

COMPARATIVE MORPHOLOGY AND PHYTOCHEMICAL TEST OF GENUS *ZINGIBER* PLANTS FOUND IN HLAWGA AREA

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Abstract

Altogether 5 species belonging to genus *Zingiber* were collected in Hlawga Area in Yangon. These species are *Zingiber cassumunar* Roxb., *Zingiber ligulatum* Roxb., *Zingiber parishii* Hook., *Zingiber squarrosum* Roxb. and *Zingiber zerumbet* Smith. The morphological characters of vegetative and reproductive parts of collected plants were studied. In phytochemical test, resin, saponin and terpene are present in collected 5 species.

Key words: 5 species, genus *Zingiber*, morphology, phytochemistry

Introduction

Nowadays, across the Globe, especially in the developing countries, people recognize the value of medicinal plants in treating and preventing common diseases. Medicinal plants are an important source of practical and inexpensive new drugs for people. The plant kingdom constitutes an invaluable source of new chemical products which may be important due to their biological properties and their potential use in medicine (W.H.O, 1998).

Zingiber is a moderately large genus of herbs of the family Zingiberaceae or Ginger family. All the plant parts of *Zingiber* spp. possess numerous secretory cells which produce essential oils and oleoresins. The main organ is rhizome. The essential oil in these rhizomes has been of great interest for people as the sources of health promotion, food preservation, food flavoring and cosmetics.

Many species of *Zingiber* are used as traditional medicine for stomachache, carminative, loss of appetite, flatulence, inflammation, acute cold and diarrhoea etc. Rhizome of *Zingiber* plants has medicinal properties. Therefore, in this research, *Zingiber* spp. growing wild in Hlawga area were collected and identified. Then, active constituents in rhizome of collected plants were studied by phytochemical tests.

Materials and Methods

Botanical Studies

Collection of specimens from Hlawga Area were carried out during the flowering time of these plants, from July to November. After the collection, all parts of the fresh specimens were studied and measured in detail and recorded for taxonomic description. Based on the resulting data, the plants were identified with the help of literatures (Backer; 1963, Burkill; 1966, Hooker; 1875, Kirtikar & Basu; 1935). Photos were recorded for all the necessary things..

Chemical Studies

Preliminary phytochemical tests on the rhizome of collected plants were studied. The fresh rhizomes were thoroughly washed with water, cut into small pieces, dried in shade, crushed and powdered with a grinding machine. The rhizome powder were tested for

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phytochemical study by using the methods in Physicochemical Standards of Unani Formulations (1987).

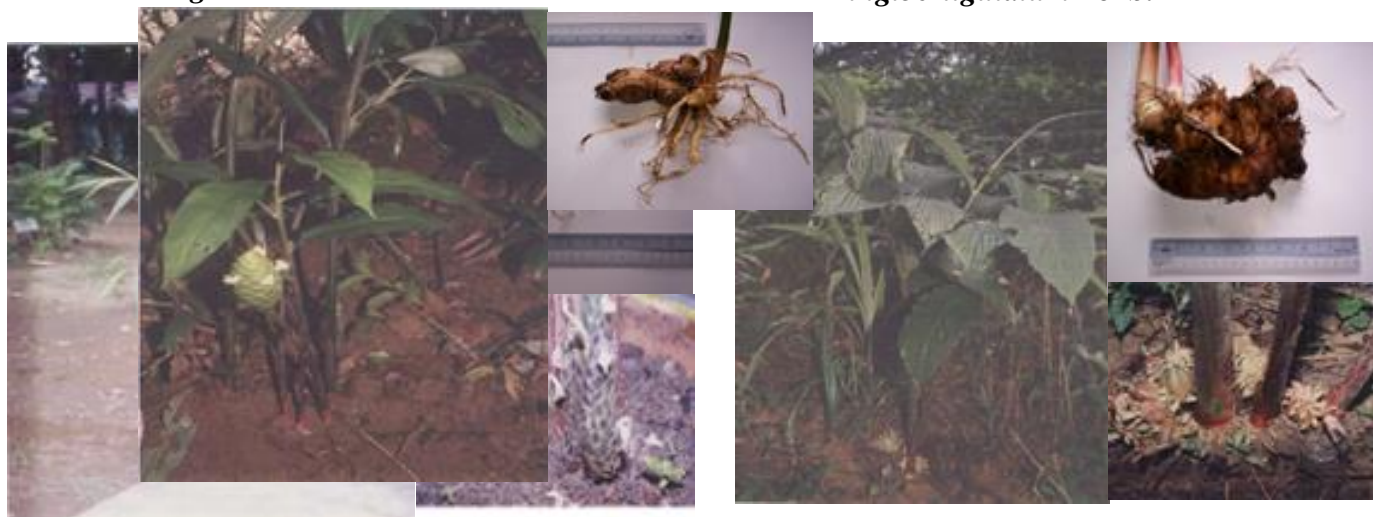
Results

Collected plants



Zingiber cassumunar Roxb.

Zingiber ligulatum Roxb.



Zingiber zerumbet Smith.

Table 1 Comparative morphology of five species of *Zingiber*

	<i>Z. cassumunar</i> Roxb.	<i>Z. ligulatum</i> Roxb.	<i>Z. parishii</i> Hook. f.	<i>Z. squarosum</i> Roxb.	<i>Z. zerumbet</i> Smith.
Rhizome	ovoid , with pale brown scale leaves and fleshy roots	cylindrical, with greenish white scale leaves and fleshy roots	ovoid, with greenish white scale leaves and fleshy roots terminating in tubers	ovoid, with pinkish white scale leaves and fleshy and non-fleshy roots	ovoid, with pale brown scale leaves and fleshy roots
Aerial stem	4-6 ft high, cylindrical	2-3 ft high, cylindrical	3-4 ft high, cylindrical	3-5 ft high, cylindrical	3-6 ft high, cylindrical
Leaf - sheath	reddish green, glabrous	green, glabrous	reddish-green, dense hairs	reddish-green, glabrous	reddish-green, glabrous
Leaf - blade	oblong lanceolate, glabrous above, pubescent beneath	oblong lanceolate, glabrous on both surfaces	oblong lanceolate, pubescent on both surfaces	broadly elliptic, pubescent on both surfaces	elliptic, glabrous on both surfaces
Ligule	small, triangular, 2-clefted	large and prominent, triangular	absolute, reduced to fringe of hairs	large and prominent, 2-lobed	elongate, orbicular truncate
Peduncle	10 – 30 cm long, pinkish	very short	6 – 12 cm long, reddish	very short	15 - 40 cm long, reddish green
Inflorescence	produced from the elongated peduncle, oblong-ellipsoid, red	produced directly from the root stock, sub-globose, greenish – white	produced from the elongated peduncle, fusiform, reddish-green	produced directly from the rootstock, globose, greenish pink to red	produced from the elongated peduncle, ovoid, obtusegreenish at first andgradually red

Table 2 Comparative morphology of five species of *Zingiber*(Cont.)

	<i>Z. cassumunar</i> Roxb.	<i>Z. ligulatum</i> Roxb.	<i>Z. parishii</i> Hook. f.	<i>Z. squarosum</i> Roxb.	<i>Z. zerumbet</i> Smith.
Bract	broadly ovate, subacute apex, bright red, pubescent	ovate, acute apex, pink, glabrous.	ovate, usually cuspidate apex, reddish-green, hairy	broadly lanceolate, tip distinctly hooked, greenish-pink, pubescent	obovate, incurved and truncate apex, bright green at first and red in fruit, glabrous
Flower	tubular, 3-dentate, white	tubular, 3-dentate, white	tubular, 3-dentate, white	tubular, 3-dentate, white	tubular, 3-dentate, white
Calyx					
Corolla lobes	lanceolate, whitish	lanceolate, pinkish-white.	lanceolate, yellowish-white	lanceolate, pink	lanceolate, whitish
Labellum	orbicular, yellowish-white, unspotted	obovate, yellowish-white, unspotted	obovate, sulphur yellow with pinkish mottling at centre	ovate, yellowish-white, mottled with reddish purple	orbicular, sulphur yellow, unspotted
Fertile stamen	pinkish- white	yellow	creamy yellow	yellow	light yellow
Ovary	oblongoid, white	oblongoid, yellowish	oblongoid, white	oblongoid, white,	globoid, white
Style	White	white	white	white	white
Stigma	white, infundibuliform, with a whorl of hairs	white, infundibuliform, with a whorl of hairs	white, infundibuliform, with a whorl of hairs	white, infundibuliform, with a whorl of hairs	white, infundibuliform, with a whorl of hairs
Fruit	small, globose, white	oblong, bright red inside	oblongoid, reddish-pink	elliptic, reddish-green	ellipsoid, white
Seed	purple with white aril	black with white aril	black with white aril	reddish-brown with white aril	black with white aril
Myanmar Name	Meik-tha-lin	Tauk-ta-yaing	Myauk-gyin-ni	Tauk-ta-ni	Gank-eik

Table 3Comparative investigation of phytochemical test of five *Zingiber* spp.

No.	Constituents	Extract	Test Reagent	Observation	Results				
					Z. c	Z. l	Z. p	Z. s	Z. z
1.	Alkaloid	3% HCL	Dragendroff's reagent Mayer's reagent Wagner's reagent.	Orange ppt. White ppt. Brown ppt.	–	+	–	–	–
2.	Flavonoid	EtOH extract	HCL, Mg turning	Pink colour	–	–	–	+	+
3.	Steroid	Pet-ether Extract	acetic anhydride+ conc. H ₂ SO ₄	Blue-green colour	–	–	–	–	–
4.	Terpenoid	Pet-ether Extract	acetic anhydride+ conc. H ₂ SO ₄	Pink colour	+	+	+	+	+
5.	Glycoside	EtOH extract	NaOH sol:	Yellow colour	–	–	–	+	–
6.	Carbonhydrate	H ₂ O extract	Fehling sol: A+B	Red colour ppt.	+	+	+	+	+
7.	Saponin	H ₂ O extract	Distilled water	Frothing	+	+	+	+	+
8.	Tannin	H ₂ O extract	5% ferric chloride sol:+ dil H ₂ SO ₄	Yellowish-brown ppt.	+	–	–	+	–
9.	Resin	CHCl ₃ extract	Acetic anhydride+ H ₂ SO ₄	Violet colour	+	+	+	+	+
10.	Polyphenol	H ₂ O extract	3% ferric chloride sol:	Blue or green colour	–	–	–	–	–
11.	Protein	H ₂ O extract	Sodium hydroxide sol:+3 % copper sulphate sol:	Red or violet colour	–	–	+	–	–
12.	Starch	H ₂ O extract	I ₂ solution	blue-black ppt.	+	+	+	+	+
13.	Cyanogenic glycosides	H ₂ O extract	Cons: H ₂ SO ₄ Sodium picrate	No colour	–	–	–	–	–

+ = Present

– = Absent

Z.c = *Z. cassumunar* Roxb., Z.l = *Z. ligulatum* Roxb. , Z.p = *Z. parishii* Hook. f.,Z.s = *Z. squarosum* Roxb., Z.z = *Z. zerumbet* Smith.

Discussion and Conclusion

The five species of the genus *Zingiber* included in the present research were usually found growing wild throughout the country during the rainy season. They were perennial rhizomatous herbs and they could be easily propagated by means of rhizome cuttings.

The distinguishing characters among species of this genus were mainly morphological characters; especially hairs characters of leaf, the length of the peduncles, the colours and the mottlings on the labellum. According to the morphological characters, collected plants were distinguished into *Zingiber cassumunar* Roxb., *Zingiber ligulatum* Roxb., *Zingiber parishii* Hook., *Zingiber squarrosus* Roxb. and *Zingiber zerumbet* Smith.

Comparative morphological studies on the plant parts of these species revealed the following observations.

The main rhizome of *Z. cassumunar* Roxb., *Z. parishii* Hook., *Z. squarrosus* Roxb. and *Z. zerumbet* Smith. were ovoid in shape while those of *Z. ligulatum* Roxb. were cylindrical. The main rhizome of *Z. parishii* Hook. was smaller than others. The fleshy roots of *Z. parishii* Hook. were different from the others as each terminates in a tuberous head.

The leaf-sheaths of *Z. ligulatum* Roxb. were green in colour, while those of other four species were reddish-green. Among them, *Z. parishii* Hook. could be easily recognized by its hairs. The broadly elliptic to elliptic leaves of *Z. squarrosus* Roxb. and *Z. zerumbet* Smith. were very much larger in size than the oblong lanceolate to lanceolate leaves of *Z. cassumunar* Roxb., *Z. ligulatum* Roxb. and *Z. parishii* Hook.. Ligules of *Z. parishii* Hook. were hairs and those of other four species were membranous. Among them, those of *Z. cassumunar* Roxb. were smaller than the others.

The inflorescences were all radical and their spikes were produced from the rootstock either on elongated peduncles as in *Z. cassumunar* Roxb., *Z. parishii* Hook. and *Z. zerumbet* Smith. or on very short peduncles as in *Z. ligulatum* Roxb. and *Z. squarrosus* Roxb.. The spikes of *Z. cassumunar* Roxb. and *Z. parishii* Hook. were oblong or fusiform with broadly ovate reddish outer bracts, while those of *Z. ligulatum* Roxb. and *Z. squarrosus* Roxb. were globose or sub-globose with ovate to lanceolate greenish pink outer bracts, those of *Z. zerumbet* Smith. were ovoid with obovate green outer bracts. Distinctly hooked bracts of *Z. squarrosus* Roxb. was one of the most outstanding features among them.

The flowers were conspicuous, infundibuliform. There were no sharp differentiations between the forms and sizes of their calyx and corolla. The posterior corolla segments were largest and all broadly lanceolate in shape. They were all white or yellowish-white, but *Z. ligulatum* Roxb. and *Z. squarrosus* Roxb. were pinkish colour in their tips.

The important characters of this genus were colour and structure of lips or labellums. The labellums of five species studied had 3-lobes, in which middle lobes were largest, while the two lateral lobes (basal auricles) were smaller. The lips were orbicular and emarginated in *Z. cassumunar* Roxb. and *Z. zerumbet* Smith., obovate with entire tip in *Z. ligulatum* Roxb., obovate and emarginated in *Z. parishii* Hook. and lastly ovate and deeply emarginated in *Z. squarrosus* Roxb. . The colours of the lips were yellowish-white with reddish or purplish mottlings in *Z. squarrosus* Roxb., sulphur yellow with pinkish mottlings in *Z. parishii* Hook., wholly yellowish white in *Z. cassumunar* Roxb. and *Z. ligulatum* Roxb. and wholly sulphur yellow in *Z. zerumbet* Smith..

The stamens of all these species were composed of short and broad filament and anther cell opening with a slit together with a curved crest clasping the upper part of the style. All anther cells of five species were yellowish-white to yellow in colour. The size of the ovaries were larger in *Z. squarrosus* Roxb. than those of other species and they were all tangentially compressed. The shape, colour and size of the capsules were different from each other. The shapes were globose in *Z. cassumunar* Roxb. oblong in *Z. ligulatum* Roxb. and *Z. parishii* Hook., elliptic to ellipsoid in *Z. squarrosus* Roxb. and *Z. zerumbet* Smith.

All morphological and taxonomical characters of the plants studied were in accordance with those described by Backer (1968), Bailey (1930), Burkill (1935), Hooker (1885), Kirtikar Basu (1933), Purselove (1976) and Ridley (1924).

The preliminary phytochemical investigation was carried out on the rhizome powder of 5 collected plants. These tests indicated that the steroid and polyphenol are absent in all of 5 plants. *Z. cassumunar* Roxb. contains carbohydrate, resin, saponin, terpene, tannin and starch. *Z. ligulatum* Roxb. consists of alkaloid, resin, saponin, terpene and starch. *Z. parishii* Hook. includes protein, resin, saponin, terpene and starch. Flavonoid, carbohydrate, glycoside, resin, saponin, terpene, tannin and starch are found in *Z. squarosum* Roxb. and *Z. zerumbet* Smith. contains flavonoid, carbohydrate, resin, saponin, terpene and starch. One prominent result is that resin, terpene, saponin and starch were found to be present in all 5 collected plants.

In conclusion, knowing the content of organic constituents will facilitate the isolation of the individual constituents and testing them on animals further resulting in the effective production of herbal medicine.

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