Breeding

SACCHARUM GERMPLASM COLLECTED IN THAILAND AND ITS SIGNIFICANCE

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ABSTRACT

Germplasm of Saccharum and the related genera was collected by expedition to the Central, Eastern and Northern regions of Thailand in 1988. A total of 172 accessions was collected, consisting of Saccharum officinarum (4), Saccharum spontaneum (126), Erianthus spp. (36), Sclerostachya fusca (2), and others (4). S. spontaneum clones exhibited the widest distribution and the greatest variation in different ecological habitats. From the viewpoint of breeding potential, remarkable gigantic stalk types of spontaneum with late tasseling habit were collected in highlands (1,450 m) on the northern border with Myanmar. Floating spontaneums inhabiting ponds and canals can be expected to be useful donors for resistance to waterlogging. Erianthus sp. showed wider variability among clones and some can be expected to be a source for vigor in commercial sugarcane breeding programs.

Key words: Germplasm, collection, Thailand, sugarcane, Erianthus, Sclerostachya.

INTRODUCTION

Germplasm resources of crop species constitute an important heritage. In sugarcane, wild species played a remarkable role in the development of modern varieties as the donors of suitable agronomic traits to broader cultivation and more tolerance to stresses (Arceneaux3). To identify this greater variability, much effort has been paid to surveying wild germplasm in various areas of natural distribution (Berding & Koike1, Krishnamurthi8, Koike6, Tew et al.14). It has been assumed that two centers of the origin in genus Saccharum are New Guinea and adjoining area, and the Indian Subcontinent (Berding & Roach3, Panje & Babu13).

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THAILAND, located at the junction line between these two centers, has produced superior *spontaneum* clones which were extensively utilized as breeding stocks in Hawaii reported by Heinz⁵ and in Louisiana by Duskelman & Breaux⁴ and Legendre⁷. Since the wild germplasm has been facing serious crisis of loss of the indigenous variability, two missions were launched in Thailand (Sadakorn¹², Sreenivasan & Sadakorn¹³).

The present paper reports 1988 expedition to Thailand, sponsored by Kasetsart University, Bangkok and Japan International Cooperation Agencies, Tokyo.

**COLLECTION AREAS AND SITES**

The expedition was conducted during December 1988. The collection localities were divided into the three regions, the Central, Eastern and Northern Thailand (Figure 1). The routes were as follows:

2. The Eastern region: Chon Buri, Trat and Rayong.

**SAMPLING TARGET AND METHODOLOGY**

The target species collected were *Saccharum spontaneum*, *S. officinarum* and *Erianthus* and other related genera. Since *S. spontaneum* is widely distributed in all the regions surveyed, the collection was done on the basis of morphological characteristics from different locations and wide ecological conditions to avoid duplication of asexual clones and to maximize the chances of wide genetic variability.

As most clones of *S. spontaneum* and *Erianthus* were flowering during the survey, the choice was based upon the flowering habits and the morphology of vegetative organs. *S. officinarum* clones were mainly found in villages. A sample was collected based on the morphology and color of stalk, leaf and canopy. *Erianthus* species were found widely and typical samples were collected from different ecological conditions. A limited number of *Sclerostachya* and other wild relatives were also collected.

Several pieces of stalk were collected in species propagated by buds, and a clump was dug out for *Erianthus* species. In some samples, fuzz was also collected.
**TABLE 1: Field collection form (Sugarcane).**

<table>
<thead>
<tr>
<th>COLLECTION No.:</th>
<th>DATE:</th>
<th>PERSON:</th>
</tr>
</thead>
<tbody>
<tr>
<td>GENUS and SPECIES:</td>
<td>S. spontaneum, S. officinarum, S. sinense, Saccharum sp. Erianthus, Sclerostachya, Others ( )</td>
<td></td>
</tr>
<tr>
<td>LOCAL NAME (CULTIVAR NAME):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SAMPLE: seed, vegetative, indiv, quantity</td>
<td>pieces herbarium: yes/no</td>
<td></td>
</tr>
<tr>
<td>STATUS: cultivar, weed, wild, market, farm, institute ( )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Landrace pure-line mutant improved ( ) / lowland rainfed upland</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LOCALITY:</td>
<td>km. of</td>
<td></td>
</tr>
<tr>
<td>Altitude:</td>
<td>m</td>
<td></td>
</tr>
<tr>
<td>CULTURAL PRACTICES:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>USAGE:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NOTES:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. DISEASE and PESTS: rust, yellow spot, downy mildew, red rot, borer, Others ( )
2. TOPOGRAPHY: swamp, flood-plain, plain, undulating, hilly, mountainous
3. SITE: level, slope, summit, depression
4. TEXTURE and STONINESS
5. DRAINAGE: poor, moderate, good, excessive
6. SALINITY: none, moderate, excessive
7. ASSOCIATED PLANTS:
8. CHARACTERISTICS: plant height, tassel length, tasseling date, leaf color, leaf size, stalk color, stalk size, stalk shape, pithiness, spongy, juiciness
9. FARMER'S NAME and ADDRESS:
10. PHOTO No. etc.:
11. ACCESSION No. COL. No. LOCAL NAME:
12. SITES OF CONSERVATION

<table>
<thead>
<tr>
<th>KU World Collection</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>COL. No.</td>
<td>COL. No.</td>
</tr>
</tbody>
</table>
The records were taken for locality, habitat, identified genus/species and characteristics of each sample on the form as shown in Table 1. The form was prepared for the expedition based on the form used for the former expedition. When a sample was decided upon for collection, photographs for each sample were taken with a tag of a given accession number. The collected materials were sent to the Kamphaeng Saen Campus, Kasetsart University and planted in flats after soaking the stalks for one night to enhance germination.

RESULTS OF THE COLLECTION

The total number of 172 accessions consists of 4 clones of *S. officinarum*, 126 clones of *S. spontaneum*, 36 clones of *Erianthus* spp., 2 *Sclerostachya*, 1 *Thimidia australis*, 1 *Thysomoloema maxima* and 2 unidentified species as shown in Table 2. These samples designated as accession number KU88-1-172 had been maintained in the germplasm collection established in Kamphaeng Saen Campus, Kasetsart University.


<table>
<thead>
<tr>
<th>Genus/species</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Central</td>
</tr>
<tr>
<td><em>S. officinarum</em></td>
<td>1</td>
</tr>
<tr>
<td><em>S. spontaneum</em></td>
<td>69</td>
</tr>
<tr>
<td><em>Erianthus</em> spp.</td>
<td>9</td>
</tr>
<tr>
<td><em>Sclerostachya fusca</em></td>
<td>1</td>
</tr>
<tr>
<td><em>Thimidia australis</em></td>
<td>2</td>
</tr>
<tr>
<td><em>Thysomoloema maxima</em></td>
<td>1</td>
</tr>
<tr>
<td>Unidentified</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>79</td>
</tr>
</tbody>
</table>

GEOGRAPHIC DISTRIBUTION OF THE SPECIES

1. *Saccharum officinarum*

Noble type canes have been cultured for chewing, ornamental and medicinal purposes on backyards and gardens of the villages all through the country (Figure 2). They are called by several local names such as 'Oi Luang', 'Oi Dum' or 'Oi Hok'. 'Oi Dum' with dark purplish stalks and purplish green leaves was used for medical purpose. The clone, 88-154, was collected in Chiang Rai (Figure 3).
FIGURE 2. *Saccharum officinarum* grown in farmer's yard at Chiang Rai.

Since most of noble canes are of little commercial value, they are confronted with a critical situation of genetic erosion, and should be collected immediately.

2. *Saccharum spontaneum*

*S. spontaneum* was distributed almost throughout the regions exploited. Huge communities were often developed on riversides, ponds and swampy plains in
the Central region (Figure 4). Special comment should be mentioned that typical water-floating spontaneums found in ponds and water channels had well developed rhizomatous systems in the water (Figures 5&6). The accessions 88-54, 55, 57, 59 and 62 on the way to Kanchanaburi, 88-71 and 72 at Chon Buri, 88-80 at Rayong, 88-84 at Trat, and 88-165, 167, 168, and 169 from Sukhothai were all collected from such floating populations. These clones can be expected to carry resistance to waterlogging stress.

FIGURE 3. *Saccharum officinarum,* “Oi Dum” with purple canes and purplish-green leaves.
FIGURE 4. Huge community of *spontaneum* distributed in the Central plain.

FIGURE 5. Water-floating type of *spontaneum* growing in a pond.
Judging from the morphology and tasseling time, at least three types are present in the Central and Eastern regions: a long-stalk type with broad leaves in late tasseling, a short-stalk type with thin leaves in early tasseling and an intermediate type between the two. The long-stalk type was generally predominant in Ban Pong, Photharam, Ayutthaya, Kamphaeng Phet and Sukhothai.

The Northern region geographically is separated by a divide of mountains from the Central plain. On the basis of morphological characteristics, the types of *S. spontaneum* in the Northern plain have generally a shorter stalk, more vigorous shoots and earlier tasseling. Dense and wide communities of *S. spontaneum* are prevalent along riversides in Chiang Mai, Chiang Rai and Chiang Saen. Continuous variations of ecological types of *S. spontaneum* are present in this region (Figure 7).

Of particular interest are gigantic stalk types of *S. spontaneum* collected at Ang Khang, the Northwestern highland at 1,450 m elevation bordering Burma (Figure 8). The accessions 88-122, 123 and 126 reached at over 6 m length of thick stalk (diameter 1.9 cm) with long internodes and very broad leaves. These types, tasseling in early December, can be easily crossed with commercial varieties to incorporate the favorable agronomic traits.
Various types of *spontaneum* present in Chiang Rai.

It is concluded that the germplasm of *S. spontaneum* is the most diversified and worthy of breeding use.


*Erianthus* is predominantly distributed on hilly country in the Eastern and Northern regions. The most prevalent species were *E. procerum* and *E. arundinaceus*, which grew wild with tall and thick stalks in dense populations at higher altitude. Wide variations were found in stalk length, diameter, leaf size, leaf canopy and tassel color in different ecological habitats. Tassel color varied from light to dark purple. Some clones in the Eastern region were infected with false smut and yellow spot diseases.

The accessions, 88-83, 89, 91 and 92 had very tall and thick stalks from 5 to 8 meters (collected from the Eastern region) and 88-141 and 143 also had vigorous tall stalks (from the Northern hills) (Figure 9). These clones will be expected to carry valuable genes for vigor and tolerances for incorporation into commercial varieties in sugarcane. *Erianthus* spp. are the most diverse germplasm among the related genera in Thailand.
4. The other wild relatives

*Sclerostachya fusca* was found in a few sites of the Central and Northern regions. It had thinner stalk as tall as 2 meters. *Thimidia australis* and *Thysomoloema maxima* were confined to the Northern highland (Figure 10). Their genetic diversities were limited.
9. *Erianthus* found in the Eastern region with vigorous, long and thick stalks.

10. *Thysmidoema maxima* found in the highland with extending broad and thick levels.
REFERENCES


Mots clés: Patrimoine génétique, collection, Thaïlande, canne à sucre, *Saccharum*, *Erianthus*, *Sclerostachya*.