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Original Article

Diversity and uses of Zingiberaceae in Nam Nao National Park, Chaiphum and Phetchabun provinces, Thailand, with a new record for Thailand

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ABSTRACT

Three tribes, 12 genera and 38 species of the ginger family (Zingiberaceae) along five routes in Nam Nao National Park were surveyed between January 2012 and December 2013 to determine their diversity, ecological data, phenology, uses and conservation status. The highest diversity was found in the tribe Zingibereae (6 genera and 21 species), of which the genera *Curcuma* and *Zingiber* comprised the highest number species (eight species each). A species key was constructed based on morphology. The ginger family was found in four forest-types—deciduous dipterocarp forest, mixed deciduous forest, dry evergreen forest and pine forest. The most flowering bloom of the ginger family in Nam Nao National Park was during March to August and the most fruiting bloom was during June to September. The popular uses of Zingiberaceae were as a food, spice, in medicine, as ornamentation and in rituals. Eight species have been evaluated as of least concern and are presented in the IUCN Red List, while two rare species were reported in Thailand Red Data: Plants, while six rare Zingiberaceae species were identified based on the evaluation criteria of Saensouk (2011). Four species were endemic to Thailand. Moreover, *Etlingera yunnanensis* (T. L. Wu & S. J. Chen) R. M. Smith was a new record for Thailand.

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Introduction

Species in the ginger family (Zingiberaceae) are well known in everyday life. Many species are used as spices, in food, cosmetics and dyes, and as ornamental plants. The Zingiberaceae family consists of herbaceous perennial plants that grow well in humid tropical and subtropical areas. The family is centrally distributed in Southeast Asia, from 0 to 2000 m above sea level. The dominant characteristic of the ginger family is the presence of essential oils in all parts of the plant, especially in the rhizomes and leaves. The family Zingiberaceae contains approximately 50 genera and 1500 species world wide. In Thailand, the Zingiberaceae contains approximately 30 genera and 300 species (Larsen and Larsen, 2006). Several Thai genera of the Zingiberaceae have been studied, namely *Kaempferia* (Sirirugsa, 1992), *Zingiber* (Triboun, 2006),

Amomum (Kaewsri, 2006), *Curcuma* (Maknoi, 2006), *Alpinia* (Saensouk, 2006) and *Cornukaempferia* (Saensouk, 2008). In Thailand, a number of localities have been studied focusing on the Zingiberaceae, such as in Phu Phan National Park, Sakon Nakhon province (Saensouk and Chantaranonthai, 2003), Thong Pha Phum Forest, Kanchanaburi province (Suvandeche and Sookchaloem, 2007), Phu Phra Bat Historical Park, Udon Thani province (Saensouk et al., 2014) and Phu Laen Kha National Park, Chaiphum province (Khamtang et al., 2014). Nam Nao National Park is located in Lom Sak district, Nam Nao district, Phetchabun province and Chaiphum province and acts as a boundary between northeastern and northern Thailand. The National Park area is approximately 966 km², contains generally high mountains (about 700 m above sea level) and many forest types, streams and a variety of plants (<http://www.dnp.go.th>). However, there are no published reports of studies in the National Park on the ginger family. Therefore, this research aimed to study the diversity, conservation

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status and uses of the Zingiberaceae in Nam Nao National Park and to construct an identification key.

Materials and methods

Study site

Ginger specimens were collected from Nam Nao National Park, in Chaiphaphum and Phetchabun provinces, monthly during the two-year study from January 2012 to December 2013, along five separate routes (Fig. 1).

Route 1 consisted of a nature trail (approximately 5.8 km) behind the headquarters of the park comprising forest types such as dry evergreen forest, mixed deciduous forest and pine forest.

Route 2 (Suan Son Ban Park) was approximately 5 km long comprising three forest types—deciduous dipterocarp forest, mixed deciduous forest and pine forest.

Route 3 went along the road to Suan Son Phu Kum Kao (approximately 14 km) comprising three forest types—deciduous dipterocarp forest, mixed deciduous forest and pine forest.

Route 4 (length approximately 700 m) at the Heaw Sai waterfalls comprised two forest types—deciduous dipterocarp forest and mixed deciduous forest.

Route 5 was along the roadside of highway No. 12 (approximately 30 km) and comprised three forest types—deciduous dipterocarp forest, mixed deciduous forest and pine forest.

Morphology and taxonomy

The dried plant specimens from many herbaria, including the Herbarium of the Department of National Parks, Wildlife and Plant Conservation (BKF), Bangkok Herbarium (BK), Chiang Mai University Herbarium (CMU), Queen Sirikit Botanical Gardens Herbarium (QBG), Prince of Songkla University Herbarium (PSU) and Khon Kaen University Herbarium (KKU) were checked for basic information such as correct species identification, ecological data, phenological data and notes on the dominant characters.

Important characteristics, such as the color of all the organs, ecological information and distribution data, were recorded. Specimens were collected as 3–5 pieces per specimen and then dried in an oven at 60 °C until completely dried. Flowers or other organs of some species were preserved in 70% alcohol. The specimens were collected and deposited as reference specimens in the Mahasarakham University Herbarium, Thailand. The morphology of the specimens was studied using a stereo microscope and the roots, rhizomes, pseudostems, leaves, inflorescence, flowers, fruit and seeds were described to verify taxonomy. Identification was based on morphological data and on references on the flora of Indo-China, British India, China and the Malay Peninsula monocotyledons and from scientific publications. A key to tribes, genera and species was constructed based on morphology. Utilization data of the Zingiberaceae was obtained through interviewing local villagers who were living in the Nam Nao National Park.

Conservation status evaluation

The conservation status of plants was based on the evaluation criteria of the IUCN Red List (IUCN Red List of Threatened Species, 2014), the Thailand Red Data: Plants (Santisuk et al., 2006) and the evaluation criteria of Saensouk (2011).

Results

Diversity of Zingiberaceae in Nam Nao National Park

Three tribes, 12 genera and 38 species of Zingiberaceae were collected from the five routes in Nam Nao National Park (Table 1 and Fig. 2). The tribe Alpinieae was comprised of four genera and 10 species—*Alpinia* (4 species), *Amomum* (4 species), *Elettariopsis* (1 species) and *Etlingera* (1 species). The tribe Zingibereae, with the highest diversity of Zingiberaceae species had 6 genera and 23 species—*Boesenbergia* (3 species), *Cornukaempferia* (2 species), *Curcuma* (8 species), *Kaempferia* (2 species), *Stahlianthus* (1 species) and *Zingiber* (7 species). The tribe Globbeae was represented by two genera and five species—*Gagnepainia* (2 species) and *Globba* (3 species) (Fig. 2).

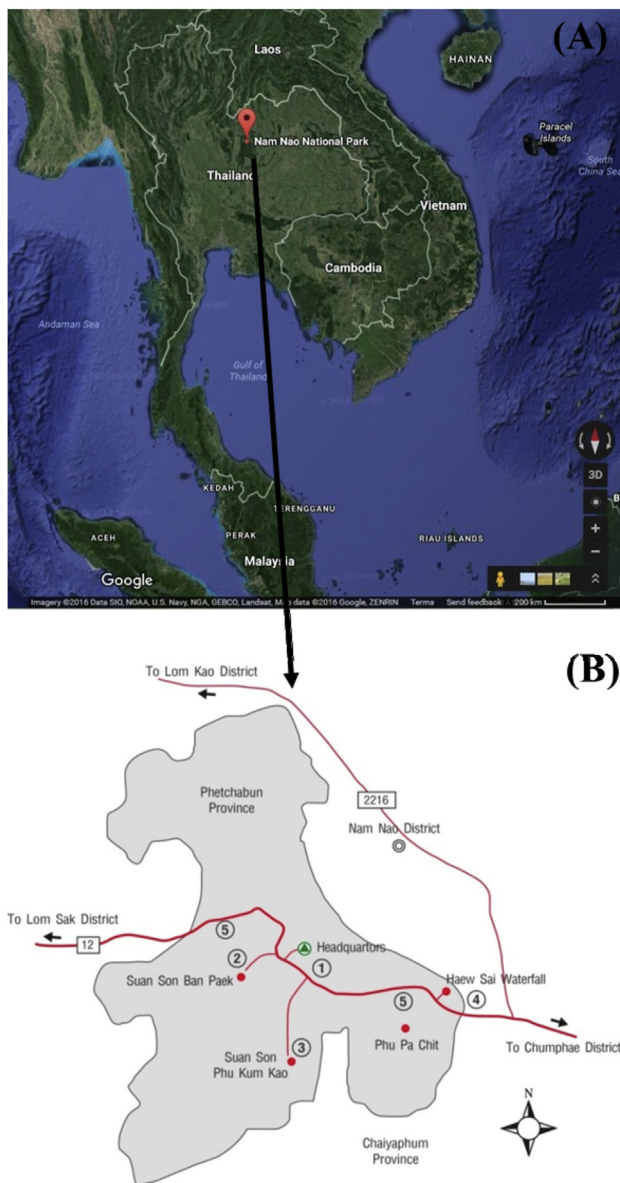


Fig. 1. General location and (A) and detail (B) of Nam Nao National Park with circled numbers showing the sampling routes.

(A) sourced: <https://www.google.co.th/maps/place/>, 27 October 2016 (Nam Nao National Park, 2016); (B) sourced: <http://www.dnp.go.th/>, 20 December 2015 (Nam Nao National Park, 2015).

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