6.1.1. ***Allium ampeloprasum*** L., Sp. Pl., ed. 1, 294 (1753); Boulos, Fl. Egypt 4: 71 (2005).

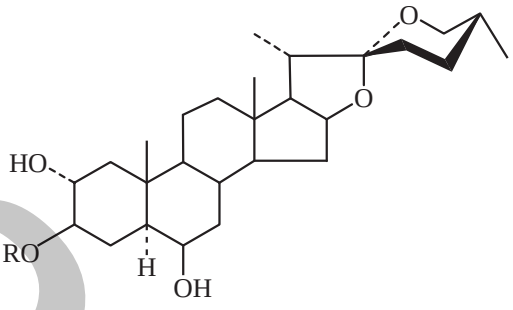
Basal El-Afrit (Ar) بصل العفريت

Allium ampeloprasum contains 0.4% alliin and the following amino acids: alanine, arginine, aspartic acid, asparagines, histidine, leucine, methionine, phenylalanine, proline, serine, threonine, tryptophan and valine (Atal and Sethi, 1961). The scales contain inulin-containing sugars (Uchida and Sakurai, 2008). The study of nutritive value of some wild growing plants, including *Allium ampeloprasum* revealed that they contain crude protein (1.59-2.6%), lipids (0.22-0.50%), carbohydrates (glucose, fructose, saccharose) (0.55-4.71%) and crude fiber (1.89-3.17%). Vitamin C content ranged from 22.50-44.12%, B complex vitamins (thiamine, riboflavin and niacin) from 0.06-1.07% and β-carotene content from 1.15-6.53% (Vedrina Dragojevic *et al.*, 2006).

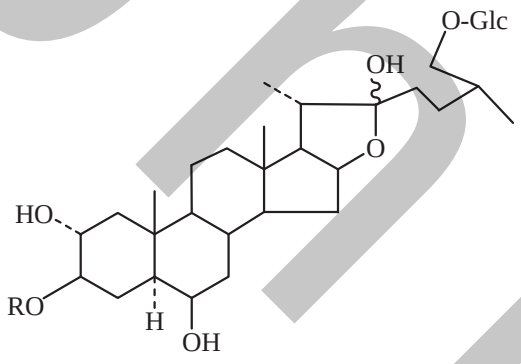
Steroidal Saponins

From bulbs of *Allium ampeloprasum* (elephant garlic, great-headed garlic, jumbo leek or broadleaf wild leek) two spirostane-type saponins, the prosapogenin of aginoside (**60**), ampeloside Bs_1 (**61**) and two furostane-type saponins, ampeloside Bf_1 (**62)** and ampeloside Bf_2 (**63**) were isolated. The structures of the three latter ampelosides were established as agigenin 3-*O*-β-glucopyranosyl (1→3)-β-glucopyranosyl (1→4)-β-galacto-pyranoside, (25*R*)-26-*O*-β-glucopyranosyl-22-hydroxy-5α-furostane-2α,3β,6β,26-tetraol-3-*O*-β-gluco-

pyranosyl (1→3)-β-glucopyranosyl-(1→4)-β-galactopyranoside, and (25*R*)-26-*O*-β-glucopyranosyl-22-hydroxy-5α-furostane-2α,3β,6β-tetraol-3-*O*-β-glucopyranosyl (1→4)-β-galactopyranoside, respectively (Morita *et al*., 1988). Later, Mimaki *et al.* (1999d) isolated seven steroidal saponins from the bulbs. Three steroidal saponins named yayoisaponins A-C were obtained together with dioscin and aginoside from bulbs of a mutant of elephant garlic (Sata *et al*., 1998). Karatavioside A (**33**) was also identified from the bulbs (Uchida *et al*., 2009b).



60 Prosapogenin of aginoside {R = β -D Gal^4 - β -D Glc}
61 Ampeloside Bs$_1$ { R= - β -D Gal^4 - β -D Glc^3 - β -D Glc}



62 Ampeloside Bf$_1$ {R= β -D Gal^4 - β -D Glc^3 - β -D Glc}
63 Ampeloside Bf$_2$ {R= -β -D Gal^4 - β -D Glc}

Organosulphur Compounds

Jacobsen *et al.* (1964) reported the presence of methyl allyl, methyl propyl and allyl propyl disulphides in great-headed garlic (*Allium ampeloprasum*). Alliin (*S*-allyl-L-cysteine sulphoxide), ethiin (*S*-ethyl-L-cysteine sulphoxide) (Rose *et al*., 2005), isoallin and methiin (Najjaa *et al*., 2011a) were detected in *Allium ampeloprasum.* Block *et al.* (1992a,b) identified the following thiosulphinates from elephant (or great-headed) garlic (*Allium ampeloprasum* var. *ampeloprasum*) (*E*)-1-propenesulfinothioic acid *S*-2-propenyl ester; 2-propene-1-sulfinothioic acid *S*-(*Z*)-1-propenyl ester; 2- propene-1-sulfinothioic acid *S*-(*E*)-1-propenyl ester; 2-propene-1-sulfinothioic acid *S*-2-propenyl ester, 2-propene-1-sulfinothioic acid *S*-methyl ester, methanesulfinothioic acid *S*-(*Z*)-1-propenylester, methanesulfinothioic acid *S*-(*E*)-1-propenyl ester; methanesulfinothioic acid *S*-2-propenylester; (*Z*,*Z*)-*d*,*l*-2,3-dimethyl-1,4-butenedithial *S*,*S'* dioxide; and methane-sulfinothioic acid *S*-methyl ester. (*Z*)-Propanethial *S*-oxide (onion lachrymatory factor), absent in garlic, is found to be formed from crushed *Allium ampeloprasum*, consistent with the classification of this plant as a closer relative of leek than of garlic (Block *et al*., 2010).

Khoshoo *et al*. (1960) reported that *Allium ampeloprasum* contained 68% moisture and 0.02-0.05% volatile oils (organosulphides). The following compounds were identified from the volatile constituents of *Allium ampeloprasum*: allyl monosulphide, allyl alcohol (Bernhard *et al*, 1964), symmetric and asymmetric methyl, propyl and allyl disulphide (Saghir *et al*., 1964). Boscher and Auger (1991) showed that the allyl moiety is the major constituent of sulphur volatile components of *Allium ampeloprasum* var. *bulbilliferum*. The formation of aroma compounds and lipoxygenase activity in unblanched leek (*Allium ampeloprasum* var. *bulga*) slices during long-term frozen storage have been studied. The arome profile changed from consisting of almost only sulphur compounds such as di- and propyl disulphide in the fresh leek to being dominated by numerous saturated and unsaturated aldehydes, such as hexanal, and (*E,E*)-2,4-nonadienal at the end of the storage period (12 months) (Nielsen *et al*., 2003). The most important aroma compounds in the freshly cut leek slices were di-Pr disulfide, Me propenyl disulfide, pentanal, decanal, and Pr propenyl disulfide in order of priority. When stored frozen and unblanched for 12 months, the aroma composition changed and the most important compounds became pentanal, decanal, 2,5-di-Me furan, unknown compound, and di-Pr disulfide. Blanching before freezing prevented to some degree these changes but also reduced the perceived intensity of the aroma compounds. The most important aroma compounds in the blanched sample were di-Pr disulfide, unknown compound, pentanal, 2,5-di-Me furan, and Pr propenyl disulfide (Nielsen and Poll, 2004). The total amount of sulphur compounds and the total amount of aldehydes were greatly influenced by storage time, atmosphere, and blanching (Nielsen *et al*., 2004).

Uchida *et al*. (2009a) compared the characteristics of sulphide precursor components in the bulb of *Allium ampeloprasum* L. (jumbo leek) with those in other *Allium* species: *Allium cepa* L. (onion), *Allium sativum* L. and *Allium ampeloprasum* L. (broad leaf wild leek). The contents of sulphides from jumbo leek were di-Me disulphide (M-SS-M; 1.7 mg/kg wet weight), Me propenyl disulphide (M-SS-Pe; 15.7 mg/kg), Pr propenyl disuphfide (P-SS-Pe; 7.5 mg/kg), di-Me trisulphide (M-SSS-M; 21.5 mg/kg), Me Pr trisulphide (M-SSS-P; 10.0 mg/kg), and Me propenyl trisulphide (M-SSS-Pe, 14.0 mg/kg). The composition of alk(en)yl cysteine sulphoxide (alk(en)yl CSO) from jumbo leek was S-Me cysteine sulphoxide (MCSO; 4.1± 0.5 mg/kg wet weight), S-Pr cysteine sulphoxide (PCSO; 0.1 ± 0.3 mg/kg) and S-propenyl cysteine sulphoxide (PeCSO; 2.4 ± 0.4 mg/kg).The total content was the same as those of *Allium cepa* and *Allium ampeloprasum*. Moreover, *N*-(γ-glutamyl)-S-(*E*-1-propenyl) cysteine (Glu-PEC, 87 mg/kg wet weight) which is a alk(en)yl cysteine precursor from jumbo leek, was detected. Therefore, the lower odor producing mechanism in jumbo leek was determined to be the same as that in leek. That is, the substrate precursor Glu-PEC is converted to *S*-*E*-1-propenyl cysteine (PEC) by γ-glutamyl transpeptidase. Then PEC is oxidized to PeCSO, a substrate for alliinase. PeCSO, another naturally present alk(en)yl CSO, is converted to *S*-alk(en)yl acid by alliinase (C-S lyase), followed by sulfide production via formation of the dialkyl thiosulphinates (Uchida *et al*., 2009a).

A number of volatile organoselenium compounds were detected in *Allium ampeloprasum, Allium cepa, Allium sativum* and *Allium tuberosum* (Chinese chive) including di-Me selenide (MeSeMe), methanesulphenoselenoic acid Me ester (MeSeSMe), di-Me diselenide (MeSeSeMe), bis(methylthio)selenide $(MeS)_2Se$), allyl Me selenide (MeSeAll), 2-propenesulphenoselenoic acid Me ester(MeSeSAll), 1-propenesulphinoselenoic acid Me ester (MeSeSCH=CHMe), and (allylthio)(methylthio) selenide (MeSSeSAll), and bis (allylthio) selenide $(AllS)_2$ Se from garlic and elephant garlic (Cai *et al*., 1994).

Flavonoids and Other Constituents

The bulbs of *Allium ampeloprasum* have been reported to contain quercetin and

kaempferol in very low amounts (below 20 mg/kg) (Horbowicz and Kotlinska, 2000). The catechins isolated from *Allium ampeloprasum* foams comprise epigallocatechin-3-*O*-isocaprylic acid 7-*O*-protocatechuic acid, catechin 3-*O*-β-D-glucopyranosyl-D-glucopyranoside, epigallocatechin 3-*O*-apigenin, epigallocatechin hydrate-3-*O*-leucocyanidin and/or their salts (Uchida and Sakurai, 2008).

Significant amounts of 9,12-octadecanoic acid and 11,14-eicosadienoic acid were detected among other unsaturated fatty acids in *Allium ampeloprasum* var. *holmens* (Kharazi and Peyvast, 2005).

Folk Medicine, Pharmacological and Biological Activities

Elephant garlic has a much milder flavor than garlic (*Allium sativum* L.) and is used for domestic cooking (Morita *et al*., 1988). *Allium ampeloprasum* (garlic) extracts have been reported as hepatoprotectants and health foods for prevention and treatment of liver diseases from hepatitis virus, stress, alcohol, immunity disorder, and drug toxicity (Uchida and Sakurai, 2005).

Both foam powder and freeze-dried powder of jumbo leek decreased the induction of hepatocyte necrosis in D-galactosamine hydrochloride-induced acute liver disorders and prevented the occurrence of ethanol-induced chronic liver disorders in rats by inhibiting the absorption of alcohol from the stomach (Uchida *et al*., 2009b).

The elevation of blood sugar level in oral glucose tolerance tests (OGTT) in rats was suppressed by feeding 8.3 g odorless jumbo leek with an inulin content of 60% (PSll) (5 g inulin)/kg per day. Among the biochemical markers, total cholesterol and triglyceride levels rose in streptozotocin (STZ)-treated rats compared with control rats. PSll fed to STZ-treated rats lowered these two marker levels below those of the control rats. The activities of blood aspartate transaminase (AST) and alanine transaminase (ALT) as well as the hepatopathological examination of liver confirmed that PSll (2 g/kg per day) protected rats from liver damage before acetaminophen treatment (Uchida *et al*., 2008). Jumbo leek foam powder at 100 mg/kg p.o. significantly lowered blood sugar level, BUN and AST activity in STZ treated rats (Uchida and Sakurai, 2008). However, *Allium ampeloprasum* subsp. *iranicum* did not show valuable inhibitory activity on α-amylase (a carbohydrate hydrolyzing enzyme useful as oral hypoglycemic drug) (Nickavar and Youefian, 2009). Yayoisaponins A-C and aginoside isolated from the plant exhibited *in vitro* cytotoxicity against P388 cells at 2.1 mg/ml, and antifungal activity against *Mortierella ramanniana* at 10 μg/disk (Sata *et al*.,1998). Methods and therapeutic compositions comprising plant extracts (including *Allium ampeloprasum*) for treatment of cancer have been reported. The compositions can be used in treatment of, and, methods of inhibiting tumor growth, tumor metastasis, and/or tumor-induced angiogenesis using the therapeutic compositions alone or in combination with an anticancer agent are, therefore, also provided (Cyr, 2006).

The findings of Nguansangiam *et al*. (2003) suggested that *Allium ampeloprasum* volatile oil, both in pre- and post-treatment could protect trichothecene toxin-induced epidermal damage in a mouse footpad.

Allium ampeloprasum and *Allium sativum* clove homogenates showed greater antibacterial and antifungal activities than a number of onion types (*Allium cepa* L.) (Hughes and Lawson, 1991). Goren *et al*. (2002) reported antiviral composition which contains dehydrated particulate derived *Allium* species such as *Allium ampeloprasum* L. (leek), *Allium cepa* L. (onion), *Allium cepa* var. *ancasti*, Southporth white glove, *Allium fistulosum* (Japanese bunching onion, scallion, Welsh onion) and *Allium schoenoprasum* (chives). The composition has antiviral activity, antimicrobial activity (antibacterial, antifungal), immunomodulating activity, immunostimulating activity, T-cell function and/or T-cell