IJPSR (2012), Vol. 3, Issue 09 **(Review Article)**

INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES AND RESEARCH

Received on 06 May, 2012; received in revised form 02 July, 2012; accepted 17 August, 2012

CRINUM; AN ENDLESS SOURCE OF BIOACTIVE PRINCIPLES: A REVIEW, PART II. *CRINUM* ALKALOIDS: CRININE-TYPE ALKALOIDS

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Keywords:
Alkaloids,
Amaryllidaceae,
Chemical constituents,
Crinine,
Crinum

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ABSTRACT

Crinum is a genus of about 130 species belonging to family Amaryllidaceae with wide geographical distribution throughout the tropics, subtropics and warm temperate regions of the world. These plants are not only showy ornamentals but they possess significant folkloric and commercial reputation as well. Long ago, *Crinums* have been subjected to extensive chemical, cytological and pharmacological investigations. Phytochemical investigations have resulted in isolation of several diverse classes of phytocompounds and have been focused predominantly on alkaloids. The present part of our review work about the phytochemical, biological and toxicological studies on *Crinums* summarizes crinine-type alkaloids isolated up to now as well as their structural and stereochemical differences, in addition to their distribution in different *Crinum* species.

INTRODUCTION: *Crinum* is a perennial bulbous herb belonging to tribe Amaryllideae of family Amaryllidaceae and contains about 130 species distributed in Africa, America, southern Asia and Australia. African lands enjoy most species and about twenty-two are endemic to Southern Africa [1]. Amaryllidaceae species are considered an exclusive source of Amaryllidaceae alkaloids that possess wide range of interesting biological activities.

Besides their popularity as ornamental plants with beautiful and elegant flowers, they possess different interesting medicinal effects such as analgesic, immunostimulating, antineoplastic, antiviral and antimicrobial effects. Since about 1950s, *Crinums* have been subjected to extensive chemical and biological investigations due to their richness in pharmacologically active principles, especially alkaloids [2].

Therefore, as a part of our ongoing comprehensive review work on various classes of *Crinum* alkaloidal and non-alkaloidal constituents as well as their biological activities, the present part of our work reviews crinine-type alkaloids isolated from *Crinums* in addition to their structural and stereochemical differences as the most common type among *Crinum* alkaloids. Additionally, their distribution in various species studied so far is also completely considered (out of around 130 species, only about thirty-five have been phytochemically investigated) [3].

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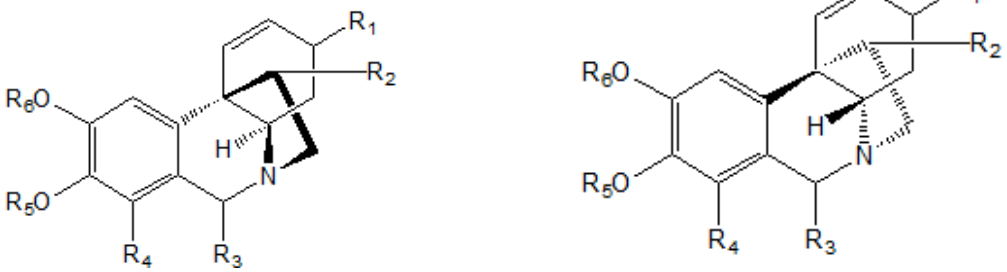
Crinine-type alkaloids: Phytochemical investigations of different plant parts of many *Crinum* species have yielded a large number of alkaloids belonging to the 5, 10b-ethanophenanthridine nucleus (crinine-type) (**Table 1 and Figure 2**). The isolated alkaloids of this type exhibited a wide and variable substitution patterns and according to their stereochemistry, they can be generally divided into two skeletons; (–)-Crinane and (+)-Crinane skeletons (**Figure 1**).



(–)-CRINANE SKELETON **(+)-CRINANE SKELETON**

FIGURE 1: BASIC SKELETONS OF CRININE-TYPE ALKALOIDS WITH COMMON SUBSTITUTION POSITIONS

TABLE 1: A LIST OF CRININE-TYPE ALKALOIDS ISOLATED FROM DIFFERENT *CRINUM* SPECIES

No.	Alkaloid name	Molecular Formula	mp (˚C) / $[\alpha]_D$	Plant source	Plant parts	References
1	11-O-Acetyl-ambelline.	$C_{20}H_{23}NO_6$	80–82˚ / –23.5˚ ($CHCl_3$)	*C. latifolium* Linn.	----	4
2	11-O-Acetyl-1,2-β-epoxy ambelline.	$C_{20}H_{23}NO_7$	195–197˚ / –49.9˚ (MeOH)	*C. latifolium* Linn.	----	4
3	1-O-Acetyl-bulbisine	$C_{19}H_{23}NO_6$		*C. asiaticum var. sinicum*	Leaves	5
4	2-O-Acetyl-bulbisine	$C_{19}H_{23}NO_6$		*C. asiaticum var. sinicum*	Leaves	5
5	2-O-Acetyl-crinamabine.	$C_{18}H_{22}NO_6$		*C. asiaticum var. sinicum*	Leaves	5
6	3-O-Acetyl-crinine (krepowine).	$C_{18}H_{19}NO_4$	140–141˚ / + 68.4˚ (EtOH) + 59.3˚($CHCl_3$)	*C. americanum* L. *C. bulbispermum* Milne. *C. macowanii* Baker *C. moorei* Hook F. *C. powellii* Hort. *C. powellii* Hort. *var. krelagei*	Bulbs Bulbs Bulbs Whole plant Bulbs ----	6 7, 8 9 10 11 12
7	3-O-acetyl-8-O-demethyl-maritidine.	$C_{18}H_{21}NO_4$		*C. asiaticum var. sinicum*	Leaves	5
8	3-O-Acetyl-hamayne.	$C_{18}H_{19}NO_5$	110–112˚ / +49.3˚ (EtOH)	*C. bulbispermum* Milne. *C. kirkii* Baker *C. latifolium* Linn. *C. macowanii* Baker *C. moorei* Hook F. *C. zeylanicum* Linn.	Whole plant Bulbs Bulbs Whole plant Whole plant Bulblets Bulbs	13 14 7 15 16 17 18
9	3-O-Acetyl-powelline	$C_{19}H_{21}NO_5$	59–60˚ / +65.8˚ ($CHCl_3$)	*C. bulbispermum* Milne.	Bulbs	8
10	Amabiline (Crinan-1,2-diol)	$C_{16}H_{19}NO_4$	210˚ / –32˚ (EtOH)	*C. amabile* Donn. *C. kirkii* Baker *C. stuhlamanii* Baker	Bulbs Bulbs Bulbs	19 20 21
11	Ambelline.	$C_{18}H_{21}NO_5$	260 –261˚ / –13.6˚ (MeOH) +32˚ ($CHCl_3$)	*C. amabile* Donn. *C. asiaticum* L. *C. asiaticum var. japonicum* *C. augustum* Rox. *C. latifolium* Linn. *C. powellii* Hort. *var.harlemense* *C. pretense* *C. stuhlamanii* Baker	Bulbs ---- ---- ---- ---- ---- Bulbs ----	22 23 23 23, 24 25, 26 27 12 21 28

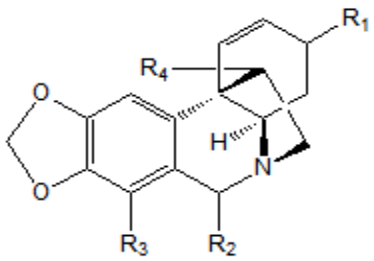
				C. yemense Defl. *C. zeylanicum*	Bulbs	29
12	3-[4'-(8'-aminoethyl)-phenoxy] bulbispermine.	$C_{24}H_{26}N_2O_4$	+53.3˚ ($CHCl_3$)	*C. moorei* Hook F.	Whole plant	10
13	3,4-Anhydropowelline.	$C_{17}H_{17}NO_3$	+ 22˚ ($CHCl_3$)	*C. bulbispermum* Milne.	Bulbs	8
14	Augustine.	$C_{17}H_{19}NO_4$	174 –176˚ / -44.8˚ (MeOH) –46.25˚ (EtOH)	*C. amabile* Donn. *C. americanum* L. *C. augustum* Rox.	Bulbs Bulbs Leaves Whole plant	19 22 30 31, 32
15	Augustisine.	$C_{17}H_{21}NO_3$	173–175˚ / –30˚ (MeOH)	*C. augustum* Rox.	Leaves	8
16	Bowdensine.	$C_{21}H_{25}NO_7$		*C. bulbispermum* Milne.	Bulbs	7
17	Bulbisine.	$C_{17}H_{21}NO_5$	182–183˚ / +27.14(MeOH)	*C. bulbispermum* Milne.	Bulbs	8
18	Bulbispermine.	$C_{16}H_{17}NO_4$		*C. bulbispermum* Milne. *C. macowanii* Baker *C. yemense* Defl.	Bulbs Whole plant Whole plant Bulbs	33 13 34 35
19	Buphanidrine.	$C_{18}H_{21}NO_4$	90–92˚ / + 4.2˚ (EtOH)	*C. erubescens* Ait. *C. kunthianum* Roem. *C. latifolium* Linn. *C. macowanii* Baker	Bulbs Leaves Leaves Bulbs	36 37 38 9
20	Buphanidrine-6-hydroxy.	$C_{18}H_{21}NO_5$		*C. latifolium* Linn. *C. zeylanicum* Linn.	Leaves ----	38 29
21	Buphanidrine-6-β-ethoxy.	$C_{20}H_{25}NO_5$		*C. bulbispermum* Milne. *C. zeylanicum* Linn.	Bulbs ----	8 29
22	(–)-Buphanisine.	$C_{17}H_{19}NO_3$	122–124˚ / – 20˚ (MeOH) – 26˚ (EtOH)	*C. amabile* Donn. *C. augustum* Rox. *C. bulbispermum* Milne.	Bulbs Bulbs Whole plants Bulbs Bulbs	19 22 31, 32 39 8
23	(–)-Buphanisine-6-α-hydroxy.	$C_{17}H_{19}NO_4$	126–128˚ / +40.04˚(EtOH)	*C. augustum* Rox. *C. bulbispermum* Milne.	Whole plants Bulbs	31, 40 8, 41
24	(–)-Buphanisine-6-β-hydroxy.	$C_{17}H_{19}NO_4$	126–128˚ / +40.04˚(EtOH)	*C. augustum* Rox. *C. bulbispermum* Milne.	Whole plants Bulbs	31, 40 8
25	Buphanisine-6-α-ethoxy.	$C_{19}H_{23}NO_5$		*C. augustum* Rox. *C. bulbispermum* Milne.	Leaves Bulbs	8 8
26	Crinafolidine.	$C_{19}H_{23}NO_6$		*C. latifolium* Linn.	Fruits	42
27	Crinafoline.	$C_{18}H_{21}NO_6$		*C. latifolium* Linn.	Fruits	42
28	Crinalbine.	$C_{17}H_{19}NO_5$	130–132˚ / +24˚ ($CHCl_3$)	*C. bulbispermum* Milne. *C. powellii* Hort. *var. album*	Bulbs Bulbs	43 44
29	Crinamabine.	$C_{16}H_{20}NO_5$	235–238˚ / +35˚ (MeOH)	*C. amabile* Donn.	Bulbs	22
30	Crinamabine-7-methoxy	$C_{17}H_{22}NO_6$		*C. asiaticum var. sinicum*	Leaves	5
31	(–)-Crinamidine.	$C_{16}H_{18}NO_5$	215–217˚ / –10˚ ($CHCl_3$)	*C. bulbispermum* Milne. *C. erubescens* Ait. *C. kunthianum* Roem. *C. latifolium* Linn. *C. laurentii* Durand & Dewild *C. macowanii* Baker *C. moorei* Hook F. *C. powellii* Hort. *C. powellii* Hort. *var. krelagei*	Bulbs Bulbs Leaves Leaves ---- Bulbs Whole plant Seeds, Bulbs Bulblets Whole plant ---- Bulbs	7 36 37 38 45 9 15, 16 46, 47 17 16 45 44

32	(+)-Crinamine.	$C_{17}H_{19}NO_4$	199–201˚ / +157˚ ($CHCl_3$) +356.8˚(MeOH)	*C. ambile* Donn.	Bulbs	19
				C. americanum L.	Leaves	30
				C. asiaticum L.	Bulbs	23, 48
				C. asiaticum var. japonicum	Leaves	7, 49
				C. augustum Rox.	Whole plant	31, 40
					Bulbs	39
				C. bulbispermum Milne.	Bulbs	43
					Whole plant	7, 16
				C. defixum Ker.	Bulbs	50
				C. erubescens Ait.	Bulbs	36
				C. firmifolium var. hygrophilum	Whole plant	51
				C. glaucum Chevalier	Bulbs	52
				C. Jagus Dandy	Bulbs	53
				C. latifolium Linn.	Bulbs	52
				C. macowanii Baker	Bulbs	7, 9
					Whole plant	15, 16
				C. moorei Hook F.	Bulblets	17
				C. ornatum	Whole plant	16
				C. powellii Hort.	Bulbs	54
				C. powellii Hort. *var. krelagei*	Bulbs	55
				C. scabrum Herb.	----	8
				C. stuhlamanii Baker	Whole plant	50
				C. yemense Defl.	Bulbs	21
				C. zeylanicum Linn.	Bulbs	18, 35
33	(+)-Crinamine-6-α-hydroxy.	$C_{17}H_{19}NO_5$	210˚ / +46˚ ($CHCl_3$)	*C. asiaticum* L.	----	23
				C. bulbispermum Milne.	Whole plant	13, 16
				C. delagoense Verdoorn	Bulbs	9
				C. erubescens Ait.	Bulbs	36
				C. firmifolium	Bulbs	56
				C. firmifolium var. hygrophilum	Whole plant	51
				C. Jagus Dandy	Bulbs	53
				C. powellii Hort.	Bulbs	27
				C. scabrum Herb.	Whole plant	50
				C. zeylanicum Linn.	Bulbs	18
34	(+)-Crinamine-6-β-hydroxy.	$C_{17}H_{19}NO_5$	210˚ / +46˚ ($CHCl_3$)	*C. asiaticum* L.	----	23
				C. bulbispermum Milne.	Whole plant	13, 16
				C. delagoense Verdoorn	Bulbs	9
				C. erubescens Ait.	Bulbs	36
				C. firmifolium	Bulbs	56
				C. firmifolium var. hygrophilum	Whole plant	51
				C. Jagus Dandy	Bulbs	53
				C. powellii Hort.	Bulbs	27
				C. scabrum Herb.	Whole plant	50
				C. zeylanicum Linn.	Bulbs	18
35	(+)-Crinamine-6-β-methoxy.	$C_{18}H_{21}NO_5$	+ 20.2° (MeOH)	*C.augustum* Rox.	Bulbs	39
				C. zeylanicum Linn.	Bulbs	18
36	Crinan-3α-ol.	$C_{16}H_{19}NO_3$		*C. latifolium* Linn.	Leaves	38
37	Crinatine.	$C_{18}H_{21}NO_5$		*C. natans* Linn.	Bulbs	57
				C. oliganthum Urban	Bulbs	30
38	(–)-Crinine.	$C_{16}H_{17}NO_3$	209–210˚ / – 11˚ ($CHCl_3$) – 9˚ (EtOH)	*C. amabile* Donn.	Bulbs	58
				C. americanum L.	Bulbs	6
				C. asiaticum L.	----	23
				C. augustum Rox.	Leaves	8
				C. bulbispermum Milne.	Bulbs	7, 43

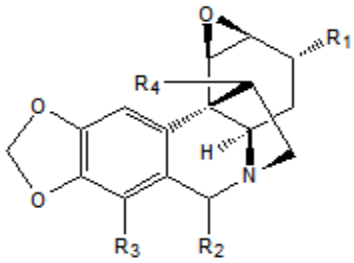
					Whole plants	16
				C. erubescens Ait.	Bulbs	36
				C. kirkii Baker	Bulbs	20
				C. lugardiae N.E.Br.	Bulbs, Roots	59
				C. latifolium Linn.	Bulbs	7, 25
				C. macowanii Baker	Whole plant	15, 16, 34
				C. moorei Hook F.	Seeds	46
					Whole plant,	10, 16, 17
				C. powellii Hort.	Bulblets	55
				C. powellii Hort. *var. album*	Bulbs	44
				C. powellii Hort. *var. harlemense*	Bulbs	60
					Bulbs	
				C. powellii Hort. *var. krelagei*	Bulbs	44
				C. stuhlamanii Baker	Bulbs	21
				C. zeylanicum Linn.	----	29
39	(–)- Crinine-6-α-hydroxy.	$C_{16}H_{17}NO_4$	268–270˚ +13.58˚ (EtOH)	*C. augustum* Rox.	Whole plant	40
				C. bulbispermum Milne.	Bulbs	8
40	(–)- Crinine-6-β-hydroxy.	$C_{16}H_{17}NO_4$	268–270˚ +13.58˚ (EtOH)	*C. augustum* Rox.	Whole plant	40
				C. bulbispermum Milne.	Bulbs	8
41	Crinine-6-α-ethoxy.	$C_{18}H_{21}NO_4$		*C. bulbispermum* Milne.	Bulbs	8
42	Crinisine.			*C. asiaticum* L. *var. sinicum*	Bulbs	61
43	Crinosine.				----	62
44	Deacetylbowdensine	$C_{17}H_{21}NO_5$		*C. bulbispermum* Milne.	Bulbs	7
				C. erubescens Ait.	Bulbs	36
45	4a-Dehydroxy-crinamabine.	$C_{16}H_{19}NO_4$	208–210˚ / +28˚ (MeOH)	*C. amabile* Donn.	Bulbs	22
				C. macowanii Baker	Bulbs	9
46	Delagoenine.	$C_{19}H_{25}NO_5$	120–122˚ / +34.2˚ (MeOH)	*C. delagoense* Verdoorn	Bulbs	9
47	Delagoensine.	$C_{18}H_{21}NO_5$	132–134˚ / +28.2˚(MeOH)	*C. delagoense* Verdoorn	Bulbs	9
48	8-O-Demethyl-oxomaritidine	$C_{16}H_{17}NO_3$		*Crinum asiaticum* var. *sinicum*	Leaves	5
49	Dihydrocrinidine.	$C_{16}H_{19}NO_3$		*C. americanum* L.	Roots	30
50	(+)-Dihydrohaemanthamine	$C_{17}H_{21}NO_4$		*C. powellii* Hort.	Bulbs	60
51	Dihydro-oxo-demethoxy-haemanthamine.	$C_{16}H_{17}NO_3$		*C. latifolium* Linn.	Leaves	38
52	Dihydrovittatine.	$C_{16}H_{19}NO_3$		*C. asiaticum* var. *sinicum*	Leaves	5
53	Epibuphanisine.	$C_{17}H_{19}NO_3$	123–125˚ / +129˚ (EtOH)	*C. moorei* Hook F.	Whole plant	16
					Bulblets	17
54	1-Epideacetyl-bowdensine	$C_{17}H_{21}NO_5$	162–164˚ / +22˚ ($CHCl_3$)	*C. kunthianum* Roem.	Leaves	37
				C. macowanii Baker	Bulbs	9
					Whole plant	15, 16
				C. moorei Hook F.	Whole plant	10
					Bulblets	17
55	1-Epijosephinine.	$C_{18}H_{20}NO_5$		*Crinum asiaticum var. sinicum*	Leaves	5
56	Epivittatine.	$C_{16}H_{17}NO_3$	208–210˚ / + 102˚ (EtOH)	*C. moorei* Hook F.	Whole plant	10
57	1,2-β-Epoxyambelline (cavinine).	$C_{18}H_{21}NO_6$	244–245˚ / +22.4˚ ($CHCl_3$) –14.6˚ (MeOH)	*C. asiaticum* L.	----	23, 24
				C. augustum Rox.	----	23, 24
				C. latifolium Linn.	----	24, 26
				C. pratense	----	24
58	Flexinine.	$C_{16}H_{17}NO_4$	233–235˚ / –25.5˚ ($CHCl_3$) –12.7˚ (MeOH)	*C. amabile* Donn.	Bulbs	22
				C. americanum L.	Bulbs	6
				C. augustum Rox.	Leaves	8
				C. erubescens Ait.	Bulbs	36

				C. kirkii Baker	Bulbs	20
59	(+)-Haemanthamine (3-epicrinamine).	$C_{17}H_{19}NO_4$	200–203˚ / +19.7˚ (MeOH)	*C. americanum* L. *C. asiaticum* L. *C. defixum* Ker. *C. glaucum* Chevalier *C. Jagus* Dandy *C. ornatum* *C. powellii* Hort. *var. album* *C. yemense* Defl.	Leaves ---- Bulbs Bulbs Bulbs Bulbs Bulbs Whole plant	30 23 28 52 52 54 44 35
60	Haemanthidine (pancratine).	$C_{17}H_{19}NO_5$	189–190˚ / – 41˚ ($CHCl_3$)	*C. asiaticum* L.	----	23
61	Haemultine.			*C. powellii* Hort.	Bulbs	27
62	Hamayne.	$C_{16}H_{17}NO_4$	79–80˚ / +79˚ (EtOH)	*C. americanum* L. *C. asiaticum* L. *C. asiaticum var. japonicum* *C. bulbispermum* Milne. *C. delagoense* Verdoorn *C. firmifolium var. hygrophilum* *C. glaucum* Chevalier *C. Jagus* Dandy *C. kirkii* Baker *C. kunthianum* Roem. *C. latifolium* Linn. *C. lugardiae* N.E.Br. *C. macowanii* Baker *C.ornatum* *C. stuhlamanii* Baker *C. zeylanicum* Linn.	Roots ---- ---- Bulbs Bulbs Whole plant Bulbs Bulbs Bulbs Leaves Bulbs Bulbs, Roots Whole plant Bulbs Bulbs Bulbs	30 49 49 33, 43 9 51 52 52, 53 14, 20 37 7 59 34 54 21 18
63	6-α-Hydroxy-crinamidine.	$C_{17}H_{19}NO_6$	254–256˚ / +26˚ (MeOH)	*C. latifolium* Linn.	Leaves	63
64	(+)-11-Hydroxyvittatine.	$C_{16}H_{17}NO_4$	225–227˚ / + 9˚ (MeOH)	*C. bulbispermum* Milne.	Bulbs	64
65	Krelagine.	$C_{17}H_{19}NO_4$	202˚ / +290˚ ($CHCl_3$)	*C. powellii* Hort. *var. krelagei*	Bulbs	44, 60
66	Macowine.	$C_{16}H_{19}NO_3$	115–117˚ / –34˚ ($CHCl_3$)	*C. kirkii* Baker *C. macowanii* Baker	Bulbs Bulbs	20 9
67	Nerbowdine (hemanthine).	$C_{17}H_{21}NO_5$		*C. erubescens* Ait.	Bulbs	36
68	Oliganine.	$C_{20}H_{24}N_2O_3$		*C. oliganthum* Urban	Whole plant	30
69	(–)-Oxocrinine.	$C_{16}H_{15}NO_3$	185–186˚/ –24.6˚ ($CHCl_3$)	*C. americanum* L.	Bulbs	6
70	(–)-Powellamine.	$C_{16}H_{17}NO_3$	198–200˚ / – 49˚ ($CHCl_3$)	*C. powellii* Hort.	Bulbs	11, 55
71	(+)-Powellamine (cripaline)	$C_{16}H_{17}NO_3$		*C. powellii* Hort.	Bulbs	55, 60
72	Powelline.	$C_{17}H_{19}NO_4$	200–201˚	*C. asiaticum* L. *C. asiaticum var. sinicum* *C. bulbispermum* Milne. *C. erubescens* Ait. *C. kunthianum* Roem. *C. latifolium* Linn. *C. macowanii* Baker *C. moorei* Hook F. *C. powellii* Hort. *C. powellii* Hort. *var. album* *C. powellii* Hort. *var.*	Bulbs Bulbs Bulbs Bulbs Leaves Bulbs Bulbs Whole plant Seeds Bulbs Whole plant Bulbs Bulbs ----	48, 61 61 43 36 37 7 9 15, 16 46 47 10, 16 30, 55 44 55, 65

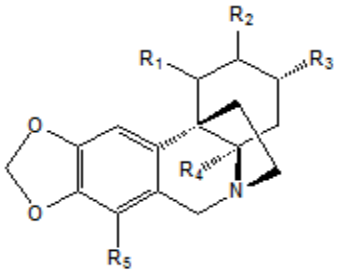
				harlemense *C. powellii* Hort. *var. krelagei*	 Bulbs	 44
73	Powelline-6-hydroxy.	$C_{17}H_{19}NO_5$		*C. latifolium* Linn.	Leaves	38
74	Powelline-6-α-ethoxy	$C_{19}H_{23}NO_5$		*C. bulbispermum* Milne.	Bulbs	8
75	(+)-siculine.	$C_{18}H_{19}NO_3$		*C. asiaticum var. sinicum*	Leaves	5
76	Undulatine.	$C_{18}H_{21}NO_5$	149–150˚ / –46˚ ($CHCl_3$)	*C. latifolium* Linn. *C. macowanii* Baker *C. moorei* Hook F. *C. powellii* Hort. *C. powellii* Hort. *var. krelagei* *C. yemense* Defl.	Bulbs Bulbs Whole plant Bulblets Bulbs Bulbs ----	7 9 10 17 27 60 28
77	Undulatine-6-hydroxy.	$C_{18}H_{21}NO_6$	113–116˚ / +8.4˚ (MeOH)	*C. latifolium* Linn.	Leaves	38
78	(+)-Vittatine.	$C_{16}H_{17}NO_3$	206–208˚ / +26˚ (MeOH)	*C. bulbispermum* Milne	Bulbs	64
79	Yemenine A.			*C. yemense* Defl.	Bulbs	35
80	Yemenine B.			*C. yemense* Defl.	Bulbs	35
81	Yemenine C.			*C. yemense* Defl.	Bulbs	35



	R1	R2	R3	R4
(1)	αOMe	H	OMe	OAc
(6)	αOAc	H	H	H
(9)	αOAc	H	OMe	H
(11)	αOMe	H	OMe	OH
(19)	αOMe	H	OMe	H
(20)	αOMe	OH	OMe	H
(21)	αOMe	βOEt	OMe	H
(22)	αOMe	H	H	H
(23)	αOMe	αOH	H	H
(24)	αOMe	βOH	H	H
(25)	αOMe	αOEt	H	H
(27)	βOMe	αOH	OMe	OH
(38)	αOH	H	H	H
(39)	αOH	αOH	H	H



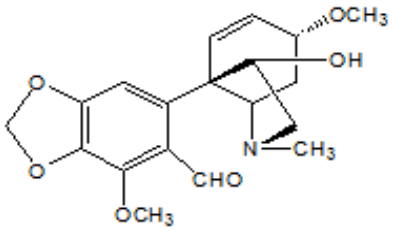
	R1	R2	R3	R4
(2)	OMe	H	OMe	OAc
(14)	OMe	H	H	H
(31)	OH	H	OMe	H
(57)	OMe	H	OMe	OH
(58)	H	H	H	H
(63)	H	OH	OMe	H
(76)	OMe	H	OMe	H
(77)	OMe	OH	OMe	H

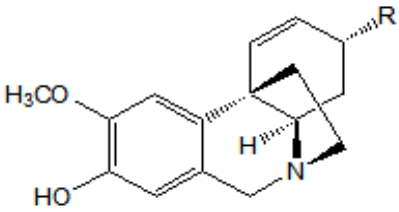


(40)	αOH	βOH	H	H
(41)	αOH	αOEt	H	H
(69)	O	H	H	H
(72)	αOH	H	OMe	H
(73)	αOH	OH	OMe	H
(74)	αOH	αOEt	OMe	H

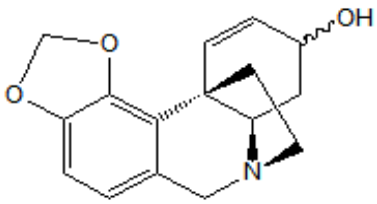
	R_1	R_2	R_3	R_4	R_5
(3)	βOAc	βOH	H	H	OMe
(4)	βOH	βOAc	H	H	OMe
(5)	βOH	βOAc	H	OH	H
(10)	αOH	αOH	H	H	H
(16)	αOAc	βOAc	H	H	OMe
(17)	βOH	βOH	H	H	OMe
(29)	βOH	βOH	H	OH	H
(30)	βOH	βOH	H	OH	OMe
(44)	αOH	βOH	H	H	OMe
(45)	βOH	βOH	H	H	H
(49)	H	H	OH	H	H
(54)	βOH	βOH	H	H	OMe
(55)	βOH	βOAc	H	H	H
(67)	OH	H	OH	H	OMe

(26)

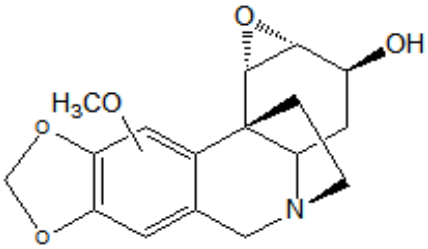




R	
(15)	OMe
(66)	OH



(70) / (71)



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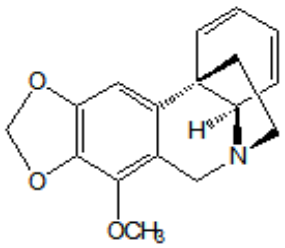

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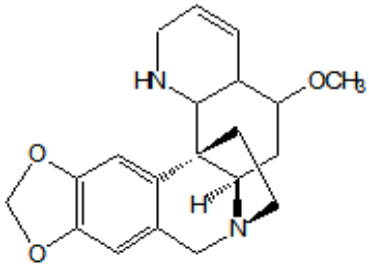

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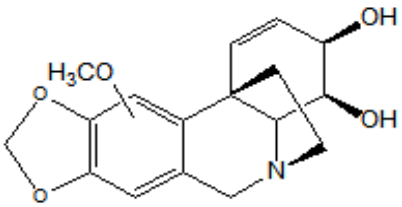

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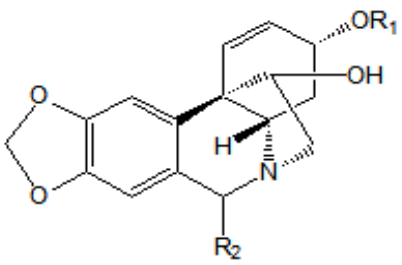
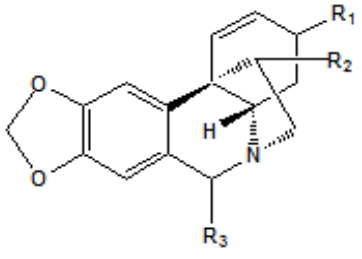
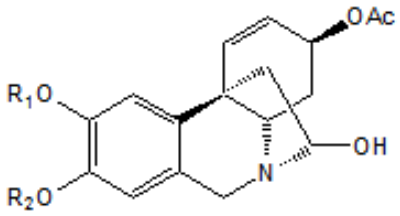


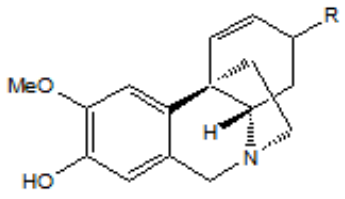


	R_1	R_2
(8)	Ac	H
(32)	Me	H
(33)	Me	αOH
(34)	Me	βOH
(35)	Me	βOMe
(62)	H	H

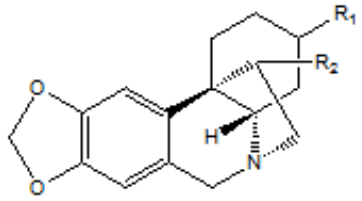
	R_1	R_2	R_3
(12)	αO-ph-$(CH_2)_2$-NH_2	OH	H
(18)	αOH	OH	H
(53)	αOMe	H	H
(56)	αOH	H	H
(59)	βOMe	OH	H
(60)	βOMe	OH	OH
(64)	βOH	OH	H
(78)	βOH	H	H



	R_1	R_2
(46)	OMe	OMe
(47)	— CH_2 —	



	R
(7)	βOAc
(48)	= O
(75)	αOH



	R_1	R_2
(36)	αOH	H
(50)	βOMe	αOH
(51)	H	O
(52)	βOH	H

FIGURE 2: CRININE-TYPE ALKALOIDS ISOLATED FROM DIFFERENT *CRINUM* SPECIES

CONCLUSION: This current part of our review work highlights crinine-type alkaloids isolated to date from the genus *Crinum* in addition to their structural differences and distribution in different species. As an endless source of bioactive principles, the extensive survey of literature presents crinine-type alkaloids as the major class within the isolated *Crinum* chemical constituents and about 81 bases belonging to this alkaloidal type were isolated and identified. Moreover, the unstudied species are still calling for phytochemical investigations that will add new members of these important bases.

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How to cite this article:
Refaat J, Kamel MS, Ramadan MA and Ali AA: *Crinum*; an endless source of bioactive principles: A Review, Part II. *Crinum* alkaloids: Crinine-Type Alkaloids. *Int J Pharm Sci Res*. 3(9); 3091-3100.