8.2. *PANCRATIUM* L.

Alkalolids

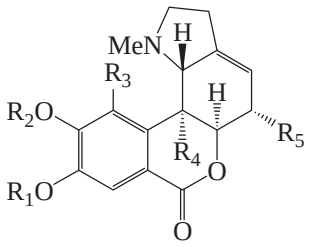
Amaryllidaceae, including *Pancratium* (Piozzi *et al*., 1969). *Pancratium* species are rich and important sources of Amaryllidaceae alkaloids e.g. *Pancratium canariense* bulbs, from which sixteen alkaloids have been isolated (Cedrón *et al*., 2009). The chemistry and biology of *Pancratium* alkaloids have been reviewed by Cedrón *et al.* (2010). In this review, the alkaloids have been classified according to their following 4 skeleton types:

1. Lycorenine and Lycorine Types

From the genus *Pancratium* four alkaloids with this skeleton have been isolated *viz.* hippeastrine (**110**), (+)-9-*O*-demethylhomolycorine (**111**), 10-norneronine (**112**) and pancratinine A (**113**). All of the alkaloids contain a lactone ring, due to the oxidation of the hydroxyl group at C-6. Pancritatin A, which has an unusual oxygenated function at position 10*b*, has only been detected in a few species (Latvala *et al*., 1995; Cedrón *et al*., 2009). Seventeen lycorine-type alkaloids (**1**, **19**, **41**, **57**, **64**, **76**, **114**-**124**) have been identified in *Pancratium* species (Rangaswami and Rao, 1966; Cedrón *et al*., 2009). Several of them have been isolated as *N*-oxides (**123, 124**) (Vazquez-Tato *et al*, 1988; Cedrón *et al*., 2009), as zwitterionic compounds (**57, 122**), in a chiral form (**64, 118, 119**) (Ghosal *et al*., 1986d; Amarasekara and Gottlieb, 1993) or with glycosidic substituents (**115, 116**) (Ghosal *et al.*,1984; Cedrón *et al*., 2010).

2.Montanine, Narciclasine, and Tazettine Types

Alkaloids belonging to the montanine (**5**), narciclasine (**4**), and tazettine (**3**) groups are unusual in the *Pancratium* genus. Only three alkaloids with a montanine-type skeleton have been identified: pancracine (**65**) from *Pancratium maritimum* (Ali *et al*., 1984c) and *Pancratium sickenbergeri* (Sener *et al*., 1998b), and pancratinine B (**125**) and pancratinine C (**126**) from *Pancratium canariense* (Cedrón *et al*., 2009). From *Pancratium maritimum* three narciclasine-type alkaloids have been isolated: pancratistatin (**127**) (Pettit *et al*., 1995b), narciclasine (**4**) (Fuganti and Mazza, 1972) and its glycosidic derivative (**128**) (Abou-Donia *et al*., 1991). The tazettine type alkalodis in the *Pancratium* genus are tazettine (**3**) and deoxytazettine (**129**) isolated from *Pancratium maritimum* (Berkov *et al*., 2004b), and pretazettine (**89**) from *Pancratium biflorum* (Ghosal *et al*., 1986d).

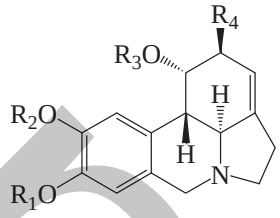


110 Hippeastrine $R_1+R_2=CH_2,R_3=R_4=H,R_5=OH$

111 (+)-9-*O*-demethylhomolycorine $R_1=H,R_2=Me,R_3=R_4=R_5=H$

112 10-Norneronine $R_1+R_2=CH_2,R_3=OH,R_4=H,R_5=OH$

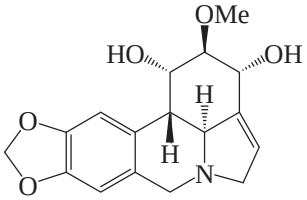
113 Pancratinine A $R_1+R_2=CH_2,R_3=H,R_4=R_5=OH$



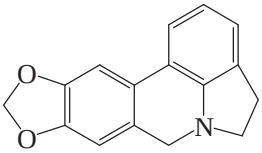
114 9- Norpluviine $R_1=Me,R_2=H,R_3=H,R_4=OH$

115 1-*O*-β-D-Glycosillycorine $R_1=Me,R_2=R_3=R_4=H$

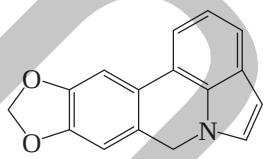
116 1-*O*-β-D-Glycosilpseudolycorine $R_1+R_2=CH_2,R_3=$β-D-glc,$R_4=OH$



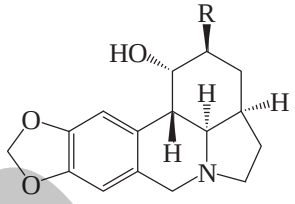
117



118 Galanthane

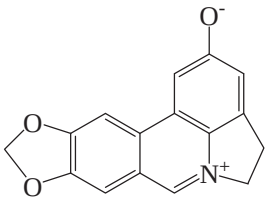


119 3, 4-Dihydroanhydrolycorine

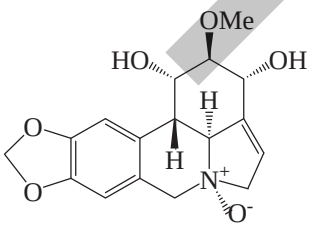


120 Dihydrocaranine R=H

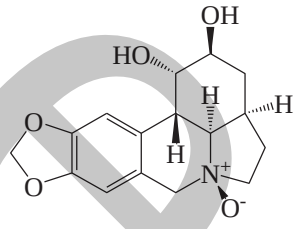
121 Dihydrolycorine R=OH



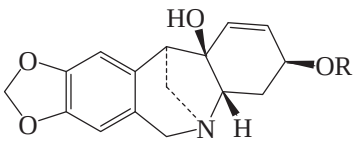
122 Ungeremine



123 Ungiminorine N-oxide

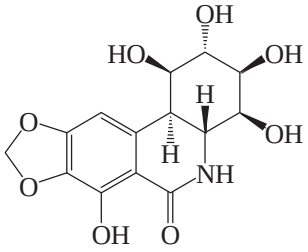


124 Pancratinine D

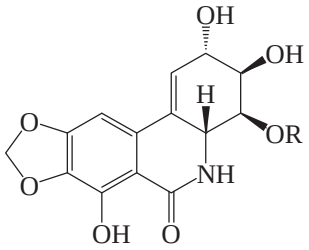


125 Pancratinine B R=Me

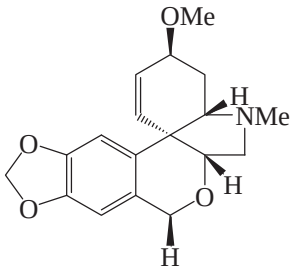
126 Pancratinine C R=H



127 Pancratistatin



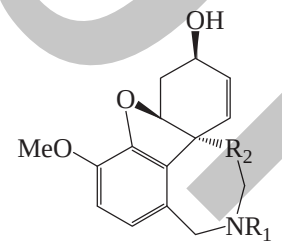
128 R=β-D-glc 4-*O*-β-D-glycosylnarciclasine

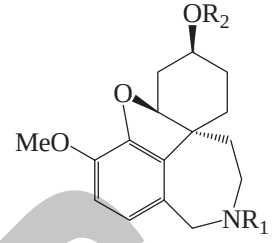


129 6-Deoxytazettine

3. Galanthamine Type

The galanthamine-type alkaloids are characterized by the presence of two *ortho* aromatic hydrogen. The galanthamine-type alkaloids are less common in this genus in comparison with other genera such as *Galanthus* or *Narcissus*. Seven different alkaloids (**2, 130-135**) have been found in *Pancratium maritimum*, *Pancratium biflorum* and *Pancratium foetidum* (Abou-Donia *et al*., 1991; Amarasekara and Gottlieb, 1993; Sarg *et al*., 1996; Berkov *et al*., 2004b; Cedrón *et al*., 2010). The more abundant alkaloids are galanthamine (Sarg *et al*., 1996) and lycoramine (Youssef and Frahm, 1998; Youssef, 1999).





130 *N*-Norgalanthamine	R_1=R_2=H	**133 Lycoramine**	R_1=Me, R_2=H
131 *N*-Formylgalanthamine	R_1=CHO, R_2=H	**134 *N*-Norlycoramine**	R_1=R_2=H
132 Habranthine	R_1=Me, R_2=OH	**135 3-*O*-Acetylycoramine**	R_1=Me, R_2=Ac

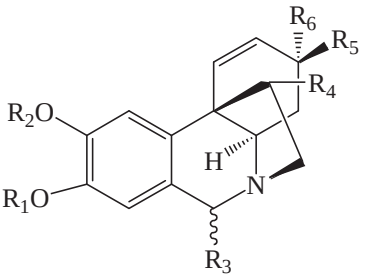
4. Crinine and Haemanthamine Type

The crinine- and haemanthamine-type alkaloids, together with the lycorine-type alkaloids, are the most abundant alkaloids in *Pancratium* genus. Six different alkaloids have been found in *Pancratium maritimum* (**8, 1, 136-139**) (Sener *et al*., 1993c, 1994). The most common type of alkaloid is haemanthamine-type. Ten of these alkaloids have been isolated from *Pancratium maritimum* (**7, 75, 140, 145**), *Pancratium sickenbergeri* (**142-144**) (Abou-Donia *et al*., 2002b), *Pancratium foetidum* (**37, 77, 142-144**) (Sarg *et al*., 1997), and *Pancratium tortuosum* (**141**) (Toaima, 2007).

Examples of the alkaloids isolated from some *Pancratium* species are shown in Table 5.

Other Secondary Metabolites

7,4'-Dihydroxy-8-methylflavan was isolated from *Pancratium littorale* stem (Ioset *et al*., 2001). Two polyoxygenated chromones, 5,7-dihydroxy-2-methylchromone and 5,6-dihydroxy-7-methoxy-2-methylchromone and a glucosyloxychromone (7-glucosyloxy-5-hydroxy-2-methylchromone) were isolated from the bulbs of *Pancratium biflorum* (Ghosal *et al*., 1982). Biflorin (**146**, a chromone *C*-glucoside) was identified from the roots of the same species (Ghosal *et al*., 1983c). The bulbs of *Pancratium biflorum* contain the following free

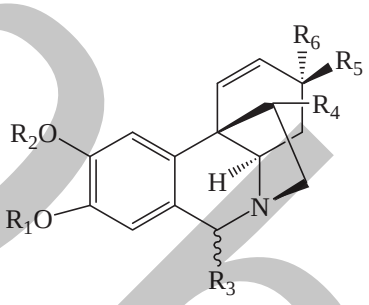


136 Crinan-3-one $R_1+R_2=CH_2, R_3=R_4=H, R_5+R_6=O$

137 Buphanisine $R_1+R_2=CH_2$, , $R_3=R_4=R_5=H, R_6=OMe$

138 -(-)-3β– Methoxy-6,11-dihyroxycriane $R_1+R_2=CH_2$, , $R_3=R_4=R_5=OH, R_6=H$

139 -(-)-3β,11-Dihyroxycriane $R_1+R_2=CH_2$, , $R_3=H, R_4=R_5=OH, R_6=H$



140 11- Hydroxyvittatine $R_1+R_2=CH_2^-$, $R_3=H, R_4$ OH, $R_5=$ H, $R_6=OH$

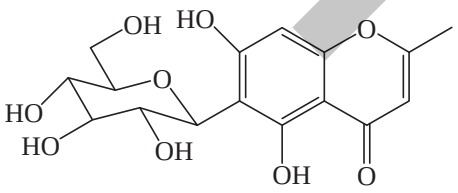
141 Maritidine $R_1=R_2=Me, R_3=R_4=R_5=H, R_4=OH$

142 *ent*-6-Hydroxybufanisine $R_1+R_2=CH_2^-$, $R_3=OH, R_4=R_5=H, R_6=OMe$

143 8-Demethyimaritidine $R_1=H, R_2=Me, R_3=R_4=R_5=H, R_6=OH$

144 9-Demethylmaritidine $R_1=Me, R_2=H, R_3=R_4=R_5=H, R_6=OH$

145 6-*O*-Methylhaemanthidine $R_1+R_2=-CH_2^-, R_3=\beta,OMe, R_4=OH, R_5=H, R_6=OMe$



146 Biflorin

and glucosyloxy acetophenones: 2,4,6-trimethoxyacetophenone, 4,6-dimethoxy-acetophenone-2-*O*-β-D-glucoside and 2,6-diemethoxyacetophenone-4-*O*-β-D-glucoside (Ghosal *et al.*, 1989c).

α-Amyrin acetate and β-amyrin acetate were isolated from *Pancratium zeylanicum* (Amarasekara and Gottlieb, 1993).