

# Collection and Evaluation of Local Thai Rice Varieties (*Oryza sativa* L.)

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**Abstract:** This study explored the biodiversity in Local Thai rice Varieties (*Oryza sativa* L.) during May 2011 to March 2013 by conducting surveys and collecting rice varieties from 4 regions of Thailand. There are altogether 89 varieties of local rice which include 16 in Central region, 12 in Northern region, 23 in Northeastern region, and 38 in Southern region. Among them are of 2 types: 21 varieties of glutinous rice and 68 varieties of non-glutinous rice. Ecological classification suggested 72 varieties of lowland rice, 10 varieties of upland rice, and 7 varieties of floating rice. These varieties of rice were cultivated in the farmer fields of Nongbondaeng sub-district in Banbueng district of Chonburi province during the rainy season and off season between 2011 and 2013 and to capture their agricultural descriptors. Results revealed germination and seedling growth in 33 varieties. The Unknow 2 variety yields maximum weight of 6.47 grams per panicle, while Sor.6 Chumpae variety gives minimum weight of 0.85 grams per panicle. Aye Khong produces highest number of 317 filled grains per panicle, while the lowest is Sewkliang with 5 filled grains per panicle. Gumrai gives biggest size of seed of  $0.47 \times 1.01$  mm, while Sangyod gives smallest size of  $0.19 \times 0.97$  mm.

**Key words:** Collection, evaluation, local Thai rice varieties.

## 1. Introduction

Thailand is one among others in the world with greatest biodiversity of rice varieties. For many generations, local rice varieties have long been traditionally selected and collected by agriculturalists. Their unique characteristics are resistance to diseases and insects, adaptability to environmental conditions, and less production cost. However, their yields are often less and hence are replaced by new certified rice varieties [1]. The decrease of local rice varieties was led by a number of major causes, for example, fostering the plantation of government promoted rice varieties, consumers' favor of a few rice varieties, changes of ecosystem and environment, a shift toward commercial production. As a result of these, agriculturalists focus more on commercial production.

The Convention on Biological Diversity indicated that the combination of *in situ* conservation and *ex situ* conservation is particularly important [2]. This is in line with the 10th National Economic and Social Development Plan of Thailand with its focus on the development based on biodiversity and local wisdom especially the conservation and restoration of the genetic diversity of local rice varieties aiming to preserve the variation of rice species in connection with the ecosystem, community way and culture. Local rice varieties provide important genetic diversity resources as the database for local rice varieties. However, it is only a part of data since in those farms of Thai agriculturalists there are a lot more of rice varieties remain unexplored. This research thus focuses on exploration the body of knowledge and the role of conservation of rice varieties, as well as collection and evaluation of local rice varieties.

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## 2. Materials and Methods

The current study collected the local Thai rice varieties from 4 regions of Thailand, during May 2011 to March 2013. It integrated both the social science knowledge and scientific knowledge about the local wisdom on management and conservation of local rice varieties. The study employed a mixed-method research of both qualitative and quantitative approaches by collecting data on the conservation of local rice varieties by farmers, evaluating the species traits and the components of the collected local rice yields. The yield trial was conducted by cultivation in the farmer fields of Nongbondaeng sub-district, Banbueng district in Chonburi province; eastern of Thailand.

## 3. Research Results

### 3.1 Result of the Collection of Local Knowledge on Local Rice Varieties

Based on the survey of local rice plantations in 4 regions of Thailand including the North, Central, Northeastern, and Southern regions, factors that affect Thai farmers' conservation of local rice varieties are listed below.

1. Farmer factor as the most important factor for the existence of local rice varieties because those who grow local rice are the ones with interest and desire to preserve local rice varieties.

2. Economic and marketing factor contribute to the farmers' conservation of local rice varieties since the basic economic need for the living differs among each family of Thai farmers. Marketing mechanism effects their decision on which of those rice varieties to be grown so as to meet the demand of market and consumers based on commercial production.

3. Social and cultural factor is a crucial condition for the existence of local rice varieties in many areas of Thailand where rice is the staple food. People in the Northern and Northeastern regions eat glutinous rice as their main dish, while those in the Central and Southern regions prefer non-glutinous rice, for example. Social and cultural dimension such as

various traditions and rituals also effect local rice conservation.

4. Factors related to the traits and properties of rice varieties are also important and affect the existence of local rice. Examples include the properties that suit the conditions of ecosystem, resistance to diseases and insects, different aspects of utilizations. As a result, farmers need to grow a range of rice varieties for each aspect of utilization.

5. Ecosystem factor is a condition affecting local rice conservation of Thai farmers since Thai paddies vary by the diversity of ecosystem as described below.

(1) Upland ecosystem. The rice varieties are grown on the highland along the hillside without wetland but they relies solely on rainwater and soil humidity. They display better drought-tolerant ability than those varieties in other types of ecosystem, and is referred to as upland rice.

(2) Lowland ecosystem. The rice varieties grow well in wetland condition of lowland and is referred to as lowland rice which is most popular in Thailand.

(3) Wetland ecosystem. The varieties can be grown in the condition of wetland of over 100 centimeters high for at least 1 month, which is referred to as deep water rice or floating rice.

6. Production related factor and production factor. In traditional production system, most of the famers adopt transplantation method that preserves the local wisdom through traditions or rituals. Today the farmers shifted their production system to direct seeding and changed the production inputs from using materials and human/animal labors to adopting machines, chemicals, fertilizers and modern varieties. Such changes hence affect the farmers' social relation as well as genetic erosion which were replaced by promoted varieties.

7. Factor on agriculturalists network and NGOs support for farmer community in conservation of local rice heredity, and promotion of farmers' increased awareness, love and value toward local rice in their community.

### 3.2 Result of Local Rice Varieties Collection in the Four Regions of Thailand

Based on the local rice survey and collection, there are altogether 89 varieties from 4 regions which include the central: 16 varieties, Northern: 12 varieties, Northeastern: 23 varieties, Southern: 38 varieties, respectively. Classifying by cropping ecosystem includes upland rice: 10 varieties, lowland rice: 72 varieties, floating rice: 7 varieties. Classifying by type of starch contained in rice grain are non-glutinous rice: 74 varieties, and glutinous rice: 15 varieties.

### 3.3 Result of Species Traits Evaluation

The seed germination test conducted on all of the collected 89 rice varieties suggests the germination of

only 33 varieties. With small amount of seeds, the trial was undertaken with two replications using  $0.75 \times 3$  m<sup>2</sup> plot, with  $25 \times 25$  cm. transplant spacing. Results show that among these species, Neaw Daeng displays maximum height of 165 cm, and Riceberry displays minimum height of 78 cm. Sew Gliang gives the panicle length for 47.70 cm. The Unknown 2 provides the highest panicle weight of 6.47 g, and Sor 6 Chumpae gives the lowest panicle weight of 0.85 g. For the number of filled grains per panicle, Aye khong produces the greatest number of 317 grains, and Sew Gliang yields the smallest number of 51 grains. Gumrai produces biggest sized unhusked grain of  $0.47 \times 1.01$  mm, while Shang Yod produces smallest sized unhusked grain of  $0.19 \times 0.97$  mm (Table 1).

**Table 1** Some agricultural traits of local rice varieties collected from 4 regions of Thailand planted.

| Varieties          | Plant height (cm) | Panicle length (cm) | Panicle weight (g) | No.of filled grains per panicle (grain) | Size of unhusked grain (mm) |
|--------------------|-------------------|---------------------|--------------------|---|-----------------------------|
| 1 Neaw Daeng       | 165.00            | 26.00               | 3.67               | 222.00                                  | 0.25 × 1.09                 |
| 2 Sahyan           | 160.00            | 25.00               | 5.00               | 197.00                                  | 0.27 × 1.01                 |
| 3 Sor.4 Chumpae    | 154.67            | 27.00               | 4.00               | 169.00                                  | 0.26 × 1.13                 |
| 4 Sang Yod         | 150.67            | 30.00               | 4.00               | 285.00                                  | 0.19 × 0.97                 |
| 5 Hawm Tung        | 150.00            | 27.00               | 4.22               | 124.00                                  | 0.26 × 1.14                 |
| 6 Hawm Jan         | 150.00            | 26.00               | 4.33               | 186.00                                  | 0.26 × 1.13                 |
| 7 Lookkhore Hawm   | 145.34            | 32.00               | 4.57               | 243.00                                  | 0.23 × 0.85                 |
| 8 Neaw Dam 1       | 144.34            | 25.00               | 3.64               | 121.00                                  | 0.32 × 0.84                 |
| 9 Unknown 1        | 141.67            | 26.67               | 3.90               | 168.00                                  | 0.25 × 1.04                 |
| 10 Unknown 2       | 141.00            | 29.00               | 6.47               | 276.00                                  | 0.28 × 1.02                 |
| 11 Ie Nhorn        | 141.00            | 24.00               | 5.07               | 198.00                                  | 0.26 × 1.08                 |
| 12 Hawm Pooparn    | 137.00            | 27.00               | 4.00               | 194.00                                  | 0.28 × 1.14                 |
| 13 Aye Khong       | 135.00            | 39.00               | 6.00               | 317.00                                  | 0.24 × 0.84                 |
| 14 Niaw Dam 2      | 134.33            | 26.00               | 4.73               | 164.00                                  | 0.35 × 0.90                 |
| 15 Hawm Daeng      | 132.34            | 28.00               | 4.20               | 151.00                                  | 0.25 × 1.07                 |
| 16 Daeng Rai       | 131.00            | 25.00               | 4.50               | 191.00                                  | 0.25 × 1.04                 |
| 17 Dammore         | 127.00            | 27.00               | 6.07               | 236.00                                  | 0.39 × 0.96                 |
| 18 Sor. 6 Chumpae  | 79.00             | 15.00               | 0.85               | 28.00                                   | 0.34 × 0.83                 |
| 19 Paedong         | 118.00            | 21.00               | 1.60               | 80.00                                   | 0.35 × 1.03                 |
| 20 Sor. 12 Chumpae | 118.00            | 25.00               | 3.90               | 135.00                                  | 0.38 × 1.02                 |
| 21 Sor. 3 Chumpae  | 116.00            | 24.00               | 2.10               | 91.00                                   | 0.35 × 1.02                 |
| 22 Hawm Sakol      | 108.00            | 18.00               | 1.50               | 77.00                                   | 0.23 × 0.98                 |
| 23 Khao Door       | 105.00            | 21.00               | 1.20               | 76.00                                   | 0.33 × 0.97                 |
| 24 Hawm Nil 1      | 100.00            | 25.00               | 1.86               | 114.00                                  | 0.24x1.01                   |
| 25 Gumrai          | 100.00            | 21.00               | 2.40               | 76.00                                   | 0.47 × 1.01                 |

Table 1 continued

|    | Varieties           | Plant height (cm) | Panicle length (cm) | Panicle weight (g) | No. of filled grains per panicle (grain) | Size of unhusked grain (mm) |
|----|---------------------|-------------------|---------------------|--------------------|--|-----------------------------|
| 26 | Hangyao             | 97.00             | 21.00               | 2.47               | 116.00                                   | 0.28 × 0.86                 |
| 27 | Sew Derm            | 94.00             | 21.34               | 2.06               | 56.33                                    | 0.25 × 1.04                 |
| 28 | Phaya Luemgang      | 90.00             | 20.10               | 1.70               | 91.33                                    | 0.25 × 1.04                 |
| 29 | Khao Chao Chiangmai | 84.00             | 23.00               | 2.07               | 65.00                                    | 0.38 × 1.03                 |
| 30 | Sew Gliang          | 81.00             | 47.70               | 1.40               | 51.00                                    | 0.34 × 1.07                 |
| 31 | Hawm Mali Daeng     | 120.00            | 26.00               | 3.50               | 159.00                                   | 0.26 × 1.07                 |
| 32 | Riceberry           | 78.00             | 30.00               | 5.10               | 180.00                                   | 0.25 × 1.05                 |
| 33 | Khao Dawk Mali 105  | 124.00            | 28.00               | 4.77               | 215.00                                   | 0.24 × 1.02                 |
|    | F-test              | **                | **                  | **                 | **                                       | **                          |
|    | LSD.01              | 11.04             | 2.70                | 0.69               | 11.60                                    | 2.56                        |
|    | C.V. (%)            | 17.24             | 13.92               | 22.31              | 20.65                                    | 14.43                       |

\*\* significant Difference at 0.01 level.

#### 4. Discussion and Conclusions

The survey and collection of rice varieties was conducted in various regions of Thailand including the Central, Northern, Northeastern, and Southern regions. It observed a number of local rice varieties, i.e. 16 varieties in the Central, 12 varieties in the Northern, 23 varieties in the Northeastern, and 38 varieties in the Southern regions. Among them, 74 varieties are non-glutinous rice, and 15 varieties are glutinous rice. Exploring by ecosystem include upland rice: 10 varieties, lowland rice: 72 varieties, and floating rice: 7 varieties. However out of these 89 varieties, only 33 exhibit seed germination. Following the cultivation and evaluation of species traits, the first 3 ranks of plant height are Niaw Daeng, Sahyan, and Sor. 4 Chumpae, respectively. Ranking by the panicle length are Sew Gliang, Aye Khong, and Lookkhorhaum, respectively. Unknown 2, Dammore, and Aye Khong display respectively highest panicle weight. Highest number of filled grains per panicle was found in Aye Khong, Shang Yod, and Unknown 2, respectively.

Evaluation of rice line stability by the traits of grain output using the method of Eberhart and Russell [3] suggested that rice varieties with high averaged panicle weight can be used for selection and examination on localized adaptation and the varieties with extensive self-adaptation. Evaluation of species trait and investigation of potential yields of individual local rice varieties permit the conservation and sustainment of rice heredity as well as utilization and for further improvement and development of rice varieties.

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