



## CHAPTER I

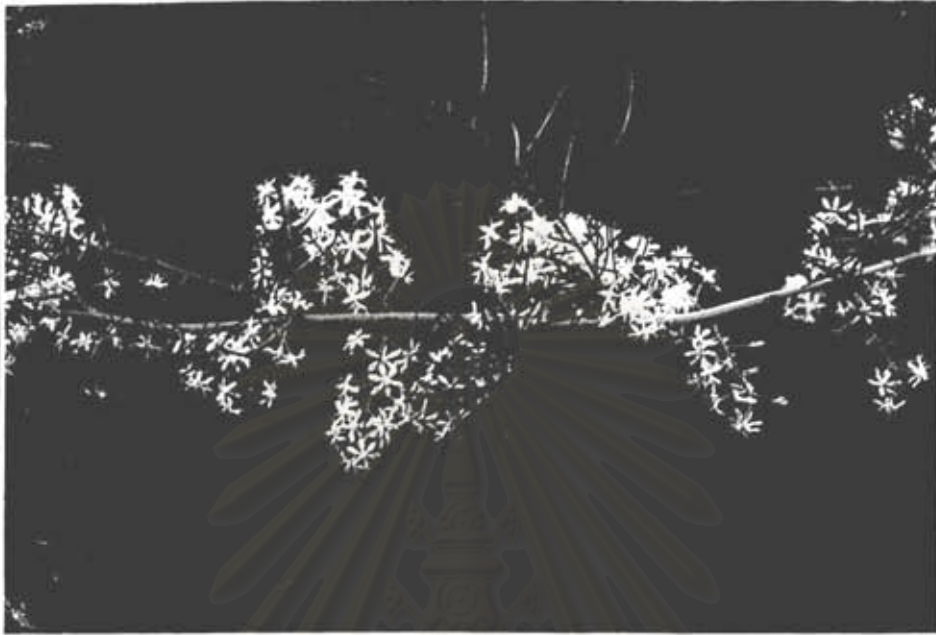
### INTRODUCTION

The plants in the Lileaceae family, with 3,500 species in 220 generas, are widely distributed over the earth and are especially abundant in warm and tropical regions. *Asparagus racemosus* Willd. has been used in folk medicine in India and Thailand. This specie is found in South - East Asia, India, Australia and Africa.<sup>(1)</sup>

The common name of *A. racemosus* Willd. in Thailand is "Saamsib" (central region) or "Saamroi - raak" (Kanchanaburi province), "Chuang Khrua" (northern region), "Phaknaam" (Nakhon Ratchasima province). It is also called Shatavari in India.<sup>(2)</sup> *A. racemosus* is a small, woody, rhizomatous plant. It has cylindrical roots, linear leaves and small white flowers. The plants grow up to 4 m with sharp spines and small red globular fruits.<sup>(3)</sup> (Fig.1)

*A. racemosus* is a root drug of Indian folk medicine and has been used therapeutically for a long time. The decorticated root, commerce comprises dried, has been specially recommended not only treated abortion but also used as a galactogogue. In Thailand, the roots are boiled in syrup for dessert and the dried roots are supposed to prevent abortion and treat diseases of the spleen, liver and other internal organs.<sup>(1)</sup>

Preliminary pharmacological screening of various extracts of the crude drug appeared to confirm some of these claims. In the alcoholic extract, a compound was found to have significant specific anti-oxytocin activity. This was a glycoside, shatavarin I.<sup>(4)</sup>



a)



b)



c)



d)

**Figure 1.** *Asparagus racemosus* Willd.  
a). Flowering and leaving branch  
b). Fruit  
c). Root  
d). Dried-root

*A. racemosus* is also used in drugs for dyspepsia and as a galactagogue. It was compared with a modern drug, metaclopramide, which is used in dyspepsia to reduce gastric emptying time. Metaclopramide and *A. racemosus* did not differ significantly in their effects.<sup>(5)</sup>

Recently, a pyrrolizidine alkaloid, the major component of this plant, showed an inhibitory effect on oxytocin-induced contracture of rat diestrus uterus, *in vitro*, at doses of  $10^{-5}$  -  $10^{-6}$  mg cm<sup>-3</sup> and antitumour activity *in vitro*.<sup>(6,7)</sup>



สถาบันวิทยบริการ  
จุฬาลงกรณ์มหาวิทยาลัย

## 1.1 Chemical constituents of *A. racemosus*

Plant of genus *Asparagus* (Liliaceae family) are known to contain steroids, steroid glycosides and saponins.

Kar and Sen have correlated saponin content and ploidy level in this genus. So far, seven saponins have been isolated, of which sarsasapogenin is of wide occurrence. Tetraploid species contain only sarsasapogenin and hexaploid species only diosgenin. Both of these saponins have been recorded in diploids. Thus, tetraploid species contain sarsasapogenin and diploid and hexaploid species contain diosgenin.<sup>(8)</sup>

Many parts of *Asparagus racemosus* Willd. have been investigated. Subramanian and Nair have extracted fresh leaves and found diosgenin and quercetin-3-glycoside.<sup>(9)</sup> From fruits parts, sitosterol, stigmasterol, sarsasapogenin, steroid glycoside, spirostanolic and furostanolic saponin were isolated by Sharma and Sati.<sup>(10)</sup>

From the roots part of *A. racemosus*, earlier workers have reported D-glucose, D-mannose and a new disaccharide, 3-O- $\beta$ -D-glucopyranosyl-D-mannopyranose.<sup>(11)</sup> Steroidal glycosides were also found in this part, of which only Shatavarin I had specific antioxytocin activity.<sup>(4)</sup> Paliwal *et al.* have isolated sitosterol, 4,6-dihydroxy-2-(2-hydroxyisobutyl) benzaldehyde and undecanylcetanoate.<sup>(12)</sup> Recently, Sekine *et al.* found a new cage-type alkaloid, Asparagine A.<sup>(6)</sup> This novel polycyclic pyrrolizidine derivative was both the first alkaloid to be isolated from this genus and also the first pyrrolizidine derivative with carbon substitution at C-5 and C-8. This compound showed anti-oxytocin activity, *in vitro*.

The chemical constituents of *A. racemosus* are summarized in Table 1 and Figure 2.

## 1.2 Chemical constituents in other genus in Lileaceae family

The petroleum ether extract of the fruit of *A. adscenden* Roxb. yielded  $\beta$ -sitosterol, sarsasapogenin and diosgenin.<sup>(13)</sup> Later, Sharma and Sati isolated sitosterol- $\beta$ -D-glucoside, two new spirostanol glycosides and two new furostanols from the methanol extract of the defatted root of this specie.<sup>(14)</sup> In the leaves, Shama *et al* found oligo furosides and spiro-stanosides, which were adscendin A, adscendin B and adscendoside A and B.<sup>(15)</sup>

Shama *et al.* also studied *A. currillus* Buch-ham. Various parts of *A. currillus* was extracted with methanol. The roots were found to contain stigmasterol and sarsasapogenin, the leaves contained  $\beta$ -sitosterol and sarsasapogenin and three steroid compounds were found in the fruits.<sup>(16)</sup>

Ethanol extracts of air-dried aerial parts of *A. gonocladus*, which were studied by Mandloi *et al.* contained apigenin, kaempferol, rutin, 4,4,6-trihydroxy aurone and a new chalcone glycoside.<sup>(17)</sup>

For *A. acutifolius.*, Panova and co-workers have isolated flavonoid mixture in the aerial parts and isorhamnetin-3-D-glucoside, which was found for the first time in this genus.<sup>(18)</sup>

The chemical constituents of some plants in Asparagus genus are shown in Table 2 and Figure 3.

**Table 1** The chemical constituents of *A. racemosus* Willd.

plant parts	Crude extract	Isolated compounds	references
leaves	hot 90% EtOH	diosgenin quercetin-3-glycoside	9
fruits	MeOH	sitosterol stigmasterol sarsasapogenin sitosterol- $\beta$ -D-glucoside stigmasterol- $\beta$ -D-glucoside spirostanol spirostanolic saponin	10
roots	75% EtOH	Asparagamine	6,7
	EtOH	D-glucose D-mannose 3-O- $\beta$ -D-glucopyranosyl-D -mannopyranose sitosterol 4,6-dihydroxy-2-O-(2- hydroxyisobutyl) benzaldehyde undecanyl cetanoate shatavarin I shatavarin II shatavarin IV compound A ( C <sub>10</sub> H <sub>20</sub> O <sub>6</sub> )	11    12    4

**Table 2** The chemical constituents of some plants in *Asparagus* genus.

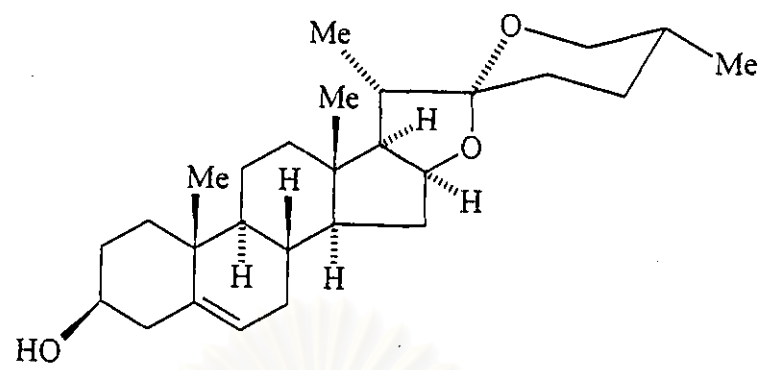
Scientific name	Plant parts	Isolated compounds	references	
<i>A. adscenden</i> Roxb.	fruits	$\beta$ -sitosterol sarsasapogenin diosgenin	13	
	roots	sitosterol- $\beta$ -D-glucoside asparanin C asparanin D asparaside C asparaside D	14	
	leaves	adscendin A adscendin B adscendoside A adscendoside B	15	
	A. currillus Buch- ham	roots	stigmasterol sarsasapogenin spirostanol glycoside I furostanol glycoside I	16
		leaves	$\beta$ -sitosterol sarsasapogenin	
		fruits	stigmasterol $\beta$ -sitosterol sarsasapogenin	

Table 2 (cont.)

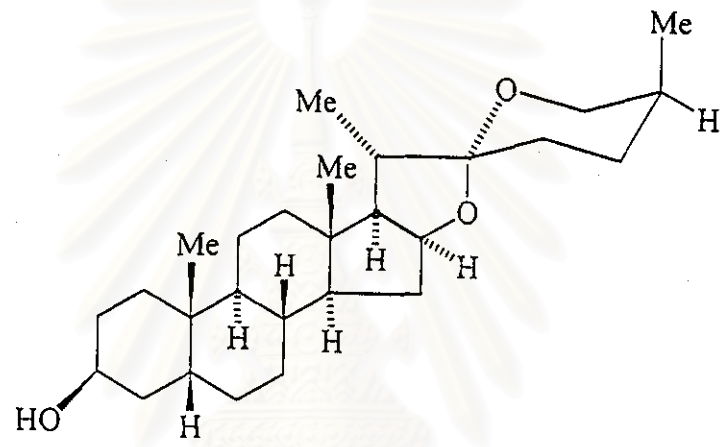
Scientific name	Plant parts	Isolated compounds	references
<i>A. gonocladus</i>	aerial parts	apigenin kaempferol rutin 4,4,6-trihydroxy aurone chalcone glycoside	17
<i>A. acutifolius</i>		isorhamnetin-3-D-glucoside	18

สถาบันวิทยบริการ  
จุฬาลงกรณ์มหาวิทยาลัย

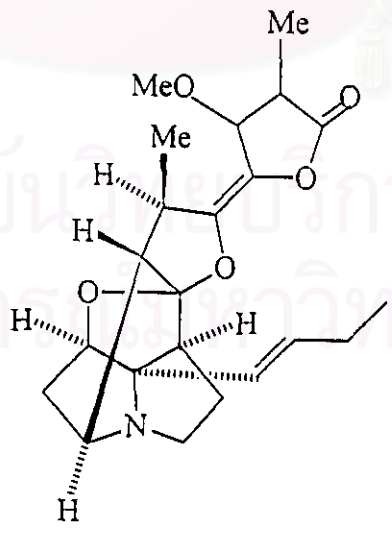




diosgenin

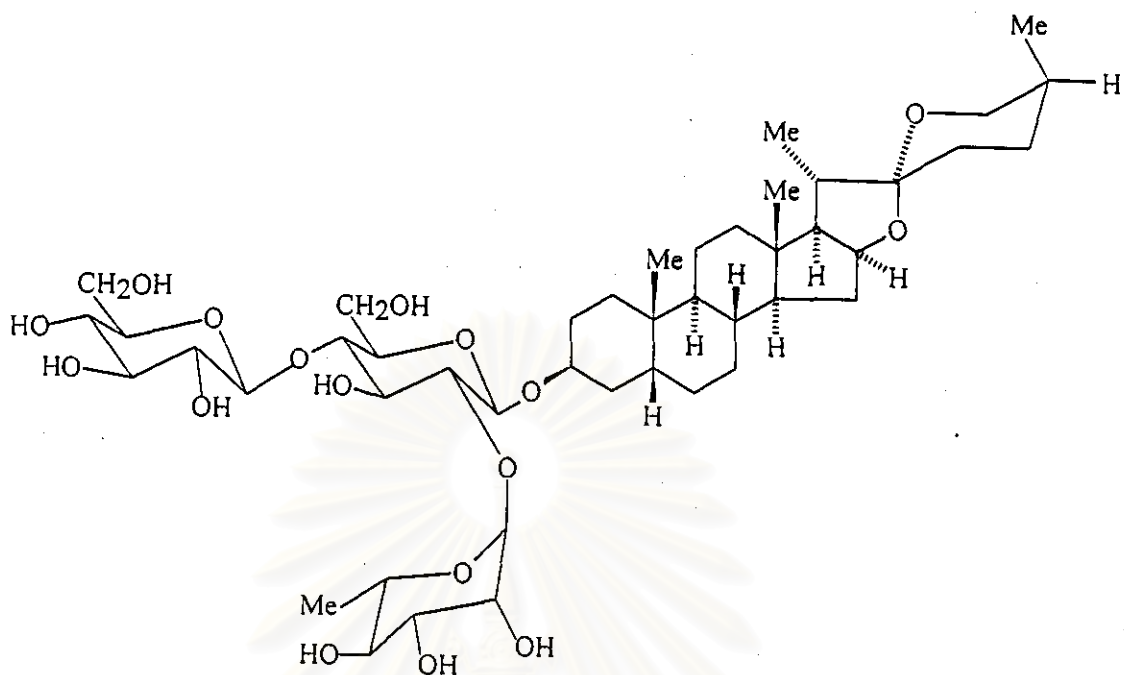


sarsasapogenin



Asparagamine A.

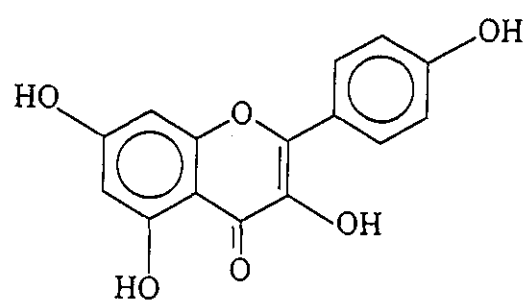
Figure 2 Major chemical constituents from *A. racemosus* Willd.



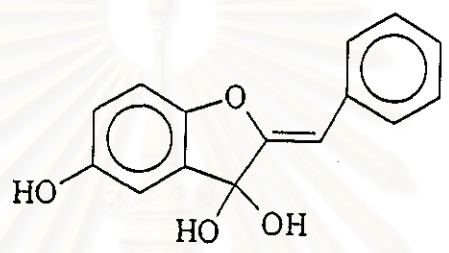
Shatavarin-IV

สถาบันวิทยบริการ  
จุฬาลงกรณ์มหาวิทยาลัย

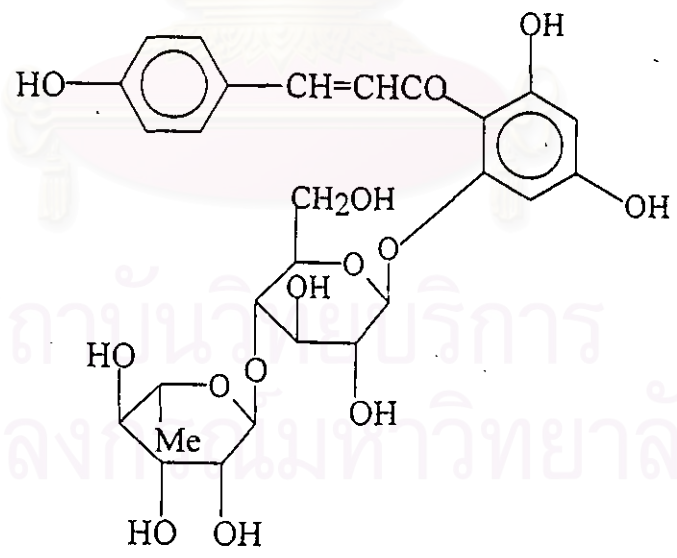
Figure 2 (cont.) Major chemical constituents from *A. racemosus* Willd.



Kaempferol

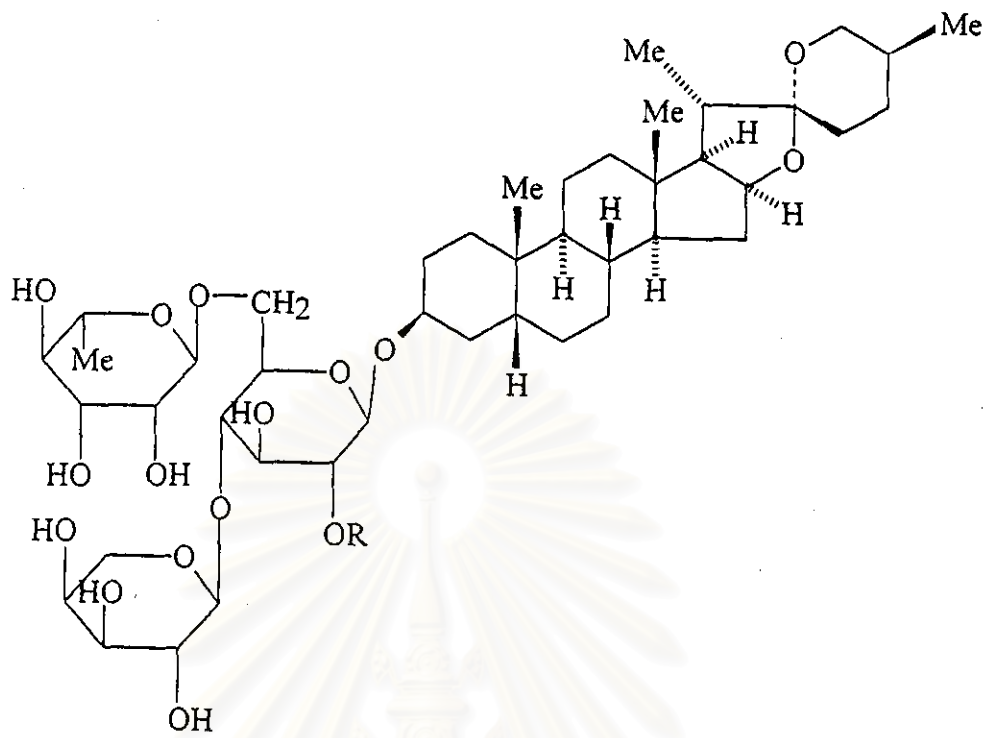


4,4,6-trihydroxy aurone



chalcone glycoside

Figure 3 Major chemical constituents of some plants in Asparagus genus



I R = H , Asparanin C

II R =  $\beta$ -D-glucoside , Asparanin D

Figure 3 (cont.) Major chemical constituents of some plants in  
Asparagus genus

สถาบันวิทยบริการ  
จุฬาลงกรณ์มหาวิทยาลัย

The present study concentrates on the chemical constituents of the roots of *A. racemosus*, especially in the non-polar parts, and also describes the effect of Asparagamine A, a pyrrolizidine alkaloid, which may have anti-oxytocic potential *in vivo*.