Constituents of *Erythrina* - a Potential Source of Secondary Metabolites: A Review

Mohammad Musarraf Hussain¹, Md. Tariqul Haque Tuhin², Fahima Akter³ and Mohammad A. Rashid³

¹Department of Pharmacy, Jagannath University, Dhaka-1100, Bangladesh
²Department of Pharmacy, State University of Bangladesh, Dhaka-1205, Bangladesh
³Department of Pharmaceutical Chemistry, University of Dhaka, Dhaka-1000, Bangladesh

Received: February 09, 2016; Accepted: March 20, 2016; Published (Web): July 31, 2016

Abstract

The genus *Erythrina* is a potential source of chemical constituents, many of which medicinal properties. Although some reviews on chemical constituents of particular *Erythrina* species could be found, no detailed review covering the chemistry of different *Erythrina* species has been reported to the best of my knowledge. Therefore, the aim of this review was to compile the phytoconstituents reported from various species of *Erythrina*. A total of 155 secondary metabolites have been published from 15 species of *Erythrina*. Among them *E. subumbrans* and *E. variegata* consist of the highest number of chemical constituents.

Key words: *Erythrina*, Phytoconstituents, Alkaloids, Flavonoids, Pterocarps, Steroids, Triterpenes

Introduction

The genus *Erythrina* (Leguminosae) consists of 110 species of trees and shrubs. Among them, 15 different species have been thoroughly analyzed in this review. *E. addisoniae* is a wild tree, small to medium sized and contains good quantity of potassium salts in its fruits. *E. americana* is a 5 m tall tree and its branches are widely spread. *E. caribaea* and *E. indica* are medium sized tree, normally grow 6 - 9 m in height and its leaves are trifoliolate, bright-emerald green. *E. latissima* is 9 - 24 m in height with root and stem burnt (Wanjala et al., 2002). *E. melanacantha* has smaller leaves and shorter, standard calyx (Gillett, 1972). *E. mildbraedii* grows upto 30 m in height and is native in West Africa. *E. poeppigiana* is a roadside tree having 8 - 12 m height with orange colored flowers (Tanaka et al., 2003). *E. stricta* Roxb is a midsize tree with cracked cork bark having pale yellow prickle branches (Hussain et al., 2011). *E. subumbrans* is a deciduous, medium sized tree (5 - 25 m tall). Three leaflets are present in leaves at alternate arrangement and its bark is whitish. *E. variegata* is a first growing deciduous tree with 15-18 m tall and leaves are 6 inches long having spiny branches (Kumar et al., 2010). *E. vespertilio* is an ambiguous tree (common name: bean tree) and indigenous to North Australia. *E. velutina* is a leguminous tall tree that grows upto 10 m and indigenous to Brazil.

*E. zeberi* and *E. zeyheri* are deciduous subshrub trees growing upto 60 cm height having glabrous, trifoliolate leaves with large leaflets armed. The species of *Erythrina* have been used as traditional medicaments as sedative, antiasthmatic, antiepileptic, anticonvulsant, antipyretic, antiinflammation, antibacterial, insomnia, helminthiasis, cough, cuts and wounds (Kumar et al., 2010).

Although some reviews carrying chemical constituents of particular *Erythrina* species have been found, no detailed review was found on different *Erythrina* species. Thus, this paper will assist the researchers working on *Erythrina* species around the globe.

Phytoconstituents

A total of 15 species of *Erythrina* have been analyzed and 155 (1-155) molecules were reported in this review as phytoconstituents. The species are *E.*
addisoniae, E. caribaea, E. indica, E. lattisima, E. melanacantha, E. mildbraedii, E. poepiggiana, E. stricta, E. subumbrans, E. veriagata, E. vespertilio, E. velutina, E. zeberi, E. zeyheri and E. americana. Different chemical constituents such as – alkaloids, flavonoids, pterocarans, triterpenes and steroids were extracted from these compounds. Erythrina is a prominent source of alkaloid. A bunch of alkaloids are isolated from these fifteen species of Erythrina such as - Erysovine-N-oxide (1), Erysosalvinone (2), Erysodine (3), 1H-indole-3-propanamide (4), Glucoerysodine (5), Erysotrine (6), Erysovine (7), Erythraline (8), Erythramine (9), Erysopine (10), Erythrocarine (11), Erythrina (17), 10, 11-Dioxyerysotrine (34), Erysosalvine (41), Erymelanthine (43), Melanacanthine (43), 8-Oxa-a-erythroidine (54), 8-Oxo-a-erythroidine epoxide (61), 8-Oxo-a-erythroidine (62), 8-Oxoyerythrine epoxide (63), 11-Hydroxyepierythratidine (66), Erythrina (67), 11-Acetyl erysotrine (68), Erythradinone (69), 10,11-dioxo erythratidine (79), 10,11-dioxoepierythratidine (80), 10,11-erythradinone (81), Epierythratine (94), 11-Hydroxyerythratine (95), 11-Hydroxyepierythratine (96), Erythritol (99), Isococolinine (103), Erythradinone (106), Demethoxyerythradinone (107), Erythramine (108), Erysopine (109), Erysodienone (110), 11-Methoxyerythraline (141) and E-erythrostoin (142), Sodium erysovine 15-O-sulfate (143), Erysopine 15-O-sulfate (144), 16-O-β-D-Glucopyranosyl coccoline (145), Sodium eerysovine N-oxy-15-O-sulfate (146), 11-Oxerythraline (147), β-erythroidine (153), Dihydro-β-erythroidine (154) and Wilsonine (155) (Figure 1) (Amer et al., 1991; Boland et al., 1998; Cui et al., 2009; Faria et al., 2007; Garin-Aguilar et al., 2000; Haggins et al., 1981; Hauschild et al., 2010; Hussain, 2002; Jang et al, 2008; Kabenei et al., 2011; Kumar et al., 2010; Soto-Hernadez et al., 2012; Lundquist, 1973; Miyazawa et al, 2006; Nakayama et al, 1978; Ozawa et al., 2011; Rodriguez et al., 2004; Watjen et al., 2008; Rahman et al., 2007; Rahman et al., 2010; Rodriguez et al., 2004; Rukachaisirikul et al., 2007; Rukachaisirikul et al., 2008; Soto-Hernadez et al, 2012; Tanaka et al., 2001; Tanaka et al., 2003; Wanjala et al, 2002; Zheng et al., 2013; Zhou et al., 2011).
79: $R_2 = CH_2$, $R_3 = Beta-OH$, $H$
80: $R_2 = CH_2$, $R_3 = Beta-OH$, $H$
81: $R_2 = CH_2$, $R_3 = O$
Many falvonoids have been derived from these 15 species of *Erythrina* such as · Indicanine A (12), Indicanine B (13), Indicanine C (14), Indicanine D (15), Indicanine E (16), Wightone (18), Alpinumisoflavone (19), Dimethylalpinumisoflavone (20), Erythrinin C (21), Erysenegalensein E (22), Abyssinone IV (28), Erylatissin A (29), Erylatissin B (30), Erylatissin C (31), Erythrinin B (33), Neobavaisoflavone (37), Licoflavone-4'-O-methyl ether (44), 2',7-Dihydroxy-4'-methoxy-5'-(3-methylbut-2-enyl)isoflavone (45), (3R)-2',7-Dihydroxy-3'(3-methylbut-2-enyl)-2''', 2''''-dimethylpyrano [5'''.6''''.''.4.5] isoflavon (46), Abyssinin II (47), Parvisoflavone B (48), Erypoein G (50), Erysubin F (57), 5-Hydroxysophoranone (75), Abyssinone V (78), Lespedezaflavanone B (87), Glabrol (91), Vogelin C (93), Erythrinins A (100), 6-Hydroxygenistein (101), Eryvarin B (111), Eryvarin F (112), Eryvarin M (114), Eryvarin N (115), Eryvarin O (116), Scandenone (123), 5,7,4'-'trihydroxy-6,8-diprenylisoflavone (124), 4',5,7-Trihydroxy-8-prenylisoflavone (125), 4',5,7-Trihydroxy-8-methyloisoflavone (126), Isobavachin (128), 5,4'-Dihydroxy-8-(3,3-dimethylallyl)-2'''-methoxyisopropyl furano[4,5:6,7]isoflavone (132), 5,7,4'-Trihydroxy-6-(3,3-dimethallylalloxiranylmethyl) isoflavone (133), 5,4'-Dihydroxy-8-(3,3-dimethalyallyl)-2'''-hydroxy-methyl-2'''-methylpyran[5,6:6,7] isoflavone (134), 5,4'-Dihydroxy-2'-'methoxy-8-(3,3-dimethyl-allyl)- 2''',2''''-dimethylpyrano[5,6:6,7] isoflavone (135), Euchrenone b10 (136), Isoerysenegalensein E (137), Laburnetin (138), Lupiwightone (139), Eryzerin A (148), Eryzerin B (149), Eryzerin C (150), Eryzerin D (151) (Figure 2) (Boland et al., 1998; Chacha et al., 2005; Hussain et al., 2008; Hussain et al., 2011; Jang et al., 2008; Kobayashi et al., 1997; Koo et al., 2013; Kumar et al., 2010; Lundquist, 1973; Miyazawa et al., 2006; Nakayama et al., 1978; Nxengfack et al., 2001; Rahman et al., 2007; Rahman et al., 2010; Rodriguez et al., 2004; Rukachaisirikul et al., 2007; Rukachaisirikul et al., 2007; Sato et al., 2003; Soto-Hernandez et al., 2012; Talikepali et al., 1990; Tanaka et al., 2001; Tanaka et al., 2002; Tanaka et al., 2003; Tanaka et al., 2004; Tanaka et al., 2011; Tehkokouha et al., 2010; Waffo et al., 2000; Wanjala et al., 2002; Watjen et al., 2008; Xiaoli et al., 2006; Zheng et al., 2013; Zhou et al., 2011).

Figure 1. Alkaloids from different species of *Erythrina*. 
The plant belonging to the genus *Erythrina* contain a number of pterocarpans such as: Erybraedin A (32), 2-(5'-hydroxy-3-methoxyphenyl)-6-hydroxy-5-methoxybenzofuran (35), Isoneorautenol (38), Erymelanthine (42), Erypoegin F (49), Erypoegin H (51), Erypoegin I (52), Erypoegin J (53), Cristacaprin (55), Dimethylmedicaprin (56), Eryvarin D (58), Folitenol (59), Erystagallin C (64), Eryvarin A (65), Erystagallin A (76), Erycristagallin (77), 1-Methoxyerythrabissin (82), Erythrabissin-I (83), Erythrabissin-II (84), Erybraedin B (85), Hydroxycristacarpone (86), Phaseollin (89), Eryvarin E (90), Dihydrofolinin (97), Orientanol-B (104), Phaseollidin (127) and Eryzerins E (152) (Figure 3) (Amir et al., 2011; Boland et al., 1998;
Hauschild et al., 2010; Innok et al., 2010; Kabenei et al., 2011; Kobayashi et al., 1997; Lundquist, 1973; Miyazawa et al., 2006; Soto-Hernandez et al., 2012; Rahman et al., 2007; Rukachaisirikul et al., 2007; Rukachaisirikul et al., 2008; Tanaka et al., 1996; Tanaka et al., 2002; Tanaka et al., 2002; Zheng et al., 2013; Zhou et al., 2011).
Erythrina species contain some triterpenes and steroids. These are - Oleanolic acid (24), Erythrodiol (25), Stigmasterol (26), Sophoradiol (70), Stigmasta-4-en-3-one (71), Stigmasta-4,22-dien-3-one (72), 3β-hydroxystigmasta-5,22-dien-7-one (73), Melilotigenin C (74), Lupeol (88), Soyasapogenol B (92), Epilupeol (98) and 3β-28-dihydroxyolean-12-ene (102) (Figure 4) (Amir et al., 2011; Boland et al., 1998; Hauschild et al., 2010; Kobayashi et al., 1997; Lundquist, 1973; Miyazawa et al., 2006; Soto-Hernandez et al., 2012; Tanaka et al., 2002; Zheng et al., 2013; Zhou et al., 2011).
A good number of miscellaneous classes of compounds were also extracted from these fifteen species of *Erythrina*, including Erythrinassinate B (23), 5-O-β-D-xylo-pyranoside (27), Neorautenol (36),
Syringaresinol (39), Vanillic acid (40), Orientanol C (60), Octacosyl ferulate (105), Eryvarin G (113), Eryvarin P (117), Eryvarin Q (118), Eryvarin R (119), Eryvarin V (120), Eryvarin W (121), Eryvarin X (122), Eryvaiestyrene (129), Eryvarinol A (130), Eryvarinol B (131), Eryvarin H (140) (Figure 5) (Amir et al., 2011; Boland et al., 1998; Koo et al., 2013; Lundquist, 1973; Miyazawa et al., 2006; Rahman et al., 2007; Soto-Hernandez et al., 2012; Zheng et al., 2013; Zhou et al., 2011).
Conclusion

The chemical compounds from 15 species of *Erythrina* have been reviewed. Structurally unique along with many diversified compounds have been observed from this genus. Our study revealed that *Erythrina* can be a prominent source of phytoconstituents as well as medicinal agents, and therefore other species of this genus need to be investigated for secondary metabolites.
References


