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A Mini Review on *Alphonsea* sp. (Annonaceae): Traditional uses, Biological Activities and Phytochemistry

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ABSTRACT

The genus *Alphonsea* belongs to the family Annonaceae, which comprises of about 30 species, consisting of small trees and shrubs are distributed in China and Indo-Malayan. In this mini review, we aim to provide an overview of the traditional uses, biological activities and phytochemistry of plants *Alphonsea* sp. Literature, abstract and full text articles from journals, books, reports and electronic searches as well as from other relevant websites are surveyed, analysed and included in this review. The crude extracts exhibit anti-cancer, anti-oxidant, anti-fungal, anti-inflammatory and anti-trypanasomal activities. The survey reveled that *Alphonsea sp*. contain alkaloids, steroids, lignan, sesquiterpenes and monoterpenes.

INTRODUCTION

Alphonsea is a small genus of the family Annonaceae, distributed in China and Indo-Malayan. In China, the species mainly found in Hainan and South Yunnan, while in Asia, the *Alphonsea* species can be found in India, Sri Lanka, Myanmar, Thailand, Laos, Vietnam, Cambodia, Malaysia, Indonesia and Papua New Guinea (Srivastava & Mehrotra, 2013). Genus *Alphonsea* were narrowly distributed and poorly known species scattered throughout tropical Asia. In Malaysia, the species that can be found are *A. borneensis, A. curtisii, A. cylindrica, A. elliptica, A. johorensis, A. maingayi* and *A. rugosa* (Turner, 2009; Latiff, 2013; Turner and Utteridge, 2015; Turner, 2016). Additionally, *A. hainanensis, A. monogyma* and *A. tsangyuanensis* have been listed as endangered species (IUCN Red List, 2010).

According to Turner (2009), the fruits of *A. javanica* were similar with *A. borneensis*, but it has more cylindrical monocarps to 2.5 cm in diameter whereas those of *A. borneensis* are ellipsoidal, or more rarely globose, and reach 4 cm in diameter. The obvious difference between *A. javanica* and *A. borneensis* is in the leaves. *A. javanica* has chartaceous leaves with a shiny upper surface, whereas *A. borneensis* has chartaceous leaves with a smooth but not markedly shiny upper surface. *A. rugosa* is similar to *A. elliptica*. The differences are *A. rugosa* have more carpels per flower than *A. elliptica,* with strongly wrinkled and globrous of monocarp surface, while *A. elliptica* have smooth and hairy surface (Turner and Utteridge, 2015). The leaves of *A. kingii* were similar to those of *A. elliptica* and *A. johorensis* (Turner, 2016).

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Traditional use

There are several uses of the plant parts of this plant. The ripe fruits of *A. ventricosa, A. mollis, A. hainanensis* and *A. lutea* are edible (Kar *et al.*, 2013; Shu *et al.*, 2011). The wood of *A. mollis, A. hainanensis* and *A. monogyma* were used for the construction of carts and agricultural implements. In addition, the wood of the Indian *A. ventricosa* was used in boat building in the Andamas (Burkill, 1966). Besides that, the flowers of *A. monogyma* are also fragrant and used for perfumery (Shu *et al.*, 2011). According to Batugal *et al.* (2004), the boiled fruits of *A. arborea* have been traditionally used for the treatment of diarrhoea, reducing fever and emmenagogue or stimulating menstrual flow. However, the leaves of *A. ventricosa* and *A. javanica* have been reported to be poisonous (Burkill, 1966).

Biological activities

A thorough survey on biological activities of *Alphonsea* species revealed that not many studies and results were found. According to Horgen *et al.* (2001), the root extract of an unnamed *Alphonsea* species, was shown cytotoxic to brine shrimp at a concentration of 100µg/ml and known to be anti-cancer against various cancer cell lines such as human epidermoid carcinoma and murine lymphoid neoplasm cancer cell with $IC_{50} \leq 20\mu g/ml$. Besides that, the ethanolic extract of *A. sclerocarpa* showed significant free radical scavenging property by inhibiting the DPPH free radical. The ability of *A. sclerocarpa* bark extracts to inhibit the hydroxyl-free radical production has also been evaluated and was found to be very promising (Narendra, 2009). In addition, anti-fungal activity of *A. sclerocarpa* against *Aspergillus flavus*, fungal organism that usually associated with dandruff, showed moderate anti-fungal activity compared with local herbs shampoo (Indrani *et al.*, 2015). According to Johnson *et al.* (2013), methanol extract of Indonesian *A. javanica* also possessed anti-inflammatory activity while the methanol extract of *A. maingayii* leaves and stem had been studied for anti-trypanosomal with $IC_{50} > 12.5$ (Norhayati *et al.*, 2013).

Phytochemistry

There were only a few studies on chemical compounds present in genus *Alphonsea* have been reported (Figure 1). Previous phytochemical investigations carried out by Xie *et al.*, (1989, 1994) on the stem bark and bark of *A. mollis*, revealed isolation of 2,6-dimethoxy-5-hydroxy onychine (**1**), liriodenine (**2**), oxostephanine (**3**), mollisine (**4**), (2*R*,3*R*)-2,3-dihydro-2-(4-hydroxy-3-methoxyphenyl)-3-methyl-5-(E)-propenylbenzofuran (**5**) and conocarpan (**6**). In 1999, Yang and Xie reported azafluorenone alkaloid, 6, 7-dimethoxy-5-hydroxy onychine (**7**) and other alkaloid, liriodenine (**2**), cyathocaline (**8**), isooncodine (**9**) and darienine (**10**) from stem and branch of *A. monogyma*. Thang *et al.* (2013) reported glaucine (**11**) and nor-glaucine (**12**) were found from *A. ventricosa*. According to Tadić *et al.*, (1987), the isolation of chemical compounds from barks of *A. sclerocarpa* revealed the presence of liriodenine (**2**), anonaine (**13**), norushinsunine (**14**), ushinsunine (**15**), stepharine (**16**), stepholidine (**17**), candicine (**18**), phenethyltrimethylammonium (**19**) and magnoflorine (**20**). On the other hand, the leaves of *A. sclerocarpa* have been found to contain crotsparine (**21**), sparsiflorine (**22**), laurotetanine (**23**), isoboldine (**24**), liriodenine (**2**) and petaline methane (**25**). In addition, Jalil *et al.* (2015) also had reported three steroids isolated from Malaysian *A. curtisii*; stigmasta-4, 6, 22-trien-3-one (**26**), stigmast-22-ene-3,6-dione (**27**) and stigmast-22-ene-3-one (**28**).

The chemical constituents of the essential oil content identified in two species of *Alphonsea*, *A. philastreana* and *A. gaudichaudiana* were reported in which sesquiterpenes; bicyclogermacrene (**29**) (9.3%, 6.3%), guaiol (**30**) (9.0%, 5.2%), bicycloelemene (**31**) (8.9%, 6.3%), γ-eudesmol (**32**) (8.3%, 5.5%), β-caryophyllene (**33**) (5.1%, 5.9%) and monoterpene (E)-β-ocimene (**34**) (6.9%, 8.5%) were found in both species, respectively (Thang *et al.*, 2013). In *A. philastreana*, additional sesquiterpene, α-humulene (**35**) (5.8%) and monoterpene β-pinene (**36**) (4.6%) were reported, whilst sesquiterpeneviridiflorol (**37**) (6.0%) was found *A. gaudichaudiana*.

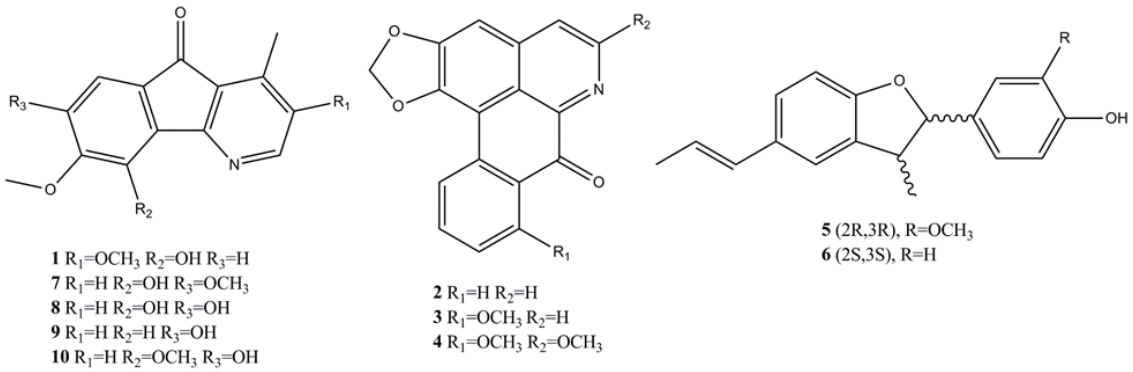

Figure 1

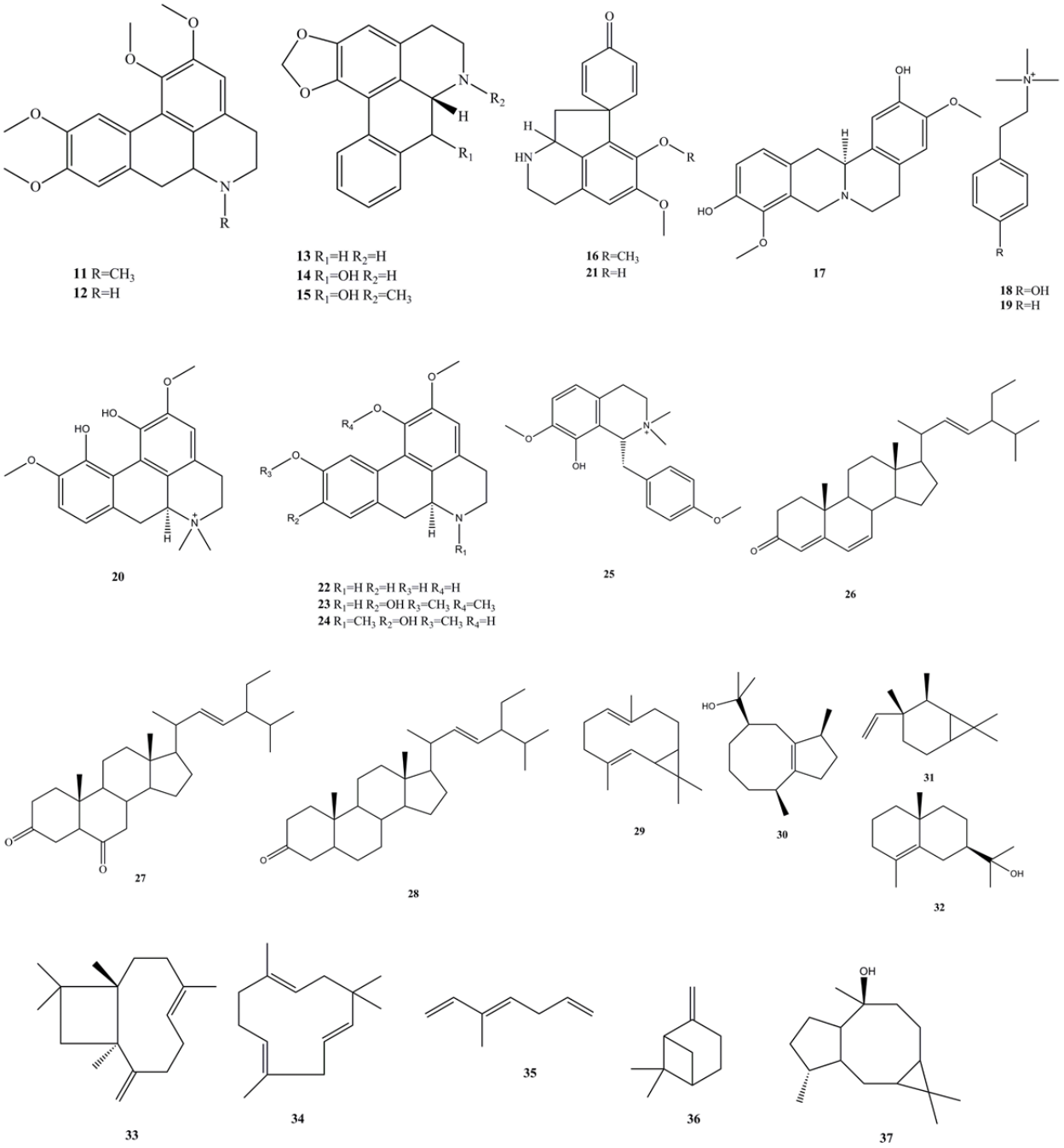

Fig. 1: Chemical compounds of *Alphonsea* sp.

CONCLUSION

Alphonsea sp. which were found from north-eastern India and southern China southwards to Ceylon and Malaysia were surveyed. Many pharmacological studies have been performed on crude extracts and these extracts exhibit anti-cancer, anti-oxidant, anti-fungal, anti-inflammatory and anti-trypanasomal activities. Phytochemical studies show that they contain alkaloids, steroids, lignan, sesquiterpenes and monoterpenes. The discovery of novel compounds from *Alphonsea sp*. is much rarer, as indicated by the fact that no publication have described isolation of novel compounds. In addition, many species of *Alphonsea* species remain to be investigated, therefore, further study should be conducted on these species especially on understanding their phytochemistry and biological activities.

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