

Preliminary Survey of Small Millets and Pulses Genetic Resources in Tamil Nadu State of India in 2007

Kuniaki FUKUI¹⁾, Makoto KAWASE¹⁾ and Natesan SENTHIL²⁾

1) *Genebank, National Institute of Agrobiological Sciences (NIAS), 2-1-2, Kannondai, Tsukuba, Ibaraki 305-8602, Japan*

2) *Department of Plant Molecular Biology and Biotechnology, CPMB, Tamil Nadu Agricultural University (TNAU), Coimbatore-641003, Tamil Nadu, India*

インド，タミル・ナドゥ州における雑穀類と 豆類探索収集の事前調査，2007 年

福井 邦明¹⁾・河瀬 眞琴¹⁾・Natesan SENTHIL²⁾

1) 農業生物資源研究所・ジーンバンク

2) タミル・ナドゥ州立農業大学・植物分子生物学生物工学部

Summary

NIAS and TNAU signed a Memorandum of Understanding (MOU) on Collaborative Research Project in Plant Genetic Resources. Based on the MOU, field surveys to mainly collect small millets and pulses in Tamil Nadu for three years were planned. This report describes the first visit from October 16 to November 2 in 2007. We mostly explored hilly areas and 42 samples were collected, which consisted of 20 millets, 21 pulses and one sample of sesame.

Introduction

A preliminary joint field survey was made based on a MOU on Collaborative Research Project in Plant Genetic Resources between TNAU, Coimbatore, Tamil Nadu, India and Genebank, NIAS, Tsukuba, Japan. The major purpose of this survey was focused on present status and recent changes of small millets cultivation in mainly hilly areas that have been suggested to possess traditional agro-pastoral culture complex with small millets cultivation. The visit also aimed to identify unique genetic resources for conservation, protection and sustainable use.

Geography and climate

Tamil Nadu is located on the south eastern India. West and North of the state is hilly while the East and South are coastal plains. The climate of Tamil Nadu is tropical. April and May are the hottest months with the temperature going above 40° C in the plains while temperatures

are moderate in hilly areas. Temperature becomes relatively low between November and February. During these months, minimum temperature in the plains rarely drops below 20° C, while the temperature may drop to 5° C or below in the hills. The rainy season are brought by the north-east monsoon between October and December. The average annual rainfall ranges between 635 and 1,905 mm a year of which more than 40 % is in the rainy season.

Methods

On-farm survey of crop genetic resources, mainly small millets and some pulses, was conducted in the Nilgiri hills (Mettupalayam in Coimbatore district, Coonoor, Wellington and Udagamandalam in the Nilgiris district), the Kolli hills in Namakkal district, the west mountain area of Krishnagiri district, the basin area in hills to the east of Harur in Dharmapuri district, the Yelagiri hills in Vellore district, and the plain area between Vriddhachalam in Cuddalore district and Attur in Salem district (Table 1, Fig. 1).

Result and discussion

We collected a total of 42 samples that included three samples of finger millet (*Eleusine coracana*), eight samples of foxtail millet (*Setaria italica*), six samples of little millet (*Panicum sumatrense*), one sample of common millet (*Panicum miliaceum*), one sample of kodo millet (*Paspalum scrobiculatum*), 13 samples of common bean (*Phaseolus vulgaris*), four samples of *Phaseolus coccineus*, one sample of *Vigna trilobata* and others as listed in Table 2. Passport data such as collection locality, cultivation practices, usage, and environmental conditions were recorded as far as possible together with collecting plant materials.

Since climate of Nilgiri hills is cooler and wetter, plants flourish more than other explored areas. Wild buckwheat (*Fagopyrum cymosum*) was found at Udagamandalam (Photo 1). At other hilly areas, we found mainly rainfed fields and some paddy fields. Finger millet, little millet, foxtail millet, rice and cassava were commonly cultivated and on some cases crops were interplanted (Photo 2). At Holly hill, we found slash-and-burn fields where foxtail millet was grown (Photo 3). In the plains, grass land and fields expanded and there were some palm trees on both sides of the road (Photo 4). Also, we could find many paddy fields (Photo 5). Kodo millet was widely cultivated in the plain area near Vriddachalam.

We found significant changes in millet farming in Tamil Nadu. The second author (Kawase) participated in an exploration team collecting millets organized by Dr. Sadao Sakamoto, Kyoto University in 1985, which was conducted in cooperation with the NBPGR, New Delhi and the UAS, Bangalore. Traditional cultivation of millets linked with animal husbandry was widely observed in Karnataka, Tamil Nadu and Andhra Pradesh, and there was a large diversity of finger millet, foxtail millet, little millet, kodo millet and others were successfully collected at that time. Rapid economic development has changed village life style and agriculture itself over the last two decades. Shortage of labors caused by increased population movement toward cities has accelerated mechanization of agriculture. Constructions of trunk roads and successful technology transfer through agricultural extension efforts have promoted commercialization of agriculture. Recently, the Indian government has started to subsidize the distribution of rice (2 rupees/kg) to people with low income, which has drastically changed local farmers' food habits.

Table 1. Itinerary of the preliminary survey in Tamil Nadu of India in 2007

| Date | Day | Itinerary | Stay |
|--------|-----|-------------------------------------|---------------|
| 16-Oct | Tue | Narita-Delhi | Delhi |
| 17-Oct | Wed | Delhi-Coimbatore | Coimbatore |
| 18-Oct | Thu | Coimbatore | Coimbatore |
| 19-Oct | Fri | Coimbatore-Wellington | Wellington |
| 20-Oct | Sat | Wellington-Coimbatore | Coimbatore |
| 21-Oct | Sun | Coimbatore-Kolly hills-Rasipuram | Rasipuram |
| 22-Oct | Mon | Rasipuram-Paiyur | Paiyur |
| 23-Oct | Tue | Paiyur-Harur-Yelagiri-Vridhachallam | Vridhachallam |
| 24-Oct | Wed | Vridhachallam-Tittakudi-Valappady | Valappady |
| 25-Oct | Thu | Valappady-Coimbatore | Coimbatore |
| 26-Oct | Fri | Coimbatore | Coimbatore |
| 27-Oct | Sat | Coimbatore | Coimbatore |
| 28-Oct | Sun | Coimbatore-Delhi | Delhi |
| 29-Oct | Mon | Delhi | Delhi |
| 30-Oct | Tue | Delhi | Delhi |
| 31-Oct | Wed | Delhi | Delhi |
| 1-Nov | Thu | Delhi- | in-flight |
| 2-Nov | Fri | Narita | |

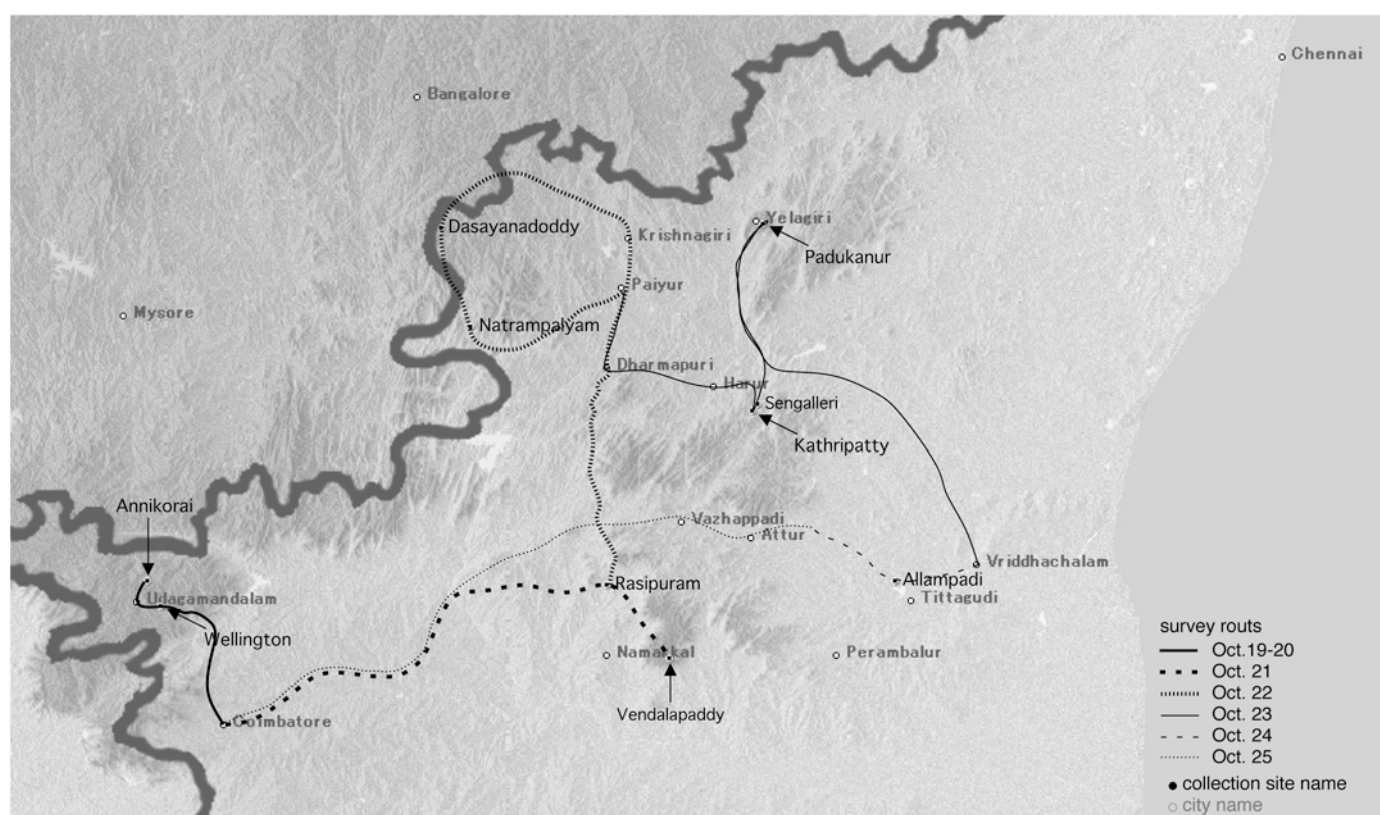


Fig. 1. Collection sites in the survey. The SRTM-3 map is used.

Most of the farmers in remote areas who were traditionally growing small millets abandoned the cultivation of millets even for home consumption, and shifted to other cash crops. Therefore, the renowned “traditional millets culture” in hilly areas and dry areas of Tamil Nadu has been declining. Based on the observation during this trip, we recommend that field studies should be conducted in areas where local landraces of millets are grown even if on a small scale. Although some collections were already conserved in the TNAU, the NBPGR, the NIAS Genebank and others, there are other yet to be explored places.

We would like to refer to the necessity of in-depth collection and analysis of *Vigna*, because wild *Vigna* species are important genetic resources in Tamil Nadu. Recent explorations carried out by Dr. Norihiko Tomooka, Genebank, NIAS and his co-researchers in Thailand, Myanmar, Laos, Sri Lanka and Bhutan followed by analyses of morphology as well as DNA polymorphism have solved taxonomic problems and described new Asian *Vigna* species. As the Western Ghats range is suggested to possess different wild *Vigna* species, hilly areas in the western part of Tamil Nadu may provide new findings on genetic diversity of *Vigna*. We found a few wild *Vigna* populations (probably *V. trilobata*) in this field study, although it was not the season for to collect seeds. In addition to the western part of Tamil Nadu, precise field studies are needed to understand crop and wild relative genetic.

和文摘要

生物研はインド・タミル-ナドゥ州立農業大学と同州における 2007 年から 3 年計画の植物遺伝資源共同探索調査の MOU を締結した。本報告はこの MOU に基づいて行われた事前調査についてとりまとめたものである。本調査は 2007 年 10 月に主に同州の丘陵地域で行われた。その結果、雑穀類 20 系統、豆類 21 系統等、合計 42 系統を収集した。経済発展に伴う農産物需要の変化・農業の機械化等によって、同州の農業は急速な変化の途上にあった。在来種の消失を防ぐために、早急な遺伝資源の探索収集が望まれる。

Table 2. Passport data of plant materials collected

| No. | Local name | English name | Scientific Name | Date MM/dd | Place/village | Latitude | Longitude | Altitude (m) | Source | Status |
|-----|----------------------------|----------------|--|------------|----------------|--------------|--------------|--------------|-----------|----------|
| | | | | | | ° ' " | ° ' " | | | |
| 1 | MOCHAI | common bean | <i>Phaseolus vulgaris</i> L. | 10/19 | Wellington | N 11 22 43.5 | E 76 46 27.0 | 1809 | farmstore | landrace |
| 2 | MOCHAI | common bean | <i>Phaseolus vulgaris</i> L. | 10/19 | Wellington | N 11 22 43.5 | E 76 46 27.0 | 1809 | farmstore | landrace |
| 3 | KODIAVARAI | common bean | <i>Phaseolus vulgaris</i> L. | 10/19 | Wellington | N 11 22 43.5 | E 76 46 27.0 | 1809 | farmstore | landrace |
| 4 | AVARAI | common bean | <i>Phaseolus vulgaris</i> L. | 10/19 | Wellington | N 11 22 43.5 | E 76 46 27.0 | 1809 | farmstore | landrace |
| 5 | AVARAI | common bean | <i>Phaseolus vulgaris</i> L. | 10/19 | Wellington | N 11 22 43.5 | E 76 46 27.0 | 1809 | farmstore | landrace |
| 6 | MOCHAI KOTTAI AVARAI | common bean | <i>Phaseolus vulgaris</i> L. | 10/19 | Wellington | N 11 22 43.5 | E 76 46 27.0 | 1809 | farmstore | landrace |
| 7 | MOCHAI KOTTAI AVARAI | common bean | <i>Phaseolus vulgaris</i> L. | 10/19 | Wellington | N 11 22 43.5 | E 76 46 27.0 | 1809 | farmstore | landrace |
| 8 | | common bean | <i>Phaseolus vulgaris</i> L. | 10/19 | Wellington | N 11 22 43.5 | E 76 46 27.0 | 1809 | farmstore | improved |
| 9 | PANDAM AVARAI | common bean | <i>Phaseolus vulgaris</i> L. | 10/19 | Wellington | N 11 22 43.5 | E 76 46 27.0 | 1809 | farmstore | landrace |
| 10 | MOCHAI KOTTAI AVARAI | common bean | <i>Phaseolus vulgaris</i> L. | 10/19 | Wellington | N 11 22 43.5 | E 76 46 27.0 | 1809 | farmstore | landrace |
| 11 | PANDAM AVARAI | common bean | <i>Phaseolus vulgaris</i> L. | 10/19 | Wellington | N 11 22 43.5 | E 76 46 27.0 | 1809 | farmstore | landrace |
| 12 | AVARAI | common bean | <i>Phaseolus vulgaris</i> L. | 10/19 | Wellington | N 11 22 43.5 | E 76 46 27.0 | 1809 | farmstore | landrace |
| 13 | AVARAI | runner bean | <i>Phaseolus coccineus</i> L. | 10/19 | Wellington | N 11 22 43.5 | E 76 46 27.0 | 1809 | farmstore | landrace |
| 14 | AVARAI | runner bean | <i>Phaseolus coccineus</i> L. | 10/19 | Wellington | N 11 22 43.5 | E 76 46 27.0 | 1809 | farmstore | landrace |
| 15 | AVARAI | runner bean | <i>Phaseolus coccineus</i> L. | 10/19 | Wellington | N 11 22 43.5 | E 76 46 27.0 | 1809 | farmstore | landrace |
| 16 | AVARAI | runner bean | <i>Phaseolus coccineus</i> L. | 10/19 | Wellington | N 11 22 43.5 | E 76 46 27.0 | 1809 | farmstore | landrace |
| 17 | KODIAVARAI | common bean | <i>Phaseolus vulgaris</i> L. | 10/19 | Wellington | N 11 22 43.5 | E 76 46 27.0 | 1809 | farmstore | landrace |
| 18 | (BEAN) | fabia bean | <i>Vicia faba</i> L. | 10/20 | Annikorai | N 11 27 29.8 | E 76 43 55.8 | 1929 | farmstore | landrace |
| 19 | SAMAI | little millet | <i>Panicum sumatrense</i> Roth ex Roem. et Schult. | 10/20 | Annikorai | N 11 27 29.8 | E 76 43 55.8 | 1929 | farmstore | landrace |
| 20 | EREGI | finger millet | <i>Eleusine coracana</i> (L.) Gaertn. | 10/20 | Annikorai | N 11 27 29.8 | E 76 43 55.8 | 1929 | farmstore | landrace |
| 21 | KORAN THENAI | foxtail millet | <i>Setaria italica</i> (L.) P. Beauv. | 10/21 | Vendalapaddy | N 11 13 3.8 | E 78 21 36.9 | 1181 | farmland | landrace |
| 22 | MASURU THENAI | foxtail millet | <i>Setaria italica</i> (L.) P. Beauv. | 10/21 | Vendalapaddy | N 11 13 3.8 | E 78 21 36.9 | 1181 | farmland | landrace |
| 23 | KARUPU THENAI | foxtail millet | <i>Setaria italica</i> (L.) P. Beauv. | 10/21 | Vendalapaddy | N 11 13 3.8 | E 78 21 36.9 | 1181 | farmland | landrace |
| 24 | SIVAPPU THENAI | foxtail millet | <i>Setaria italica</i> (L.) P. Beauv. | 10/21 | Vendalapaddy | N 11 13 3.8 | E 78 21 36.9 | 1181 | farmland | landrace |
| 25 | PILURUVI | | <i>Panicum psilopodium</i> Trin. | 10/21 | Vendalapaddy | N 11 13 3.8 | E 78 21 36.9 | 1181 | farmland | wild |
| 26 | | | <i>Vigna trilobata</i> (L.) Verdcourt | 10/22 | Rasipuram | N 11 26 50.5 | E 78 9 45.8 | 230 | wild | wild |
| 27 | PICHAKADDI | finger millet | <i>Eleusine coracana</i> (L.) Gaertn. | 10/22 | Dasayana-doddy | N 12 33 27.2 | E 77 38 49.0 | 916 | farmstore | landrace |

| No. of plant sampled | Cultural practices | Sowing Month | Harvest Month | Topography | Site | Stoniness | Soil Texture | Drainage | Farmer Name | Glutinous | Other Observations |
|----------------------|--------------------|--------------|---------------|-------------|-------|-----------|--------------|----------|-------------|-----------|--|
| population | irrigated | 3-5 | 6-8 | mountainous | slope | none | red loam | good | | | 70 d** crop, determinate, annual, immature seeds boiled for food |
| population | irrigated | 3-5 | 6-8 | mountainous | slope | none | red loam | good | | | 70 d crop, determinate, annual, immature seeds boiled for food |
| population | irrigated | 3-5 | 10- | mountainous | slope | none | red loam | good | | | 4 M*** crop, vining up to 8 ft, indeterminate |
| population | irrigated | 3-5 | | mountainous | slope | none | red loam | good | | | perennial type, harvest except 11, 12 & 1 |
| population | irrigated | 3-5 | 6-8 | mountainous | slope | none | red loam | good | | | perennial type, harvest except 11, 12 & 1 |
| population | irrigated | 3-5 | 6-8 | mountainous | slope | none | red loam | good | | | annual, Vadukas tribe prefer to, for special preparation |
| population | irrigated | 3-5 | 6-8 | mountainous | slope | none | red loam | good | | | annual, Vadukas tribe prefer to, for special preparation |
| population | irrigated | 5-9 | | mountainous | slope | none | red loam | good | | | dwarf, annual, 25 pods/plant, harvest after 70 d, as green vegetables |
| population | irrigated | 3-5 | | mountainous | slope | none | red loam | good | | | perennial, house consumption, after 6 M harvest for 3 M except 11, 12 & 1 |
| population | irrigated | 3-5 | 6-8 | mountainous | slope | none | red loam | good | | | annual, Vadukas tribe prefer to, for special preparation |
| population | irrigated | 3-5 | | mountainous | slope | none | red loam | good | | | perennial, house consumption, after 6 M harvest for 3 M except 11, 12 & 1 |
| population | irrigated | 3-5 | 7-10 | mountainous | slope | none | red loam | good | | | annual, 3 M crop |
| 5 seeds | irrigated | 3-5 | | mountainous | slope | none | red loam | good | | | perennial, 6 M crop, big seed size, for house consumption |
| 8 seeds | irrigated | 3-5 | | mountainous | slope | none | red loam | good | | | perennial, 6 M crop, big seed size, for house consumption, red flower |
| 2 seeds | irrigated | 3-5 | | mountainous | slope | none | red loam | good | | | perennial, 6 M crop, big seed size, for house consumption, red flower |
| 1 seed | irrigated | 3-5 | | mountainous | slope | none | red loam | good | | | perennial, 6 M crop, big seed size, for house consumption, red flower |
| population | irrigated | 3-5 | 10- | mountainous | slope | none | red loam | good | | | perennial, 6 M crop, white flower |
| population | irrigated | | | mountainous | slope | low | red loam | good | | | 3 M crop |
| population | | 4 | 7 | mountainous | slope | low | red loam | good | | | 3 M crop, cook like rice in the past, now for ceremony |
| population | rain-fed | 4-5 | 8-9 | mountainous | slope | low | red loam | good | low | red loam | |
| 1 panicle | rain-fed | 4-5 | 10 | mountainous | slope | medium | red loam | good | | | yellow grain, cook like rice, sweets (upma, pongal, adoresum & payosum) |
| 1 panicle | rain-fed | 4-5 | 10 | mountainous | slope | medium | red loam | good | | | yellow grain, bristle, cook like rice, sweets (upma, pongal, adoresum & payosum) |
| 1 panicle | rain-fed | 4-5 | 10 | mountainous | slope | medium | red loam | good | | | black grain, cook like rice, sweets (upma, pongal, adoresum & payosum) |
| 1 panicle | rain-fed | 4-5 | 10 | mountainous | slope | medium | red loam | good | | | orange-colored grain, cook like rice, sweets (upma, pongal, adoresum & payosum) |
| 1 plant | | | | mountainous | slope | medium | red loam | good | | | |
| population | | | | plain level | level | low | sandy loam | moderate | | | |
| population | rain-fed | 8 | 12 | hilly | slope | low | red loam | good | | | resistant to drought |

Table 2(continued).

| No. | Local name | English name | Scientific Name | Date MM/dd | Place/village | Latitude | Longitude | Altitude (m) | Source | Status |
|-----|----------------|----------------|--|------------|---------------|--------------|--------------|--------------|-----------|----------|
| | | | | | | ° ' " | ° ' " | | | |
| 28 | KARUPPU SAMAI | little millet | <i>Panicum sumatrense</i> Roth ex Roem. et Schult. | 10/22 | Natrampalyam | N 12 15 7.1 | E 77 44 13.5 | 527 | farmstore | landrace |
| 29 | NAVANE | foxtail millet | <i>Setaria italica</i> (L.) P. Beauv. | 10/22 | Natrampalyam | N 12 15 7.1 | E 77 44 13.5 | 527 | farmstore | landrace |
| 30 | ELLU | semame | <i>Sesamum indicum</i> L. | 10/22 | Natrampalyam | N 12 15 7.1 | E 77 44 13.5 | 527 | farmstore | landrace |
| 31 | PILLU SAMAI | little millet | <i>Panicum sumatrense</i> Roth ex Roem. et Schult. | 10/23 | Sengalleri | N 12 0 28.1 | E 78 38 0.0 | 374 | farmstore | landrace |
| 32 | SURUTTU KEVURU | finger millet | <i>Eleusine coracana</i> (L.) Gaertn. | 10/23 | Sengalleri | N 12 0 28.1 | E 78 38 0.0 | 374 | farmstore | landrace |
| 33 | SENTHENAI | foxtail millet | <i>Setaria italica</i> (L.) P. Beauv. | 10/23 | Sengalleri | N 12 0 28.1 | E 78 38 0.0 | 374 | farmstore | landrace |
| 34 | VELLAI TENAI | foxtail millet | <i>Setaria italica</i> (L.) P. Beauv. | 10/23 | Sengalleri | N 12 0 28.1 | E 78 38 0.0 | 374 | farmstore | landrace |
| 35 | PILLU SAMAI | little millet | <i>Panicum sumatrense</i> Roth ex Roem. et Schult. | 10/23 | Kathripatty | N 11 59 11.3 | E 78 37 5.7 | 399 | farmstore | landrace |
| 36 | TENAI | foxtail millet | <i>Setaria italica</i> (L.) P. Beauv. | 10/23 | Kathripatty | N 11 59 11.3 | E 78 37 5.7 | 399 | farmstore | landrace |
| 37 | KARUN SAMAI | little millet | <i>Panicum sumatrense</i> Roth ex Roem. et Schult. | 10/23 | Padukanur | N 12 34 15.5 | E 78 39 13.8 | 939 | farmstore | landrace |
| 38 | VELLAI SAMAI | little millet | <i>Panicum sumatrense</i> Roth ex Roem. et Schult. | 10/23 | Padukanur | N 12 34 15.5 | E 78 39 13.8 | 939 | farmstore | landrace |
| 39 | MALAI THUVARAI | pigeon pea | <i>Cajanus cajan</i> (L.) Millsp. | 10/23 | Padukanur | N 12 34 15.5 | E 78 39 13.8 | 939 | farmstore | landrace |
| 40 | VELLAI AVARAI | lablab bean | <i>Lablab purpurea</i> (L.) Sweet. | 10/23 | Padukanur | N 12 34 15.5 | E 78 39 13.8 | 939 | farmstore | landrace |
| 41 | PANI VARAGU | common millet | <i>Panicum miliaceum</i> L. | 10/23 | Padukanur | N 12 34 15.5 | E 78 39 13.8 | 939 | farmstore | landrace |
| 42 | VARAGU | kodo millet | <i>Paspalum scrobiculatum</i> L. | 10/24 | Allampadi | N 11 27 30.3 | E 79 3 44.5 | 81 | farmstore | landrace |

* Collection No. is designated as COL/INDIA/2007/TNAU-NIAS/(Sr. No.).

**d means days

***M means months

| No. of plant sample | Cultural practices | Sowing Month | Harvest Month | Topography | Site | Stoniness | Soil Texture | Drainage | Farmer Name | Glutinous | Other Observations |
|---------------------|--------------------|--------------|---------------|-------------|-------|-----------|-------------------|----------|-------------|-----------|--|
| population | rain-fed | 6 | 9 | hilly | slope | medium | red loam | good | | | semilooper, if sowing is delayed, cook as rice, semi-solid gruel (kanji) |
| population | rain-fed | 6 | 9 | hilly | slope | medium | red loam | good | | | cook as rice, semi-solid gruel (kanji) |
| population | rain-fed | 4 | 7 | hilly | slope | medium | red loam | good | | | |
| population | rain-fed | 6-7 | 10 | undulating | slope | medium | sandy loam | good | | | food & fodder, cook like rice |
| population | rain-fed | 7-8 | 12 | hilly | slope | medium | sandy loam | good | | | food (curry ball) |
| population | rain-fed | 5-6 | 9-10 | hilly | slope | medium | sandy loam | good | | | cook like rice |
| population | rain-fed | 5-6 | 9-10 | hilly | slope | medium | sandy loam | good | | | cook like rice |
| population | rain-fed | 6-7 | 10-11 | hilly | slope | medium | sandy loam | good | | | cook like rice |
| population | rain-fed | 6-7 | 10-11 | hilly | slope | medium | sandy loam | good | | | cook like rice |
| population | rain-fed | 7-8 | 12-1 | hilly | slope | none | sandy loam | good | | | cook like rice |
| population | rain-fed | 7-8 | 10 | hilly | slope | medium | | good | | | cook like rice |
| population | rain-fed | 6-7 | 1 | hilly | slope | low | sandy loam | good | | | food |
| population | rain-fed | 6-7 | 1 | hilly | slope | low | sandy loam | good | | | grain for food |
| population | rain-fed | 6-7 | 9 | hilly | slope | medium | sandy loam | good | | | cook like rice |
| population | rain-fed | 8-9 | 1 | plain level | level | low | black cotton soil | poor | | | cook like rice (varagu sadham), sweets |



Photo 1. Wild buckwheat at Udakamandalam.



Photo 2. Interplanted field of finger millet and sorghum.



Photo 3. Slash and burned field.



Photo 4. Landscape at plain area.



Photo 5. Paddy fields in the plain.