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研究課題名(和文) 南日本・東南アジアの野生サトイモの民族植物学的・遺伝子学的緊急研究

研究課題名(英文) Wild Taro in Southern Japan and Southeast Asia: an Urgently Needed Ethnobotanical and Genetic Survey

研究代表者

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交付決定額(研究期間全体)：(直接経費) 6,400,000円、(間接経費) 1,920,000円

研究成果の概要(和文)：2011-13年、野外調査地で収集した野生種・栽培種のサトイモ、また、1984年から今日までにアジア・太平洋地域で収集してきた総計、約200サンプルを分析した。その結果は博士論文として提出された(Ahmed 2013)。ハノイの生態学・生物資源研究所(IEBR)との共同研究から、これまでに2つの論文が書かれた(Ahmed et al. 2013, Matthews and Nguyen, 2014)。この研究に基づく論文は多くの学会で発表された(C-19参照)。研究結果はまた、図書(査読有)として出版された(Matthews 2014)。第11回サトイモ科植物学会の開催に協力した。

研究成果の概要(英文)：We have analysed samples of wild and cultivated taro from all the fieldwork regions (2011-2013, present project), in addition to older samples collected in previous years from across Asia and the Pacific (1984 and later). A total of two hundred samples (approx.) were analysed, and the work has been successfully submitted as a PhD thesis (Ahmed 2013). Collaboration with the Institute of Ecology and Biological Resources (IEBR) in Hanoi has resulted in two papers so far (Ahmed et al. 2013, Matthews and Nguyen, 2014). Papers based on this work have also been presented at a number of conferences (see below). Some of the work has been reviewed in a book (Matthews 2014). Together with Dr NGUYEN Van Du project member, IEBR, Vietnam) I was co-organiser for the 11th International Aroid Conference, Hanoi, Dec. 11-13, 2013 (sponsored by the International Aroid Society in association with the Institute for Ecological and Biological Research, Hanoi).

研究分野：農学A

科研費の分科・細目：資源保全学

キーワード：araceae colocasia taro asia chloroplast DNA ethnobotany agriculture domestication

### 1. 研究開始当初の背景

Taro is a very widely distributed and ancient root crop in the Asia-Pacific region. Historical research on the origins, domestication and dispersal of this crop is needed to understand the origins and spread of agriculture in the region. Research on taro (2011-2013) was part of the author's long-term investigation (1984 to present) of the origins, domestication, dispersal, and ethnobotany of taro (Matthews 2010, 2014; Matthews et al. 2012, Spriggs and Matthews 2012). Recently, new techniques have been established to analyse the chloroplast genomes of taro and other aroids (Ahmed et al. 2012), and it is now possible to identify and track the spread of plastid lineages of taro.

Ahmed, I., P. J. Biggs, P. J. Matthews, L. J. Collins, M. D. Hendy and P. J. Lockhart (2012). "Mutational dynamics of aroid chloroplast genomes." *Genome Biology and Evolution* 4(12): 1316–1323.

Matthews, P. J. (2010). An introduction to the history of taro as a food. In V. R. Rao, P. J. Matthews, P. B. Eyzaguirre and D. Hunter (eds) *The Global Diversity of Taro: Ethnobotany and Conservation*. Rome: Bioversity International, pp. 6-30.

Matthews, P. J. (2014). *On the Trail of Taro: an Exploration of Natural and Cultural History*. Osaka, National Museum of Ethnology.

Matthews, P. J., E. M. G. Ago, D. N. Tandang and D. A. Madulid (2012). Ethnobotany and Ecology of Wild Taro (*Colocasia esculenta*) in the Philippines: Implications for Domestication and Dispersal. In M. Spriggs, D. Addison and P. J. Matthews (eds) *Irrigated Taro (Colocasia esculenta) in the Indo-Pacific: Biological, Social and Historical Perspectives*. Osaka: National Museum of Ethnology, pp. 307-340.

Spriggs and Matthews (2012) Spriggs, M. and P. J. Matthews. Irrigated Taro in the Indo-Pacific: Multiple Perspectives. In M. Spriggs, D. Addison and Matthews P. J. (Eds.), *Irrigated Taro (Colocasia esculenta) in the Indo-Pacific: Biological, Social and Historical Perspectives*. Osaka: National Museum of Ethnology, pp. 341-347.

### 2. 研究の目的

Our aims were (a) to develop fundamental historical understanding of the crop in order to explain agricultural history, and by so doing, (b) support efforts to preserve and develop the crop for future utilisation. The future potential of this crop cannot be fully recognised and achieved without knowing something about the history and past uses of the crop.

During the three-year project, fieldwork was carried out in southern Japan, Philippines, Vietnam, and Taiwan. The fieldwork was aimed at (1) Locating and sampling wild taro populations (*Colocasia esculenta*), (2) locating and sampling wild relatives of taro (*Colocasia* spp.) and a related crop, *Alocasia macrorrhizos*, (3) learning how people use and manage wild taros as food and fodder, and (3) investigating genetic relationships between wild taro, cultivated taro, and various wild and cultivated relatives (*Colocasia* species and other aroid genera).

The distribution and origin of wild taro in the Ryukyu Islands of southern Japan was also studied. Previous research showed that wild taro in southern Japan is associated with traditional, small-scale pig husbandry. If the sources of the wild taro can be identified, this may tell us something about (a) the dispersal of wild taro in Southeast Asia, and (b) the origins of pig husbandry in southern Japan.

### 3. 研究の方法

Field surveys were carried out by road and by foot, together with interviews and photography. In this way, we could locate wild taro populations, learn about their uses (or non-use) by local people, and record the natural and cultural context of each sample collected (location, habitat, uses, etc.). For genetic analysis, leaf samples from wild and cultivated taros were collected and placed in bags with silica gel. The research was carried out in collaboration with local research organisations and counterparts, and samples were obtained with local permission. Chloroplast DNA was sequenced at multiple loci to identify different genetic lineages within taro, and to compare wild and cultivated taros from Japan, Southeast Asia, and the Pacific Islands.

#### 4 . 研究成果

Analytical work was carried out in collaboration with a PhD student (now Dr Ibrar Ahmed) at Massey University, New Zealand (I was formally appointed as one of his PhD supervisors). The student was able to sequence the full chloroplast genome of taro, and identify polymorphic loci that can be used to learn about the evolutionary history of taro and its wild relatives, and the dispersal of different genetic lineages within taro (Ahmed et al. 2013). We have analysed samples of wild and cultivated taro from all the fieldwork regions (2011-2013, present project), in addition to older samples collected in previous years from across Asia and the Pacific (1984 and later). A total of two hundred samples (approx.) were analysed, and the work has been successfully submitted as a PhD thesis (Ahmed 2013). A third paper reporting the results of our survey, and coauthored by all participants involved in the survey, is currently in preparation. Collaboration with the Institute of Ecology and Biological Resources (IEBR) in Hanoi has resulted in two papers so far (Ahmed et al. 2013, Matthews and Nguyen, 2014). Papers based on this work have also been presented at a number of conferences (see below). Some of the work has been reviewed in a book (Matthews 2014). Together with Dr NGUYEN Van Du project member, IEBR, Vietnam) I was co-organiser for the 11th International Aroid Conference, Hanoi, Dec. 11-13, 2013 (sponsored by the International Aroid Society in association with the Institute for Ecological and Biological Research, Hanoi). Further publications are expected in the near future, based on part on recent conference presentations (see below).

#### 5 . 主な発表論文等

(研究代表者、研究分担者及び連携研究者には下線)

{ 雑誌論文 } (計 2 件)

Matthews, P. J., and D. V. Nguyen (2014) Origins and Development of Taro. In C. Smith (ed.), Encyclopedia of Global Archaeology. Vol. 9, pp. 7237-7240. Berlin: Springer.(査読有)

Ahmed, I., P. J. Matthews, P. J., Biggs, M. Naem, P. A. McLenachan, and P. J. Lockhart (2013) Identification of chloroplast genome loci suitable for

high-resolution phylogeographic studies of *Colocasia esculenta* (L.) Schott (Araceae) and closely related taxa. Molecular Ecology Resources, 13(5)929-937 (査読有)

{ 学会発表 } (計 6 件)

By MATTHEWS P.J.

Japan. Invited speaker:

“New evidence for the genetic and geographical origins of cultivated taro, and names for wild and cultivated taro in Southeast Asia and Oceania”

presented at the conference “Dispersion of People, Crops, and Language”, 20-21 March 2014, Tachikawa City, Tokyo; sponsored by National Institute of the Humanities (NIHU), National Institute for Japanese Language and Linguistics (NINJAL), and Research Institute for Humanity and Nature (RIHN).

Japan. Invited speaker:

“Natural Habitats, Human Habitats, and the Spread of Edible Aroids” presented at the SOKENDAI International Symposium: “Modern Human Diversity on Genes and Culture - with special reference to Asia and Oceania”, February 3rd - 4th, 2014, Hayama, Japan.

Vietnam.

(a) Co-organiser and speaker: “Ethnobotany and Natural History of Wild Taro: *Colocasia esculenta* and *C. formosana*”;

(b) paper coauthor: J. Castillo, P. J. Matthews, and M. Medecilo, “Ethnobotany of *Alocasia macrorrhizos* in the Philippines”;

(c) poster co-author: Masuno, T., N. A. Luu Dam, V. D. Nguyen and P. J. Matthews, “Use of aroids as fodder plants in a Yao community, northern Vietnam”;

all presented at the 11th International Aroid Conference, Hanoi, Dec. 11-13, 2013 (International Aroid Society in association with the Institute for Ecological and Biological Research, Hanoi).

Korea. Invited speaker:

“Ethnobiology, Systematics, and the Trail of Taro (Toran)” Presented International Symposium for the 10th Anniversary of KoLRI, 23rd August 2013, Seoul, Korea; jointly organized by Korean Lichen Research Institute (KoLRI, Sunchon National University) and Korean National Arboretum.

Philippines. Keynote Lecture:  
“Ethnobiology, Plant Trails, and the Human Niche” presented at the symposium “Systematics in Ethnobiology: Partnership of Biology with Culture and Economy”, May 23-25, 2013, Saint Louis University, Baguio City (organised by the Association of Systematic Biologists of the Philippines in cooperation with the Departments of Biology of Saint Louis University, University of the Philippines Baguio, and Benguet State University.

By MASUNO T.

Masuno, T., L. D. Nguyen, V. D. Nguyen and P. J. Matthews (2012). Fodder sources and backyard pig husbandry in BaVi, Hanoi province, northern Vietnam. Proc. of the 1st International Conference on Animal Nutrition and Environment. A.-N. 2012. Khon Kaen Khon Kaen University Press: 657 - 660.

〔図書〕(計2件)

Matthews, P. J. (2014) On the Trail of Taro: An Exploration of Natural and Cultural History (Senri Ethnological Studies 88) National Museum of Ethnology: Osaka, pp. 429.

Ahmed, I. (2013). Evolutionary Dynamics in Taro (*Colocasia esculenta* L.). Unpublished PhD thesis. Palmerston North: Massey University. pp.108

〔その他〕

ホームページ等

<http://wildtaro.ning.com>

## 6 . 研究組織

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