The Conservation of Zingiberaceae in Lao PDR

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ABSTRACT
Surveys and collections of the Zingiberaceae plants have been undertaken between 2011 and 2013 in many provinces of the southern, central and northern parts of Laos. The total living collection number of ginger species obtained during this field study was 214, and among these, only 54% (i.e. 76 species) were identified, while the remaining 46% need to reach the flowering stage to be identified. Up to now, the whole living collection has been grown in the nursery at the Pha Tad Ke Botanical Garden for future planting of a Zingiberaceae Garden for conservation, research and educational activities.


Caulokaempferia alba K. Larsen


Mr. Sengthong gives water in Ginger nursery

INTRODUCTION
The family Zingiberaceae consists of over 1,400 species of rhizomatous perennial herbs, of which some genera have perennial pseudostems with a very strong and thick rhizome, such as *Alpinia*, *Amomum*, *Etlingera* and *Elettariopsis*, while a large number have deciduous pseudostems whose rhizome are tubers with rootstock, including *Curcuma*, *Zingiber*, *Gagnepainia*, *Globba*, *Hedychium*, *Kaempferia*, *Stahlianthus*, *Boesenbergia*, *Caulokaempferia*. They are pan-tropical with their centre of diversity in South and SE Asia and some species spread in America and in subtropical and warm temperate areas of Asia. Considering the richness of Zingiberaceae of the neighbouring countries, it seems safe to estimate that more than 400 species could be found in Laos (Škorničkova). In Laos, the Zingiberaceae plants are found in diverse habitats such as dry evergreen forest, mixed deciduous forest, evergreen forest, limestone forest, pine forest and dipterocarp forest where the pseudostems appear only during rainy season. They provide a wide scope of use eg. several *Kaempferia* species for medicinal purposes, *Etlingera elatior* are used as ornamental plants and *Alpinia galanga* and *Zingiber officinale* for cooking. More than a century ago, the Zingiberaceae of Indochina attracted the interest of French botanists, especially F. Gagnepain who argued that about 111 species of this family occurred in Indochina. The results of their research were published in the 'Flore generale de l'Indochine'. The existing trade of Zingiberaceae plants across neighbouring countries has developed more recent surveys and research. This


Keooudone collecting Gingers in Phou Khao Khuay NPA

is a group of new species and new records have been published: *Caulokaempferia burttii* K. Larsen & Jenjitt., *Hedychium chayanianum* Wongsuwan, *Kaempferia champasakensis* Pichean. & Koonterm, *Kaempferia gigantiphylla* Picheans.& Koonterm, *Kaempferia attapeuensis* Picheans. & Koonterm, *Hedychium champasakense* Picheans. & *Kaempferia sawanensis* Picheans. & Koonterm and *Laosanthus graminifolius* K. Larsen & T. Jenjitt.. Among the existing genera of Zingiberaceae, the *Amomum* is the most represented in Laos with 31 species out of 35 species occurring in Indochina (Lamxay, V. & Newman, M., 2012).

OBJECTIVES OF GINGER COLLECTION IN PHA TAD KE
- To investigate taxonomic and ecological aspects of the Zingiberaceae
- To undertake their ex-situ conservation and to seek further possible uses

STUDY AREAS
Over a three-year period, surveys have been undertaken in 22 sites in the northern, central and southern parts of Laos from 14º22'19.6"N and 20°28'11.3"N, from 100°28'51.44"E to 107º11' 57.6"E (Houa Phanh, Bokeo, Xiengkhoueng, Luang Prabang, Vientiane, Bolikhamxay, Khammouane, Champasack and Attapeu provinces and Vientiane municipality as well) and from 113 m to 1253 m. altitude.

MATERIALS AND METHODS
All specimens used for this study were collected from these study sites. The discussion with local people, local healers, local traders and old women on their use was undertaken during the field work. The taxonomical aspects have been worked on as well as their conservation status. The cultivation of a living Zingiberaceae collection at Pha Tad Ke Botanical Garden provides information on their growth performance, their soil requirements and their flowering. A database, including flowering period, growth performance, distribution, use, trade, local exploitation, cultivation, etc. was started. The whole living collection with related data


Curcuma petiolata Roxb.

base have been prepared for the creation of a Zingiberaceae Garden within the Pha Tad Ke Botanical Garden. Therefore a map of this garden has been prepared, based mainly on their growth performance, their affinity and their distribution. Besides the living collection, dried specimens were prepared as well and sent to the national herbarium located in Vientiane.

RESULTS
A living collection of 214 numbers has been obtained and planted at Pha Tad Ke nurseries for further taxonomical study and for a planned ginger garden.
A list of Zingiberaceae plants with their conservation status has been obtained (Table 1). Among these 76 species or 54% (116 collection numbers) were identified while the remaining 48 numbers (46%) need to reach flowering stage to be identified properly. 13 genera were represented: *Alpinia* 14%, *Amomum* 21%, *Boesenbergia* 3%, *Caulokaempferia* 1%, *Curcuma* 19%, *Elettariopsis* 2%, *Etlingera* 6%, *Gagnepainia* 2%, *Globba* 11%, *Hedychium* 10%, *Kaempferia* 5%, *Stahlianthus* 2%, *Zingiber* 13%. Among this rich group, 15 species were newly recorded in Laos. (Figure 1.)


Zingiber thorelii Gagnep.

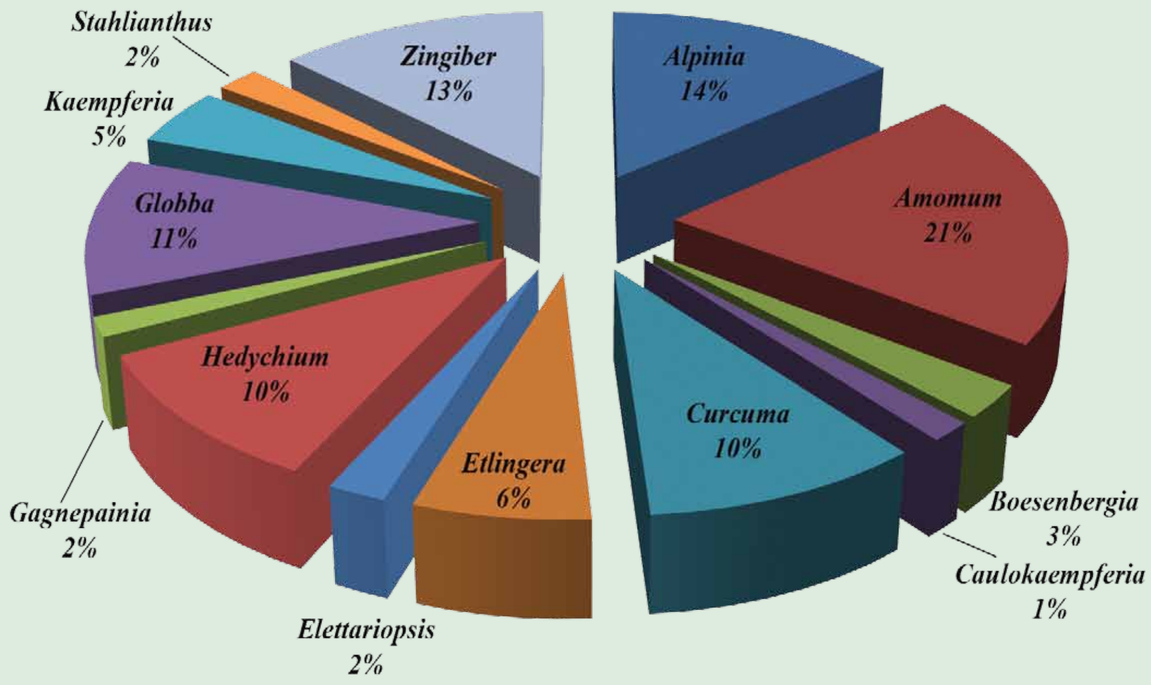

Figure 1. Diagram of each genus calculated by percentage


Zingiber laoticum Gagnep.


Curcuma corniculata Škornič.

Nursery and Ginger Garden
A 900 m² area of land with necessary irrigation system has been set aside for a future Zingiberaceae garden for the purpose of ex-situ conservation. In this ginger garden the seedlings or adults plants from existing nurseries of the Pha Tad Ke Botanical Garden will be planted. This garden will be divided in two habitats: one less humid habitat for deciduous pseudostems species and one more humid habitat for receiving perennial pseudostems species. Seven groups of the Zingiberaceae plants will be included in the ginger garden (Figure 2.) with details as below:
1. Amomum walk
2. The ginger order area will show related families: Costaceae, Cannaceae, Heliconiaceae, Lowiaceae, Marantaceae, Musaceae and Strelitziaceae, etc...
3. Gingers of Indochina area will show gingers native to Indochina.
4. Endemic gingers of Laos
5. Edible and medicinal gingers
6. Asian ornamental gingers
7. Gingers native to Luang Prabang area


Alpinia laosensis Gagnep.

Conclusion
The field work was quite difficult, because Zingiberaceae includes many species which grow and flower in the rainy season, so we need more time for surveying them, but in the field we had only a little time and some places have not been covered yet. Some species are growing well in the nursery, including *Alpinia* spp. and *Amomum* spp., and are easy to take care of. Making a ginger garden at Pha Tad Ke Botanical Garden is good for the conservation of ginger ex-situ. Some species in our collection were quite difficult to plant such as *Caulokaempferia* and *Globba*, because they don't need much water so the rhizomes were decaying because sometimes in the rainy season we could not control the amount of water they received. Some collections died, because the habitat was different from the original habitat. This means that it is difficult to do ex-situ conservation for these plants and if their original habitat is damaged, these species of ginger are vulnerable. We also need to give better trainning to our gardeners. For the herbarium specimens, we can get these from cultivation in nurseries. Now we have just a small grant to support field work close to Luang Prabang, but in the future when we have more funds, we will survey elsewhere in Laos.


Amomum dealbatum Roxb.

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Figure 2. Map of Ginger Garden in Pha Tad Ke Botanical Garden

Design and photos by Keooudone Souvannakhoummane