พืชวงศ์ก่อในภาคตะวันออกเฉียงใต้ของประเทศไทย

Fagaceae in Southeastern of Thailand

กนกอร บุญพา[1] สุมน มาสุธน[1] และจำลอง เพ็งคล้าย[2]

Kanokon Bunpha[1] Sumon Masuthon[1] and Chamlong Phengklai[2]

บทคัดย่อ

ศึกษาพืชวงศ์ก่อในภาคตะวันออกเฉียงใต้ของประเทศไทย ระหว่างเดือน ตุลาคม 2546 ถึงเดือนมีนาคม 2552 พบพืชวงศ์ก่อที่สามารถจำแนกได้ 3 สกุล 19 ชนิด ดังนี้ ก่อเดือย *Castanopsis acuminatissima*, ก่อขี้หมู *C. pierrei*, ก่อหิน *C. piriformis*, ก่อแจง *Lithocarpus cantleyanus*, ก่อผ๊ัวะ *L.* cf. *dealbatus*, ก่อเหน่ง *L. elegans*, ก่อหมุน *L. eucalyptifolius*, ก่อขี้กวาง *L. harmandii*, ก่อข้าว *L. thomsonii*, ก่อหมู *L. wallichianus*, ก่อเกรียบ *L. wrayi*, ก่อแดง *Quercus auricoma*, ก่อคิชฌกูฏ *Q.* cf. *lineata,* ก่อหมวก *Q. oidocarpus,* ก่อสีเสียด *Q. poilanei,* ก่อสาทิต *Q. quangtriensis,* ก่อปลายจัก *Q. rex*, ก่อเกลี้ยง *Q.* cf. *saravanensis* และก่อสอยดาว *Q. thorelii* โดยแต่ละสกุลนั้นสามารถนำลักษณะของใบ ผล และกาบหุ้มผลมาใช้ในการระบุชนิดได้

จากการศึกษาพบก่อชนิดใหม่ของไทย 1 ชนิด คือ ก่อสอยดาว *Q. thorelii* นอกจากนี้ ยังพบการกระจายพันธุ์ของพืชวงศ์ก่อในพื้นที่ภาคตะวันออกเฉียงใต้เพิ่มขึ้นอีก 8 ชนิด ได้แก่ ก่อแจง *Lithocarpus cantleyanus,* ก่อผ๊ัวะ *L.* cf. *dealbatus*, ก่อแดง *Quercus auricoma*, ก่อคิชฌกูฏ *Q.* cf. *lineata,* ก่อหมวก *Q. oidocarpus,* ก่อสีเสียด *Q. poilanei*, ก่อปลายจัก *Q. rex* และก่อสอยดาว *Q. thorelii* ในจำนวนนี้มีก่อ 3 ชนิด ได้แก่ ก่อสีเสียด *Q. poilanei*, ก่อปลายจัก *Q. rex* และก่อสอยดาว *Q. thorelii* มีแนวโน้มเสี่ยงต่อการสูญพันธุ์มากกว่าชนิดอื่น ๆ เนื่องจากพบการกระจายพันธุ์ค่อนข้างน้อยทั้งในพื้นที่ภาคตะวันออกเฉียงใต้และทั่วประเทศ

ABSTRACT

The taxa of Fagaceae in Southeastern Thailand were studied from October 2003 to March 2009 by searching literature, and surveying in Southeastern Thailand. Three genera and nineteen species of Fagaceae were identified, i.e., *Castanopsis acuminatissima*, *C. pierrei*, *C. piriformis*, *Lithocarpus cantleyanus*, *L.* cf. *dealbatus*, *L. elegans*, *L. eucalyptifolius*, *L. harmandii*, *L. thomsonii*, *L. wallichianus*, *L. wrayi*, *Quercus auricoma*, *Q.* cf. *lineata, Q. oidocarpus, Q. poilanei, Q. quangtriensis, Q. rex*, *Q.* cf. *saravanensis* and *Q. thorelii*. Each genus can be identified to species with characters of leaf, fruit and cupule.

One species, *Q. thorelii*, is a new record for Thailand. Eight species are new records for Southeastern Thailand, namely, *Lithocarpus cantleyanus, L.* cf. *dealbatus*, *Quercus auricoma*, *Q.* cf. *lineata, Q. oidocarpus, Q. poilanei*, *Q. rex* and *Q. thorelii*. Three species, i.e., *Q. poilanei, Q. rex* and *Q. thorelii* are more likely to be endangered than the others because they are less common in both the Southeast and throughout Thailand.

Keywords : Fagaceae, Southeastern of Thailand

kbunpha@yahoo.com

1/ ภาควิชาพฤกษศาสตร์ คณะบัณฑิตวิทยาลัย มหาวิทยาลัยเกษตรศาสตร์ กรุงเทพฯ 10900

Department of Botany, Graduate School, Kasetsart University, Bangkok 10900

2/ สำนักงานหอพรรณไม้ กรมอุทยานแห่งชาติ สัตว์ป่า และพันธุ์พืช กรุงเทพฯ 10900

Office of the Forest Herbarium, Department of National Parks, Wildlife and Plant Conservation, Bangkok 10900

INTRODUCTION

The Southeastern region of Thailand sits on two floristic elements, namely the Indo-Chinese element and the Malaysian element. As most of the area is lowland adjacent to the sea, it is strongly influenced by the Southwestern and Northeastern monsoons which cause the average rainfall per year in this area to be as high as that of the South. In addition, this region has a high mountain range sitting in the central area of it, resulting in the area facing the monsoon having more rain than that of the other side of the mountain. From the influence of rainfall and nature of the area, vegetation types differ from those in other parts of the country. Vegetation types of the Southeastern region are mainly evergreen rain forest and dry evergreen forest which are suitable for Fagaceae.

The family Fagaceae is one of the large dicotyledon family, consisting of eight genera (*Nothofagus, Fagus, Castanea, Chrysolepis, Castanopsis, Lithocarpus, Quercus* and *Trigonobalanus*) and about 620–750 species (Kubitzki, 1993). This family is challenging because it is very difficult to identify to species level. Although taxonomic study of Fagaceae in Thailand has been thorough, still there is lack of complete specimens because of different periods of flowering and fruiting. Complete collections of specimens including leaf, staminate flower, pistillate flower, fruit and cupule at the same time is not possible, so many species are still not well known.

This study can be of benefit by adding more information to our knowledge about Fagaceae and will provide a basis for plant identification which will help to identify species in Southeastern Thailand, and enlarge the database of Fagaceae in Thailand.

MATERIALS AND METHODS

Data of Fagaceae from floras, journals, reports on the survey and the herbarium specimens deposited in the Forest Herbarium (BKF) of this family from various areas were collected and compiled. Collections of Fagaceae were made in sets of three to ten, from the natural habitats in 8 areas of Southeastern Thailand. Photographs and notes were also taken. The specimens were mounted on herbarium sheet and some of the flowers and fruits were preserved in alcohol 70% for further study. This study defined shapes of the cupule by the ratio of cupule to the length of the acorn as follow: <1/8 = dish-shaped; ≥1/8–1/4 = saucer-shaped and the height of the >1/4 = cup-shaped. Identification of plants into species was done by observing morphological characteristics, checking references and comparing with herbarium specimens at BKF and Bangkok Herbarium (BK). Then, the names were verified to be the correct botanical names by taxonomic study, followed by the construction of a key to the species.

RESULTS AND DISCUSSION

This study found nineteen species three genera separated to three species of *Castanopsis*, eight species of *Lithocarpus* and eight species of *Quercus*. Taxonomic characters are monoecious, evergreen trees; bark mostly smooth and shallowly fissured, sometimes distinct lenticels, rarely flaky or deeply

fissured, buttresses sometimes present. Indumentum of simple hairs, stellate hairs or lacking; scales or pits on the leaf underside. Stipules mostly caducous, rarely persistent. Leaves simple, spiral or alternate, pinnately nerved, cross veins scalariform, margin entire or serrate; petiolate. Inflorescences catkins or panicles, male and female separate or mixed. Male inflorescences erect or pendulous catkins or panicles; male florets single or in clusters, perianth 4–6-lobed, connate; stamens 6–12, filaments filiform, basifixed or dorsifixed, anther opening by longitudinal slits; hairy pistillode frequently present. Female inflorescences erect catkins or panicles; female florets single or in clusters, individually or collectively by a cupule formed from numerous fused bracts, perianth as in male but usually smaller; ovary inferior; style and carpels as many as locules, stigmas capitate or punctate; staminodes 6(–12) or absent. Mixed inflorescences panicles both male and female flowers on the same axis, female flowers arranged individually or in small groups along an axis or mixed in the same axis or on a separate axis. Fruit a nut, 1–3 nuts surrounded or enclosed by a cupule formed by the involucral bracts. Cupule partly or completely covering the nut, indehiscent or dehiscent. Seed usually solitary by abortion, without endosperm.

Key to genera of Fagaceae in Southeastern Thailand

1. Blaze thin and elongated furrows; cupule completely covered, irregular vertical dehiscence……
……..……..……..……..…….....…….....*Castanopsis*

1. Blaze distinct furrows; cupule partly covered, indehiscent

2. Stigma punctiform; male floret with pistillode…….....…….....…… *Lithocarpus*

2. Stigma capitate; male floret without pistillode…….....…….....…… *Quercus*

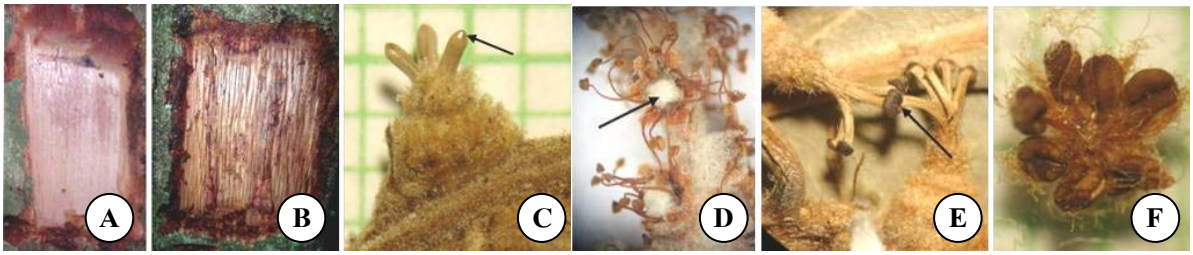

Figure 1 Details of each part used in key to genera: A. blaze thin and elongated furrows; B. blaze distinct furrows; C. stigma punctiform; D. male foret with pistillode; E. stigma capitate; F. male foret without pistillode.

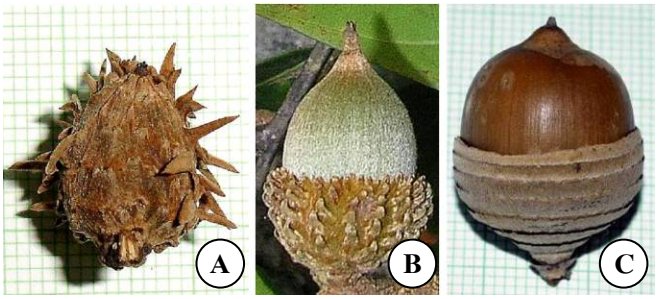

Figure 2 Acorns of *Castanopsis, Lithocarpus* and *Quercus*: A. cupule completely covering nut, surface with spines: *Castanopsis*; B. cupule partly covering nut, surface with scales: *Lithocarpus*; C. cupule party covering nut, surface with lamellae: *Quercus.*

Castanopsis Spach

Leaves spiral or alternate; margin entire or serrate on the upper half to apex; petioles thickened at base. Inflorescences panicles or catkins, erect, rachis hairy. Male florets in clusters or single; perianth 6–lobed, stamen (8–)10–12, filaments free, filiform; anther rather small, 0.2–0.3(–0.5) mm long, dorsifixed, longitudinally dehiscent; pistillode ca. 0.5–1 mm in diam. Female florets single or in clusters; perianth 4–6-lobed, styles 3, stigmas punctiform. Acorns ovoid, globose, two lobes or pear-shaped. Cupule completely covering nut, outer surfaces with hard spines, rarely smooth, irregularly dehiscence. Nuts 1 or 1–3 per cupule, subglobose, ovate, rarely semicircular or wedge–shaped. This study found three species of *Castanopsis* in Southeastern Thailand (Figure 3).

Key to species of *Castanopsis* in Southeastern Thailand

1. Cupule smooth or with undulate lines……..…..……..……..3. ***C. piriformis***
1. Cupule with spines
    2. Leaf serrate; acorn diameter 0.8–2 cm; nut 1 per cupule……..…..1. ***C. acuminatissima***
    2. Leaf entire; acorn diameter 3–5 cm; nut 1–3 per cupule……..…...2. ***C. pierrei***

Lithocarpus Blume

Leaves spiral or alternate; margin entire, rarely serrate; petioles mostly thickened throughout its length. Inflorescences panicles or catkins, erect, rachis hairy. Male florets in clusters or single; perianth 6-lobed, stamen 10–12, filaments free, filiform; anther rather small, 0.2–0.4 mm long, dorsifixed, longitudinally dehiscent; pistillode ca. 1 mm in diam. Female florets in clusters or single; perianth 4–6-lobed, styles 3, stigmas punctiform. Acorns ovate, depressed globose or ellipsoid. Cupule partly covering nut, outer surfaces with scales, soft spines, rarely lamella, indehiscent. Nut 1 per cupule, ovate, depressed globose, subglobose or obovate. This study found eight species of *Lithocarpus* in Southeastern Thailand (Figure 3).

Key to species of *Lithocarpus* in Southeastern Thailand

1. Cupules single
    2. Cupule without spines, saucer-shaped, stalk $\geq$ 4 mm……..…….....1. ***L. cantleyanus***
    2. Cupule with soft spines, cup-shaped, stalk < 4 mm or sessile
        3. Nut ovate; acorn base slightly truncate; branchlets, petiole and midvein hairy.....8. ***L. wrayi***
        3. Nut oblong; acorn base obtuse; branchlets, petiole and midvein glabrescent or glabrous.…
        ……..…..…...…4. ***L. eucalyptifolius***
1. Cupules 3–7, united at base or mature cupule uniting rudimentary acorns at base
    4. Nut glabrous
        5. Nut depressed globose; diameter $\geq$ 1.5 cm…….....…..……3. ***L. elegans***
        5. Nut ovate, diameter < 1.5 cm……..……..……5. ***L. harmandii***
    4. Nut hairy
        7. Cupule scales distinct, nut sparsely hairy or glabrescent, shining, dark green (fresh

specimen)…..……..…..……2. *L.* cf. *dealbatus*

7. Cupule scale inconspicuous, nut densely hairy, greenish grey (fresh specimen)

8. leaf obovate, margin serrate or dentate…..……7. *L. wallichianus*

8. leaf elliptic, margin entire……..……..……6. *L. thomsonii*

Quercus L.

Leaves spiral or often closely crowded of 3–6; margin mostly serrate, rarely entire; petioles thickened at base. Inflorescences catkins, pendulous or erect, rachis hairy. Male florets clusters or single; perianth 6-lobed, stamen 6–8, filaments free, filiform; anther 0.5–1 mm long, basifixed, longitudinally dehiscent; pistillode lacking. Female florets in clusters or single; perianth 4–6-lobed, styles 4–6, stigmas capitate. Acorns ovate, depressed globose, subglobose, oval or dorsiventral compressed. Cupule partly covering nut, outer surface with lamella, indehiscent. Nut 1 per cupule, ovate, obovate, oblate, depressed globose, or dome-shaped. This study found eight species of *Quercus* in Southeastern Thailand (Figure 3).

Key to species of *Quercus* in Southeastern Thailand

1. Acorn diameter $\geq$ 3 cm (usually 3–4 cm)

2. Leaf mostly obovate; cupule enclosing $\leq$ ½ of the nut, lamellae $\leq$ 10 layers……..…..6. *Q. rex*

2. Leaf elliptic to elliptic-oblong; cupule enclosing the nut, lamellae 13–14 layers…...8. *Q. thorelii*

1. Acorn diameter < 3 cm

3. Cupule enclosing $\geq$ ½ of the nut, cupule height > 1 cm (1.2–1.7 cm)

4. Nut glabrous; leaf apex caudate……..……..…..…...7. *Q.* cf. *saravanensis*

4. Nut hairy or glabrescent; leaf apex acuminate, acute or obtuse

5. Leaf base mostly symmetric, lower surface glaucous; cupule cover densely brown hairy; nut slightly obovate or depressed globose…..……..……..……1. *Q. auricoma*

5. Leaf base mostly asymmetric, lower surface pale green; cupule cover densely grey hairy; nut ovate or ovate-oblong…..……..….3. *Q. oidocarpus*

3. Cupule enclosing < ½ of the nut, cupule height $\leq$ 1 cm (0.4–0.8 cm)

6. Stylopodium height 3–6 mm; leaf distinctly serrate, lower surface glabrescent

7. Petiole length 0.8–1.2 cm; lamellae edge denticulate; nut bottom convex or flat……

……..……..……..……5. *Q. quangtriensis*

7. Petiole length 1.3–2.5 cm; lamellae edge dentate; nut bottom concave……..…..

……..……..……..……..…2. *Q.* cf. *lineata*

6. Stylopodium height ca. 1 mm; leaf entire or slightly serrate, lower surface densely stellate hair……..……..……,,……..…..4. *Q. poilanei*

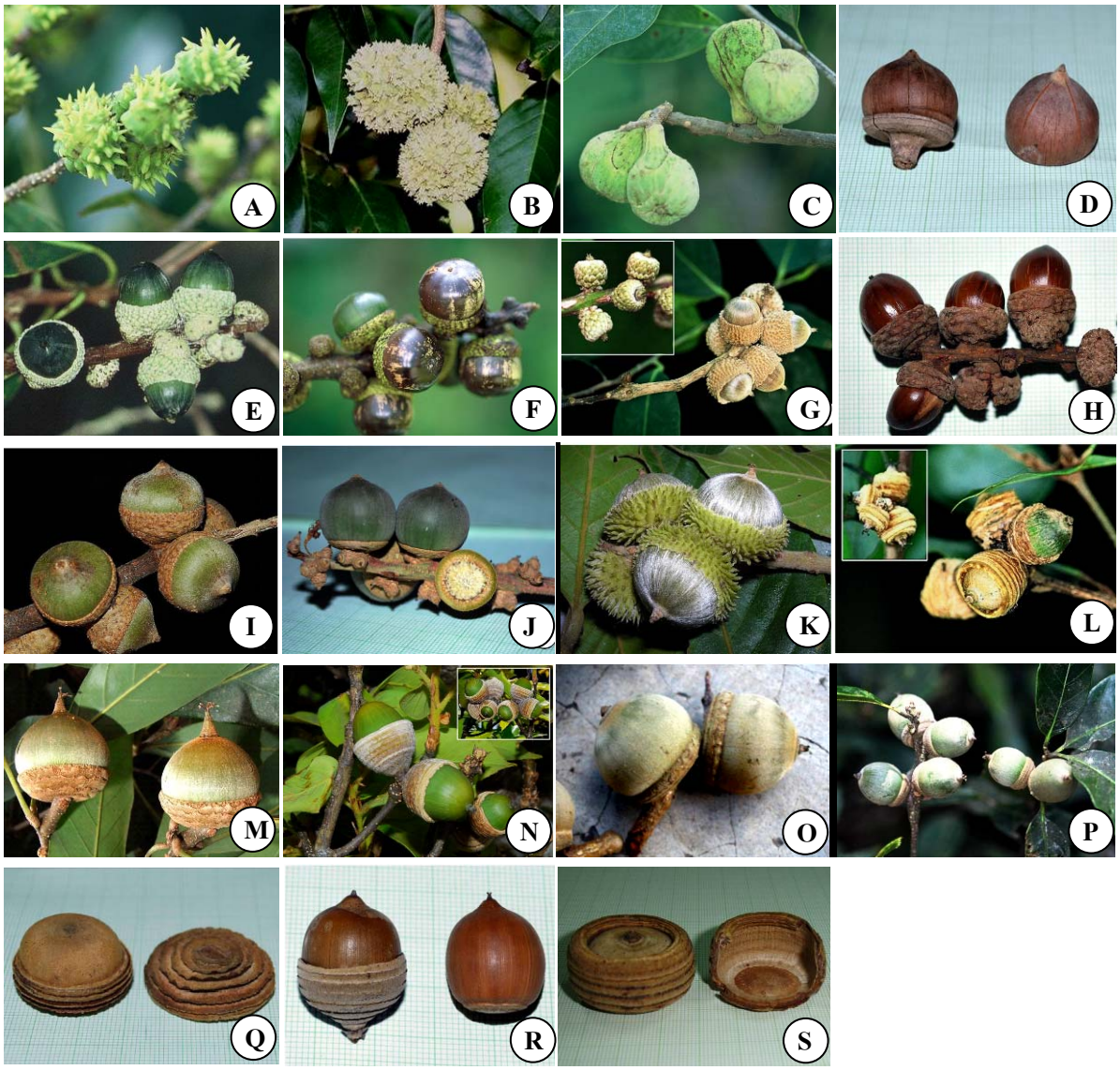

Figure 3 Acorn characters: A. *Castanopsis acuminatissima*; B. *Castanopsis pierrei*; C. *Castanopsis piriformis*; D. *Lithocarpus cantleyanus*; E. *Lithocarpus* cf. *dealbatus*; F. *Lithocarpus elegans*; G. *Lithocarpus eucalyptifolius*; H. *Lithocarpus harmandii*; I. *Lithocarpus thomsonii*; J. *Lithocarpus wallichianus*; K. *Lithocarpus wrayi*; L. *Quercus auricoma*; M. *Quercus* cf. *lineata*; N. *Quercus oidocarpus*; O. *Quercus poilanei*; P. *Quercus quangtriensis*; Q. *Quercus rex*; R. *Quercus* cf. *saravanensis*; S. *Quercus thorelii*.

Distribution of Fagaceae in Southeastern of Thailand

Fagaceae in Southeastern Thailand comprises three genera, nineteen species, widespread within eight studied areas of Southeastern Thailand; seven species in Khao Yai National Park, four species in Pang Sida National Park, four species in Khao Ang Ruenai Wildlife Sanctuary, three species in Khao Chamao-Khao Wong National Park, eight species in Khao Khitchakut National Park, twelve species in Khao Soi Dao Wildlife Sanctuary, three species in Nam Tok Khlong Kaeo National Park and six species in Mu Ko Chang National Park (Table 1).

Lithocarpus has the most widespread distribution and can be found in every studied area, *Castanopsis* is not found in Khao Chamao-Khao Wong National Park, and *Quercus* was rather common in Khao Soi Dao Wildlife Sanctuary and sparse in other areas except Khao Ang Ruenai Wildlife Sanctuary and Nam Tok Khlong Kaeo National Park, where it does not occur at all.

Member of Fagaceae in Southeastern Thailand occur at various altitudes from sea level to 1500 m. Three species, *Quercus auricoma*, *Q. oidocarpus* and *Q. poilanei* are specific to high altitude in hill evergreen forest, altitude over 1100 m, and three species are specific to low altitude evergreen forest, often near streams, i.e., *Castanopsis pierrei*, *Lithocarpus* cf. *dealbatus* and *L. wallichianus*, altitude under 100 m. Comparision with the distribution reported by Phengklai (2008) which found twenty-five species of Fagaceae in Southeastern Thailand that match with this study for eleven species and there are new location for eight species, *Lithocarpus cantleyanus*, *L.* cf. *dealbatus*, *Quercus auricoma*, *Q.* cf. *lineata, Q. oidocarpus, Q. poilanei, Q. rex* and *Q. thorelii* (Table 1). One species is a new record in Thailand; *Q. thorelii* is known from Khao Soi Dao Wildlife Sanctuary at altitude from 300–800 m. Two of these species, *Q. poilanei* and *Q. rex* were previously only found in Northern Thailand.

Table 1 Distribution of Fagaceae in Thailand compare with studied areas in SE

Species	Thailand Florestic Regions[1/]							Studied Sites in SE[2/]							
	N	NE	E	SW	C	SE	PEN	1	2	3	4	5	6	7	8
C. acuminatissima	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓		
C. pierrei		✓				✓	✓					✓		✓	✓
C. piriformis		✓	✓			✓	✓		✓	✓		✓	✓	✓	✓
L. cantleyanus		✓	✓				✓						✓		✓
L. cf. *dealbatus*	✓	✓	✓	✓								✓			
L. elegans	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓		
L. eucalyptifolius			✓		✓	✓	✓	✓	✓	✓		✓	✓		
L. harmandii	✓	✓	✓	✓		✓		✓							
L. thomsonii	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓		✓		✓
L. wallichianus	✓			✓		✓	✓								✓
L. wrayi	✓	✓				✓	✓							✓	
Q. auricoma	✓	✓	✓					✓							
Q. cf. *lineata*	✓	✓					✓					✓			✓
Q. oidocarpus	✓	✓					✓						✓		
Q. poilanei	✓												✓		
Q. quangtriensis	✓	✓		✓	✓	✓	✓				✓	✓	✓		
Q. rex	✓												✓		
Q. cf. *saravanensis*						✓		✓	✓				✓		
*Q. thorelii**													✓		

Notes [1/]Source: Phengklai (2008); N= Northern; NE= Northeastern; E= Eastern; SW= Southwestern; C= Central; SE= Southeastern; Pen= Peninsular. [2/]1= Prachin Buri, Khao Yai National Park, 2= Sa Kaeo, Pang Sida National Park, 3= Chachoengsao, Khao Ang Ruenai Wildlife Sanctuary, 4= Rayong, Khao Chamao-Khao Wong National Park, 5= Chanthaburi, Khao Khitchakut National Park, 6= Chanthaburi, Khao Soi Dao Wildlife Sanctuary, 7= Trat, Nam Tok Khlong Kaeo National Park, 8= Trat, Mu Ko Chang National Park. * new record of Thailand.

CONCLUSION AND RECOMMENDATION

In Southeastern Thailand, three genera of family Fagaceae were found, *Castanopsis*, *Lithocarpus* and *Quercus*. Nineteen species of Fagaceae were identified, i.e., *Castanopsis acuminatissima*, *C. pierrei*, *C. piriformis*, *Lithocarpus cantleyanus*, *L.* cf. *dealbatus*, *L. elegans*, *L. eucalyptifolius*, *L. harmandii*, *L. thomsonii*, *L. wallichianus*, *L. wrayi*, *Quercus auricoma*, *Q.* cf. *lineata, Q. oidocarpus, Q. poilanei, Q. quangtriensis, Q. rex*, *Q.* cf. *saravanensis* and *Q. thorelii.*

Eight species are new records for Southeastern Thailand, namely, *Lithocarpus cantleyanus, L.* cf. *dealbatus*, *Quercus auricoma*, *Q.* cf. *lineata, Q. oidocarpus, Q. poilanei*, *Q. rex* and *Q. thorelii*. One species is a new record in Thailand; *Q. thorelii* from Khao Soi Dao Wildlife Sanctuary at altitude from 300–800 m. Three species, i.e., *Q. poilanei, Q. rex* and *Q. thorelii* were more likely to endangered than the others because they are less common in both the Southeast and throughout Thailand.

The study raises many questions about the correct identification of several species found, and recommends that much more time be spent collections more complete flowering and fruiting material. This material then needs to be compared with type material. This study is still lacking inflorescences in some species, they should be collected in the future and try methods such as pollen or molecular study to make a decision.

ACKNOWLEDGEMENTS

This research was funded by the Graduate School Kasetsart University.

REFERENCES

Kubitzki, K. 1993. Fagaceae, pp. 301-309, *In* K. Kubitzki, J. G. Rohwer and V. Bittrich, eds. **The Families and Genera of Vascular Plants Vol. 2.** Springer-Verlag Berlin Heidelberg, Germany.

Phengklai, C. 2008. Fagaceae, pp 179-410, *In* T. Santisuk and K. Larsen, eds. **Flora of Thailand Vol. 9(3).** The Forest Herbarium, Department of National Parks, Wildlife and Plant Conservation, Bangkok.

Soepadmo, E. 1973. Fagaceae, pp. 265-403, *In* C. G. G. J. Van Steenis, ed. **Flora Malesiana Vol. 7.** Noordhoff International Publishing, Leyden, Netherlands.