CHAPTER I

INTRODUCTION

1. Review of the Genus *Kaempferia*

Kaempferia is a perennial herb, one of the 21 tribes of the family Zingiberaceae(1) which are mainly confined in tropical rain forest. This genus is widely distributed from tropical Africa to India and Southeast Asia. The last update by Puangpen Sirirugsa indicated that *Kaempferia* comprises of approximately 60 species. Among them, 15 species were found in Thailand as shown in Table1.1 (2, 3).

Table 1.1 The occurrence of *Kaempferia* in Thailand

No.	Sciencetific name	Local name
1	*Kaempferia angustifolia*	Thao nhang hang (เต่าหนังแห้ง), Prab samut (ปราบสมุทร)
2	*Kaempferia elegans* Wall. ex Bak.	เปราะใหญ่
3	*Kaempferia fallax*	เปราะหูวัว
4	*Kaempferia filifolia*	เปราะใบข้าว
5	*Kaempferia galangal* Linn.	Proh hom (เปราะหอม); Hom proh (หอมเปราะ) (Central); Waan teen din (ว่านดีนดิน), Waan phaen din yen, Waan hom (ว่านหอม) (Northern)
6	*Kaempferia glauca*	เปราะขาว

7	*Kaempferia laotica*	เปราะโคก
8	*Kaempferia larsenii*	ว่านเปราะ
9	*Kaempferia marginata*	Proh thuean (เปราะเถื่อน) (Prachuap Khirikhan, Chumpon) ; Proh paa (เปราะป่า) (Central)
10	*Kaempferia parviflora* Wall. ex Bak.	Krachai dam (กระชายดำ)
11	*Kaempferia pulchra*	Proh pa (เปราะป่า) (Peninsular)
12	*Kaempferia roscoeana* Wall.	Proh pa (เปราะป่า) (Central)
13	*Kaempferia rotunda* Linn.	Waan dokdin (ว่านดอกดิน), Waan tuu muup (ว่านตูบหมูบ) (Loei); Waan nonlap (ว่านนอนหลับ) (Chiang Mai); Waan som (ว่านส้ม) (Khon Kaen); Waan haao non (ว่านหาวนอน) (Ratchaburi); Ueang din (เอื้องดิน) (Northern)
14	*Kaempferia siamensis*	เปราะสยาม
15	*Kaempferia spoliata*	เปราะหนู

2. Historical Background of *K. parviflora*

In Thailand, the name "Krachai" was commonly applied to some species of plant in the genus of *Boesenbergia.* Krachaidam was mistaken to be identified as *Boesenbergia pandurata* (black rhizome) with the difference of morphology between Krachai *(B. pandurata)* and Krachaidam, it was revised by Puangpen Sirirugsa to be *Kaempferia parviflora* Wall. *ex* Bak. The description of *K. parviflora* is shown as below.

K. parviflora is a perennial herb with 6-10 cm. height. The rhizome is dark purple with several succulent roots in a fascicle. The leaves are blades ovate or elliptic, slightly unequal sided, 7-11 x 4-16 cm., apex acute or mucronate, base subcordate, upper surface glabrous, under surface hairy; petiole ca 3 mm. long, hairy; leaf-sheaths ca 6 cm. long, margin membranous, usually red-tinted to purple-tinted in color; bladeless sheath greenish, purple tinted; ligule broadly triangular, ca 2 mm. long, membranous, caducous. The inflorescence is enclosed by the two innermost leaf-sheaths or by the leaf-sheath and the bladeless sheath, usually elongate; peduncle 5-6 cm. long. The flowers are bracts oblong ca 1.7-2.3 x 0.6 cm., glabrous, apex rounded; bracteoles long, finely hairy, apex bifid. The corolla-tube is 3-3.2 long, lobes linear; dorsal lobe ca 1.2 x 0.25 cm., apex hooded, aristate; lateral lobes slightly smaller, apex round. The staminodes are white, oblong, 1-1.3 x 0.3 cm., apex cute or rounded. The labellum is usually purple to dark purple at the middle, obovate, 1.2-1.5 x 0.8-0.9 cm., apex emarginated. The stamen is very short filament, ca 1 mm long; anther ca 2 mm long, anther-crest suborbicular, entire or emarginated, 1-1.5 x 2 mm. The ovary ca 2 x 1 mm., hairy; stylodes filiform 8-9 mm. long (2). The figures of *K. parviflora* are shown in Figures 1.1 and 1.2.

a.

b.

Figure 1.1 *Kaempferia parviflora* Wall. ex Baker

a. leaves

b. flowers

a. b.

c.

Figure 1.2 Rhizomes of *K. parviflora.*

a fresh rhizomes

b sliced rhizomes

c rhizome powder

In Thailand, *K. parviflora* has long been used as traditional medicine for anti-diarrhea, colic pain etc. (6-8). Its ethnopharmacological uses include alcohol extract of fresh rhizomes, a decoction or infusion of dried rhizomes as well as a mixture of dried rhizomes with honey. These preparations are topically applied to use as health-promotion, nerve stimulation, treatment of colic disorder, duodenal ulcers, gastro-intestinal disorders. Other medicinal uses include stimulate cardiotoic and aphrodisiac. (6, 19-20).

Previous reports revealed that crude extract and isolated compounds of *K. parviflora*, especially, methoxyflavones were reported on anti-inflammatory effect (6-9), cytotoxicity (10), antiplasmodial, antifungal and antimycobacteria activities (11-12) and inhibited HIV-1 (Human Immunodeficiency Virus) protease, HCV (Hepatitis C Virus) and HCVM (Human Cytomegalovirus) protease (15). On the other hand, the ethanol extract of *K. parviflora* promoted nitric oxide production in human umbilical vein endothelial cells (13), increased the accumulation of rhodamine 123 and daunorubicin in LLC-GA5-COL150 cells (14), possessed gastroprotective effect (16), anti-allergic effect (17) as well as increase weights of seminal vesicle and stimulate spermatogenesis in male rats (18). Additionally, our preliminary study in chemical constituents and antioxidant activity of *K. parviflora* revealed that the flavones were found in *n*-hexane and ethyl acetate extracts whereas anthocyanin, flavones and other phenolic compounds were detected in methanol fraction. Antioxidant activity is determined by $ABTS^{\circ+}$ free radical scavenging assay indicated that methanol extract showed the highest activity followed by ethyl acetate, *n*-hexane and water extracts, respectively. These results suggested that the chemical compounds of Krachaidam's extracts, especially in alcohol extract, act as health promotion via antioxidant.

Recently, several products of *K. parviflora*; tonic drink, fermented juice, instant tea and other products, are widely distributed to the market and increasingly consumed among Thai men for health-promoting and relief impotent symptoms, in particularly, sexual enhancing activity (13-14, 18-20). Despite, the popular uses, the existing literature in beneficial health effects, especially antioxidant activity which enhancing health promoting, are inadequate and have not been clarified for their

effectiveness and safety. The empirical uses of medicinal plants based on the knowledge and experiences of the ancestor without sufficient scientific evidences. According to these, this present study was aimed to assess the antioxidant activity of *K. parviflora*. These cumulative data would support the traditional uses and provide more scientific data on effectiveness of *K. parviflora* products.