taught at the University of Auckland. The teacher was an American archaeologist who visited the university in 1981 while writing a book on the subject of the course (Terrell 1986). At that time, Terrell was developing ideas about how theories, models, and scenarios of the past are established, reported, and used. In his classes, he repeatedly emphasised the tenuous nature of our understanding of the past, based as it is on extremely fragmentary and often ambiguous evidence. Although my interests in botany and archaeology made archaeobotany an attractive subject, I came to realise that most living plants and animals had been little studied with the goal of learning about the human past, or prehistory. The subject of my course essay was 'using plants and animals as biological tracers of human migration in the Pacific', and much of the inspiration for this came from the work of D. E. Yen, including his book, *The Sweet Potato in Oceania* (Yen 1974), and a lesser-known paper entitled 'Introduction of taro into the Pacific: the indications of chromosome numbers' (Yen and Wheeler 1968). While reading the 1968 paper on taro, I found that the New Zealand plants examined had not been described, that their present-day distribution and uses had not been reported, and that much more remained to be learned about this crop in my own country and beyond. With encouragement from the Department of Anthropology, I took this subject to the Department of Botany as a proposal for MSc research, and was soon happily making plans to begin a series of journeys by car and boat across the northern half of the North Island and its offshore islands, in warmer regions where Māori agriculture had flourished in the past, and where rural communities of Māori remained strong.

Since time and funds were very limited, I prepared for fieldwork by writing letters to various people around New Zealand, and two short research notes. These were published in the newsletter of the New Zealand Association of Archaeology (NZAA) (Matthews 1982 a, b**)** in order to solicit information about locations of taro from archaeologists doing fieldwork around New Zealand (see Chapters Two and Three). Archaeologists and anthropologists in New Zealand already were conscious of the

importance of taro as a staple crop in the tropical Pacific, and knew that the plant was cultivated by the Māori long before the 19th and 20th century arrivals of Europeans, Chinese, Pacific Islanders, and other new immigrants. Archaeological site records held by the Association already included records of taro dating back, in one example, to fieldwork conducted by J. Davidson, A. Leahy, and M. Nicolls in 1961 (Mataka Beach, Kerikeri, NZAA Site N11/300, Leahy 1/1/1978). The apparent association between taro and the distribution of archaeological sites was intriguing, and the anthropological research community in Auckland gave me great encouragement in my first steps on the trail of taro.[2)]

Subsequent feedback from correspondents and readers provided me with personal introductions to people in the field, helped decide the survey routes, and generated new information and questions relevant to the subject. This approach, developed for the MSc project in New Zealand, was later employed as preparation for exploration in northern Australia. It approximated the concept of 'prior informed consent', which in its broadest sense means explaining to communities and individuals the aims of research being carried out (often literally in this case) in their backyards. I soon found myself being sent from person to person, down the road, across paddocks, and over hills on journeys that led to many wonderful and memorable encounters in remote and unexpected locations. For the first time in my life, I heard the Māori language spoken as a primary means of daily communication, in the rural communities of East Cape and Northland.

Through letter writing I also made contact with D. E. Yen, and was fortunate to receive an invitation to visit the Prehistory Department of the Australian National University (ANU) with a three-month summer scholarship. In Canberra, Yen already had assembled a living taro collection in order to pursue questions raised by the 1968 paper. He also had established good working relationships with the Australian Plant Quarantine Service holding station at Weston Creek, the Australian National Botanical Gardens (where the collection was maintained), the Research School of Biological Sciences (RSBS), ANU (where the laboratory for population genetics specialised in cytological methods), and plant scientists at the Commonwealth Scientific and Industrial Research Organisation (CSIRO) (conveniently located between the university and the gardens). The visit allowed me to learn cytological techniques, observe the chromosomes of New Zealand taro plants carried to Canberra, and thus complete the research needed for the MSc thesis (Matthews 1984; and Part 2 this volume).

1.2 Further Opportunities, and Serendipity

While still in Canberra I was offered an ANU Scholarship for PhD research, and simultaneously an offer from the German Academic Exchange Service (DAAD) for one year of study in Germany. The second offer led me in early 1984 to the University of Saarbrücken and Paul Mueller (a biogeographer who had worked on snakes in the Amazon), and to Barbara Koller at the European Molecular Biology Laboratories (EMBL) in Heidelberg, where I was guided through steps to extract chloroplast DNA from the New Zealand taro plants (which still travelled with me). A bicycle ride and serendipity

eventually took me to the gate of the Max Planck Institute for Molecular Genetics, Dahlem-Zehlendorf, Berlin, an institution previously unknown to me.

In Germany, my primary aim was to gain experience in the analysis of chloroplast DNA as a way to study maternal lineages in taro, and thus track the movement of vegetatively propagated 'mother plants' across Asia and the Pacific (see also Chapter Eight, Section 8.3.2, 'The genetic evaluation of crop plants'). At the Max Planck Institute I met Alap R. Subramanian, a laboratory leader working on the structure and expression of chloroplast genes, and Yasunari Ogihara, a postdoctoral researcher and one of the pioneers of chloroplast genetics in Japan. The basic methods I learned from these researchers were indispensable for the work in Canberra (1985 to 1990), where I completed the PhD research reported here. Despite all the support in Germany (and later in Australia), my attempts to track 'mother plants' through chloroplast DNA eventually failed in the test tube. Other efforts were more successful.

An unexpected result of the stay in Germany was having time and sufficient income to visit some of the larger herbarium collections in Europe (Vienna, Paris, Kew, and Oxford), and to use the Berlin herbarium at Dahlem (a stone's throw from the Max Planck Institute) as a base for receiving specimens from Leningrad (as it was still known) and elsewhere. From the scattered botanical records of taro, *C. esculenta*, and other *Colocasia* species I later developed the first global map of the distribution of taro and its wild relatives (Matthews 1991, and Figure 9.2 this volume), and could begin to speculate on the possible origin and natural range of the species. The technically simple but logistically difficult work of collating botanical records provided a good foundation for later fieldwork in Australia, Papua New Guinea, and other countries since.

1.3 Main Findings

In the winter of 1984–85, while living in Berlin, I managed to write a paper 'Nga taro o Aotearoa' based on the work in New Zealand (Matthews 1985). The paper reported the presence of three main introduced varieties of taro in New Zealand, two that are very similar to each other in appearance and uses (var. RR and var. GR) and one that is very different (var. GP). That was a particularly harsh winter, during which the water pipes in some older buildings froze solid. Jumping from winter in Germany, I arrived in the searing dry heat of Canberra, and then promptly jumped again to the humid swelter of Papua New Guinea to begin fieldwork under the guidance of Douglas Yen. Despite culture shock and physiological shock, the support of our counterparts in Lae allowed me get a glimpse of taro flowering and fruiting in apparently natural habitats (Matthews 1987) and to assemble a living collection of local cultivars that were sent to Canberra for further study.

In Australia, further letter writing was carried out to solicit information on wild taro across northern Australia, leading me to target Queensland for extended fieldwork in 1987 (and again in 1992). In Queensland, wild taro was found scattered throughout the wet rainforest zone of northeastern Queensland. Following the work in Australia and Papua New Guinea, I could announce the existence of 'a possible tropical wild-type taro'

(Matthews 1991), thus providing circumstantial botanical support for previous suggestions that taro might have been domesticated in New Guinea. In subsequent papers I recommended the use of genetics to investigate prehistory using taro and aerial yam as examples (Matthews and Terauchi 1994), explored the use of insect associates (especially taro planthoppers) as possible indicators of natural range and dispersal routes (Matthews 1995), provided 'a field guide for wild-type taro' (Matthews 1997; and Appendix 22, this volume), and discussed the question of how to distinguish natural and feral populations of wild taro in relation to the movements of Austronesian speakers in Asia and the Pacific (Matthews 2003). I also analysed the highly polymorphic ribosomal RNA locus in taro, developing DNA tests that were later used to characterise Japanese cultivars held in a collection at the National Institute for Vegetables Ornamental Plants and Tea (NIVOT) (Matthews, Matsushita et al. 1992).

1.4 Research Questions and Present Volume

Here is a basic general question regarding crop history:

(1) *By looking at modern* (*living*) *plants, how can we learn about the natural and cultural history of a crop?*

This can be addressed by considering a range of more specific questions:

(2) *What is the natural range of the species?*
(3) *What are the genetic and geographical origins of cultivated forms?*
(4) *How was the plant domesticated?*

These in turn lead to more specific questions that may be easier to answer:

(5) *Where are wild breeding populations* (*if any*) *distributed?*
(6) *Which wild populations are natural or indigenous, and which are invasive, naturalised, or transplanted?*
(7) *Where are wild relatives of the crop distributed?*
(8) *Which wild relatives are most closely related?*
(9) *How are wild populations or wild relatives used?*
(10) *Which uses of the wild plants might be analogous to very early uses, before cultivation and domestication?*
(11) *How and where can human selection be effective in changing the genetic composition of the plant, thus creating forms genetically adapted to production and use by people* (*i.e. domesticated forms*)*?*

Of course, many other questions need to be asked in order to understand the natural and cultural history of a plant. In retrospect, the initial work in New Zealand can be seen as a series of first steps taken in order to gain familiarity with taro, and with methods for gathering, recording, and reporting information. While working in Australia and Papua New Guinea, further basic questions and theoretical issues became obvious, and approaches for answering some of the questions listed above began to emerge.

As the work proceeded, it also became apparent that there had been — in studies of crop plant history — a general lack of empirical observation, theory building, and theory

testing. Yen's work on the sweet potato in Oceania (Yen 1974) was a notable exception, and provided a template for a more theoretical approach that is still relevant today (cf. Fuller 2013). Modern biology, beginning in the early 20th century and now providing a vast array of methods for analysing plant genomes and phenotypic variation, can answer many questions, but this is not enough. There is a still a great need for fieldwork, observation of living plants in their ecological and social contexts, and communication with all the people involved in managing, growing, processing, using, and thinking about plants of historical importance. Many students and researchers are based in countries with little money to invest in 'big science'. Big science is typically where crowds gather. There may be better opportunities for original work in less crowded areas. With an ancient, widespread, and little-studied crop such as taro, there is still much important work that can be done with nothing more than a camera, notebook, pen, and a good list of questions.

Until the present industrial era of synthetic medicine, textiles, construction materials, and food, living plants provided the main material foundations for human economic and symbolic life. Most plants that are cultivated now were known and used as wild food sources long before they were cultivated and domesticated, though it is possible that some wild species have only been used in recent times because of food shortages, changes in access to wild plant resources, the extinction of preferred wild species, or changes in food preferences. Knowing which wild species were used in the distant past, and how, is not easy. The difficulty is greatest for soft herbs such as taro, and other root crops, since they have high water content and lack hard parts that can be easily preserved in archaeological contexts (cf. King 1994).

The second part of this volume is a study of the relatively recent history of taro as an introduced crop in New Zealand. This was my first step on a trail into an ever-deeper and wider history of taro as a wild plant and ancient crop in Asia and the Pacific. Future research on taro may lead even further into the natural and cultural history of humankind as archaeological methods develop, as knowledge of the plant accumulates, and as theories regarding human relationships with plants develop (cf. Etkin 1994; Harris 1996a; Ingold 1996; Smith 2001; Mithen 2006; Winterhalder and Kennett 2006). In the present volume, my focus is on initial empirical observation and developing theories of origin, domestication, and dispersal that can be tested by looking in detail at a single crop. Empirical studies of the evolution, ecology, archaeology and ethnobotany of individual crops and their wild relatives are required before we can generalise with any confidence about the origins and spread of agriculture, crop assemblages, and agricultural societies (cf. Harris 1996b, 2006; Blumler 1996).

Deeper understanding of a plant that has been used in many different societies, for thousands of years, may also help to promote respect for the plant as something that cannot and should not be claimed as the property of any single society, state, or commercial entity. This statement applies to the plant, and also to certain kinds of common or shared knowledge relating to the plant, but not to more specific aspects of local knowledge or belief concerning the plant.

There are no clear boundaries between what is common knowledge and what is

local or private knowledge that should not be made public. This can create conflict between obligations to share information, respect the interests of people, and protect biological and cultural diversity (Bannister and Barrett 2004). The present publication conforms to the academic information-sharing obligation. I hope that it also will serve the interests of people — in many different societies — who have long associations with the plant and who care about the plant. The present publication will be useful if it can encourage a general awareness that most cultivated plants in any particular place have a wider social and geographical context. They can represent a living connection between the distant past and immediate present, and also between geographically and culturally distant peoples. Plants are not just inanimate things to be exploited without regard for context or past. To treat them as such devalues plants, the relationships between plants and people, and the relationships among people.

Notes

1) For more stories about childhood experiences of wildness, and how these may guide a person's life course, see Nabhan and Trimble (1994).
2) Taro sites continue to be recorded by archaeologists, and most records have been from the conservancy regions of Northland, Auckland and Waikato (Furey 2006: 21).

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Chapter Two
Notice to Archaeologists Recording Taro Sites [1)]

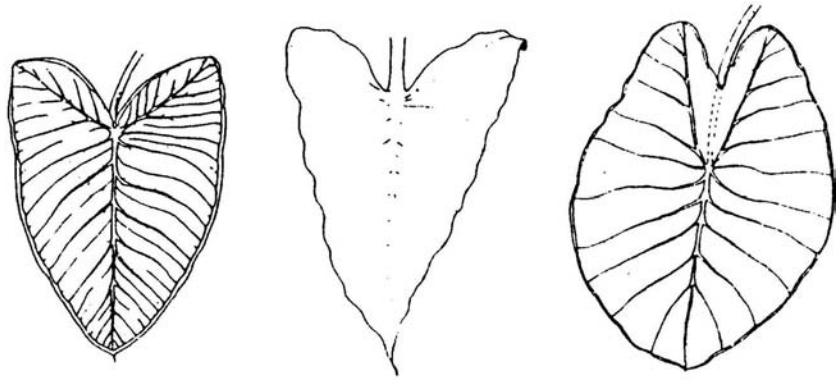
Early European explorers (e.g. Cook, Dieffenbach, and Colenso) provide reports of taro (*Colocasia esculenta*) cultivation in Northland, North Island East Coast, Marlborough Sounds, and Taramakau in Westland. It is (not) clear[2)] that taro persists today in the wild as a remnant from prehistoric cultivation. Although the plant is sometimes recorded by site surveyors, most people are unsure when trying to identify it.

Presently a botanical study of the distribution and variation of taro in New Zealand is being made by Peter Matthews, Department of Botany, University of Auckland. It is hoped that something will be learnt of its use by the Māori. Taro continues to be used in many rural communities, and within historic times there may have been considerable movement of taro about the country. It is important for describing prehistory that all locations where taro is found be recorded so that prehistoric and historic influences can be sorted out. This includes gardens, where owners are amenable.

Records should be made on New Zealand Archaeological Association site record forms and sent to N.Z.A.A. site record file keepers. If possible, send copies directly to the Dept. of Botany — site numbers for the archaeological locations will be added when available.

Taro is often confused with the closely related elephant's ear and sometimes with arum lily when fully open leaves aren't obvious. Leaf blades of all three are shown in Figure 2.1.

If cormels can be collected (only a handful required) during site recording and sent to me this would be useful. Leafless cormels or short stolons may be sent dry in a small cardboard box. I am particularly interested in collections from south of Auckland. Flowering may be observed occasionally in spring and summer but is not known to result in viable seed. Leaves in some areas reach a height of between one and two metres in summer. During winter smaller leaves are produced.



Alocasia macrorrhizos (elephant's ear) | *Zantedeschia aethiopica* (arum lily) | *Colocasia esculenta* (taro)

Figure 2.1 Leaf shapes of aroids common in New Zealand[3]. The *Alocasia* species common as an ornamental or naturalised in New Zealand may be *A. brisbanensis* (L.) Hay.

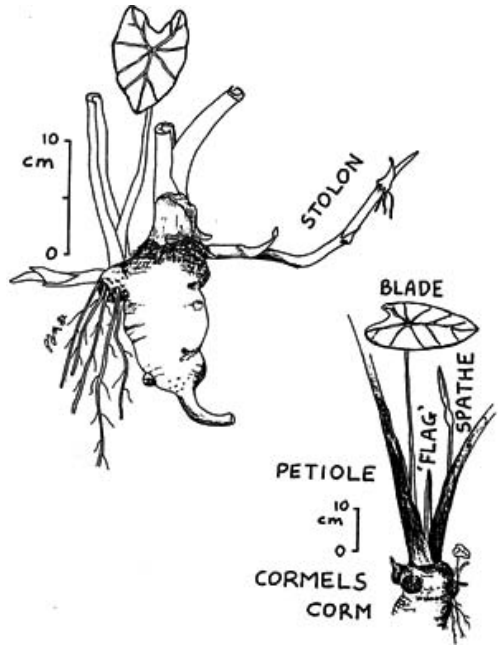


Figure 2.2 *C. esculenta* (taro). Upper: stoloniferous form from Kapowairua (Spirits Bay). Lower: illustrating flag leaf which first appears before flowering (spathe), leaf (petiole and blade), and the easily collected cormels. Scale approximate only.

Notes

1) Adapted from Matthews (1982a).
2) 'Not' is newly inserted; the original positive statement was made in error.
3) Adapted from Healy and Edgar (1980).

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Chapter Three
Taro in the Bay of Islands [1)]

A study is being made of the variation and distribution of taro (*Colocasia esculenta*) in New Zealand. This work has two purposes: botanical exploration, and to provide new information for the discussion of the origins and development of horticulture in New Zealand.

In May 1982 the opportunity was taken to work in the Bay of Islands area with members of the Department of Anthropology, University of Auckland (Sutton 1982) (see Figure 3.1). The aims of the one week of fieldwork were:

To establish what distinct forms are present in the Bay of Islands.

To search for sites with taro, and to determine by casual observation something of the extent of present cultivation as a food crop.

To collect samples for propagation and for counts of 2n chromosome numbers.

To attempt application in the field of a scheme for classifying the historical status of taro sites.

This paper records initial observations on the morphology and distribution of two forms of taro found wild in the Bay of Islands. Some problems inherent in the study of New Zealand taro are identified in the light of these observations and historical evidence.

Chromosome numbers have been used to identify likely routes of introduction of taro cultivars into the Pacific (Yen and Wheeler 1968; Cable 1984). Little new information appears to have been published since the 1968 paper. An origin for New Zealand plants in Melanesia was indicated by the discovery in both New Caledonia and New Zealand of plants with chromosome numbers of 2n = 42. The 2n = 42 number has not been reported for any other location in Melanesia or Polynesia. On the other hand, taro with the chromosome number 2n = 28 have been found throughout the South Pacific. The 42-chromosome form has been reported in New Zealand on the Cavalli Islands (Rattenbury 1956), Spirits Bay and Great Barrier Island (Yen and Wheeler 1968). Yen and Wheeler drew no definite conclusion from their discussion of whether this likely introduction from Melanesia occurred before or after the arrival of Europeans.

The present study of New Zealand taro is aimed at establishing whether or not taro of 2n = 42 can be assigned definite pre-European status in New Zealand. The study must show how varieties are distributed, and whether 2n = 42 taro exists in such wide distribution or in such remote sites that introduction only after the arrival of Europeans seems unlikely.

Plucknett et al. (1970: 414) and Purseglove (1972: 61) note that the taxonomy of *Colocasia* is confused and that cultivars exhibit considerable variation. Both authors follow Hill (1939) in recognising only one polymorphic species, namely *C. esculenta* (L.)

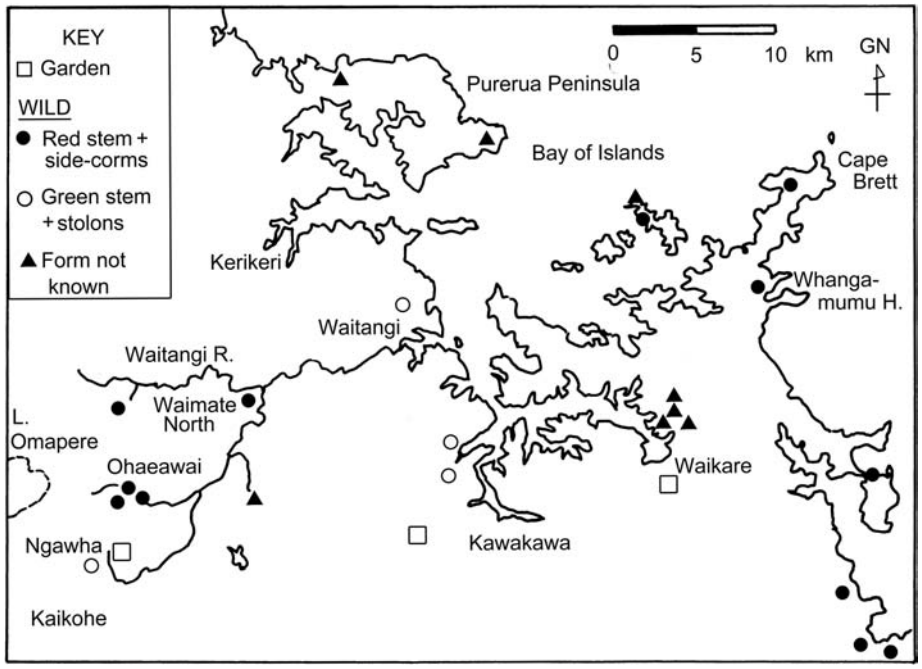

Figure 3.1 Distribution of taro in the Bay of Islands (and vicinity)

Schott. This nomenclature is used by Healy and Edgar (1980) for taro in New Zealand. Plucknett et al. (1970) and Purseglove (1972) do not mention stolon formation by *Colocasia*, but cultivars which produce stolons are briefly discussed by Wilson (1982: 284).

Taro is primarily adapted to moist environments but can grow under a wide range of moisture regimes (Plucknett et al. 1970: 416). The survival of different forms of taro in New Zealand streams or other locations thus provides no indication of how these forms were cultivated. Evidence of pre-European cultivation techniques, wetland or dryland or otherwise, may be found by the study of archaeology, early ethnographic records, and perhaps from present-day cultivators of taro.

Observations of flowering plants by Cooper (1969) and by the present author indicate that viable seed is not produced in New Zealand. Natural dispersal by seed almost certainly never occurs here.

3.1 Field Method

Most sites were located by conversation with farmers and members of Māori communities. To make best use of travelling time, new road routes were taken each day and roadside streams viewed from the elevated position of the rental van passenger seat. Permission was sought before removing plants. Plant samples (cut tops of corms, corms,

cormels, and stolons with nodes) were washed, wrapped damp in newspaper, and stored in unsealed plastic bags in a refrigerator until the return to Auckland.

3.2 Results and Discussion

3.2.1 Variation

Two morphologically distinct forms of taro were found in the Bay of Islands. Both forms have been illustrated by Matthews (1982a) (see Figure 2.2, this volume) using material from outside the Bay of Islands. Although a number of botanical varieties have been described inside New Zealand, it is too soon to assign varietal names to the present forms.

Figure 3.2 shows the acutely lobed, peltate leaves of the form which produces stolons. Cormels were found infrequently on plants of this form. Leaf blades and petioles are a light green. Petioles of up to approximately two metre height were observed.

Figure 3.3 shows the broadly lobed leaves of the form which produces cormels. Stolons have not been observed on plants of this form. Leaf blades are a dark green on the upper surface and light underneath. Petioles have variable red coloration.

A third form is known from the Bay of Islands, but no plants of this form were seen during the May trip. Plants from a garden at Pakaraka (inland Bay of Islands) have been propagated near Whangarei (K. Reynolds, pers. comm.). Figure 3.4 shows the Whangarei plant with a small central corm and many cormels sprouting around it. The petioles of this form are green.

3.2.2 Distribution

The known distribution of taro through inland and coastal areas of the Bay of Islands is shown in Figure 3.1. Host sites on the Purerua Peninsula and in the eastern Bay of Islands have not been seen or visited by the author. They have been located by the reports of residents and visitors and by a computer search of the N.Z.A.A. site records in the New Zealand Historic Places Trust Site Index. The oldest record not since reconfirmed is from about 1953. All the sites shown between Waitangi, Kawakawa, and Kaikohe were either seen or visited during May 1982. All sites are recorded in a botany department site register. Where appropriate, records will be copied for the N.Z.A.A. archaeological site record file. To protect sites, details of location are not published.

The gardens shown in Figure 3.1 are those in which plants are grown as a food crop, with cultivation of the soil. Ornamental gardens are not shown, although two were recorded. Gardens were only viewed from the road, despite their potential ethnographic importance, because present interest centres on wild taro sites. For this reason identifications of morphological form can not be given in Figure 3.1.

Cultivation of taro appears on casual observation to be quite common in the Bay of Islands. Contemporary cultivation in Northland was reported by Ishida (1966: 134) and Yen and Wheeler (1968: 264). On the return to Auckland via southern Hokianga, fifteen food gardens were counted from the main highway. Further south, cultivations were seen at Kaihu near the west coast.

The distribution of wild taro is the product of two factors: transfer and planting by people, and natural dispersal by water. Wild taro sites are those in which propagation is all or almost entirely by natural means, and in which the soil is not cultivated. Many wild taro sites, whatever their origin, are used with varying frequency as food sources. For example, it was learned that taro growing in natural light, boggy ground, behind a marae, is occasionally used during occupation of the marae. Unwanted corm tops and small cormels are replanted at the time of digging. The site has been classed as wild although it lies near the head of a stream, and therefore almost certainly arose by planting at the site.

The above example and many other sites could be placed in a category of semi-wild. However, since information on use cannot be obtained consistently, both fully and semi-wild sites are identified as wild in Figure 3.1.

Wild taro in New Zealand may have had some importance as a food source in pre-European times also, even if taro cultivation was common. Although taro is commonly cultivated, wild taro found in streams and under bush is an important green vegetable for villages throughout Fiji (Thaman 1992: 208–9).

Natural dispersal down streams appears common and was reported by farmers visited during May. One patch was reported washed out in a recent flood of a Waitangi River tributary, with subsequent colonisation of swamp downstream.

A wild taro site at Ngawha (Figure 3.5) was photographed eleven years ago in 1971 by R. C. Cooper, then botanist at the Auckland Institute and Museum. The stoloniferous plants still found there grow in light, boggy ground for a distance of over half a kilometre. In such wet ground the patch could have survived from the scrub or forest burn-off suggested by a surviving stand of large tree ferns.

Taro growing in a swamp in the Waitangi State Forest may have an origin predating the late-1930s clearance of regenerating forest in this area (Mr. Olsen, Forest Ranger, pers. comm.).

Both forms encountered in the wild have widespread distributions within the Bay of Islands. There is an indication that the stoloniferous form may be absent from the eastern Bay of Islands, but fieldwork in the area is needed to establish this point.

The present evidence on distribution suggests that both forms are possibly of pre-European origin. More fieldwork to locate remote sites such as that found in the Waitangi State Forest may provide circumstantial confirmation or otherwise of this suggestion. So too might a search for wider distribution both within and beyond the Bay of Islands.

3.2.3 Collection of propagating material

Samples were collected from ten of the eleven sites visited in the area. Reference numbers for the plants now held in Auckland are AKL 21 to AKL 31. Chromosome counts have not yet been made. A collection of plants is being assembled in Auckland at the Department of Botany and at the Department of Scientific and Industrial Research, Mount Albert.[2)]

Figure 3.2 Acutely lobed, peltate leaves of stoloniferous form (later identified as var. GP)

Figure 3.3 Broadly lobed leaves of form that produces cormels (later identified as var. RR)

Figure 3.4 Whangerei plant (later identified as AKL 34)

Figure 3.5 Taro at Ngawha, May 1982 (a left, later identified as var. GP)

3.2.4 Classification of historical status

Prior to fieldwork a scheme was developed for classifying in a consistent fashion the historical status at taro sites. Categories (definitely old, probably old, probably recent, and definitely recent) were defined on the basis of geographical distance from present settlements and taro cultivations. The basic assumption used was that geographically remote sites have a greater probability of pre-European origin. Such a classification would, in a circumstantial way, aid interpretation of the distributions of different taro varieties. Different varieties might be found consistently in sites of a particular assigned historical status.

The scheme was found impossible to apply for two reasons which became obvious in the field:

(1) The shifting nature of settlement patterns within post-European contact times. Remains of post-contact settlement were frequently met in the field.

(2) The strong likelihood that cultivation and transfer of taro has continued from pre-European times to the present day. Early European records exist of taro cultivation in

the Bay of Islands. Gardens may have been abandoned or provided a source for natural dispersal at any time.

A geographically wide picture of distributions may nevertheless show general pre-European patterns if most movement of plants by people and natural dispersal has taken place within local communities. Diamond (1982) however records the use of taro by Northland's bushmen and other poor rural transients in the first half of the 20th century. These people transferred plants as well as using plants found growing wild.

Further consideration of the above factors affecting taro distribution will be necessary as the study of New Zealand taro proceeds.

3.2.5 Historical records

Wild taro is today distributed on a number of tributaries of the Waitangi River. European records of taro in this catchment span most of the nineteenth century (Nicholas 1817, 1; Cheeseman in Cooper 1969).

In January 1815 (Leach 1980: 136) Nicholas, in the company of Samuel Marsden, crossed the Waitangi River after staying at a village on its banks (Nicholas 1817, 1: 232). Four miles further he encountered thirty to forty acres of kumara and potato plantations at the edge of forest. After passing half a mile through forest he came to Waimate, a fortified village at the summit of a lofty hill. He writes:

'In the plantations adjoining this village, I observed a plant very common in our West India settlements, where it is called *tacca*, and named by the natives of this island *tarro*. It does not appear to me that this plant is indigenous to New Zealand, but must, in my opinion, have been brought hither, either by Captain Cook or some other European navigator who has visited the country.' (Nicholas 1817, 1: 351)

Nicholas also describes the cultivation method at Waimate; plants were in rows 18 inches apart, with the earth dug up and pressed around the roots of each plant. Cheeseman, in February 1895, collected a taro flower at Waimate. The specimen is lodged at the herbarium of the Auckland Institute and Museum and has been described by Cooper (1969).

A number of records exist of the nineteenth century cultivation of European crops in the vicinity of the Waimate Mission Station (Leach 1980). These records were made at different times by the various European visitors to the Mission Station. Wade (1842: 18) describes for January 1838 wheat being gathered in at Rangaunu, close to the Mission Station. He notes that the missionaries introduced European crops amongst the Māori, and that throughout the island the Māori have potato cultivations and in many parts, kumara, taro, maize, pumpkins and gourd. He also states (Wade 1842: 20) that taro is rarely planted to any extent because it fails to multiply at the root like potato. Wade presumably refers to the extent of planting *within cultivations*.

Three points may be made with regard to the above records:

(1) Identifying the origin of New Zealand taro was a problem for Europeans from the time they first observed the plant here. The opinion expressed by Nicholas in 1817 probably reflects ignorance of the Pacific-wide distribution of taro and the voyaging capabilities of Oceanic peoples. Accepting that taro was introduced to New Zealand in

pre-European times does not however deny the suggestion that it was introduced by Europeans from other European colonies.

(2) Taro was displaced in importance by European crops by the early nineteenth century, but nevertheless remained in wide distribution in Māori cultivations. Hargreaves (1959: 62, 64) notes that by the time the first European settlers arrived in the North Island, Māori agriculture had developed to such an extent that it was able to provide the settlers with regular supplies of pigs, potatoes, maize, and wheat.

(3) It is possible to speculate that Wade had observed roots of the stoloniferous taro (Figure 3.2). This is the only form known to the present author that does not multiply at the root by forming (potato-like) cormels that would make extensive planting easy. There is thus a hint that the stoloniferous form presently growing in the Waitangi River catchment was also observed there last century. It is not known with which vegetative form the 1895 flower is associated.[3)]

3.3 Conclusions

The present field evidence together with historical record strongly suggest that taro found today in the Bay of Islands is the same stock as that grown in Māori cultivations early last century.

Taro has probably persisted since that time for two main reasons:

(1) The plant readily grows in the wild and self-propagates vegetatively.

(2) The plant has probably never fully ceased to be used and cultivated as a food crop. Further, by either or both of these mechanisms taro has undoubtedly persisted in the Bay of Islands and elsewhere since pre-European times. Taro of pre-European origin may also persist today in ornamental gardens.

Archaeological evidence may establish the pre-European antiquity of taro cultivation *practices*, but is unlikely to include remains of the soft, herbaceous taro plant. Evidence for the pre-European antiquity of *particular forms* of taro found wild in New Zealand may come from further study of their distribution. For very recent introductions, in the present century, direct evidence may come from importers and cultivators.

Notes

1) Adapted from Matthews (1982b).
2) This collection was not maintained after conclusion of the MSc project, but some accessions were taken to Australia for further study (see Part 3).
3) The observation might also mean that Wade was witness to cultivation of tropical Polynesian (pre-European) introductions of taro that did not produce many small side corms. This contrasts with cultivars found in the 1980s, which do produce many small, potato-like side corms, and are easy to multiply (see Part 2).