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GENUS *SORBUS* L.: A PHYTOCHEMICAL REVIEW

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ABSTRACT

The current review is focused on the phytochemical and pharmacological aspects of the genus *Sorbus*. Its numerous species have been utilized as a traditional medicine in the world. Despite, the therapeutic importance of genus *Sorbus*, out of 100 species only 13 species have been screened phytochemically. Up till now, around 150 secondary metabolites have been reported from this genus, which are summarized in this review.

Keywords: Rosaceae, *Sorbus*, phytochemical, pharmacological potential.

INTRODUCTION

The *Sorbus* L. is a genus from the Rose family (Rosaceae). *Sorbus* comprises of 100 species among which many are medicinally important and are being used in the folklore medications all over the world (Bhattacharjee, 2003). Several taxa from *Sorbus* are found in customary and local medicines that are used as anti-diarrhea, diuretic, anti-inflammatory, anti-diabetic, vaso- protective, broncho- and vaso-relaxant, along with potent antioxidative qualities (Hukkanen *et al*., 2006, Olszewska and Michel, 2009, Olszewska *et al*., 2010, Olszewska, 2012; Perry and Metzger, 1980; Krishna, 1972; Jayaweera, 1982; Krachmal, 1980.

The fruit of *S. aucuparia* L. is bitter in nature and having characteristics of, astringent, laxative, diuretic and cholagogue. Traditionally these are used as drugs in the form of tea, syrup, jelly or liqueur in Austria for the treatment of ailments related to respiratory tract, fever, infections, colds, flu, rheumatism and gout. The bark of *S. aucuparia* L. is used as astringent for the treatment of diarrhea and leucorrhoea as a vaginal injection. Its infusion is also used for the cure of constipation, kidney disorders and painful menstruation (Gillham, 1980; McAllister, 1996; Sperens, 1997; Vogl *et al*., 2013).

S. commixta Hedl is used as medication for asthma, cough, and other bronchial disorders. The plant exhibits promising antioxidative, anti-inflammatory, anti-atherosclerotic, anti-athero genic and vascular relaxant effects. It decreases hepatic lipid peroxidation by lowering the bioavailability of alcohol and its oxidative metabolites by the protection of hepatic catalase (Gabsik and Hyo-Jin, 2014). Ethnomedicinal uses of *S. amurens* varies with the plant parts such as its bark is Koehne and is used to cure nausea, cough, cleansing of blood and heart diseases whereas the fruits are used to treat severe wounds, stroke, and heart disease, gall bladder irritation and digestive disturbance (Bhattacharjee, 2003). The infusion of the leaves to some extent is laxative and used as pectoral in cough and bronchitis (Krachmal, 1980). Uses of *S. decora* C.K. Schneid is associated with the diabetes mellitus (Guerro-Analco *et al*., 2010). The bark of *S. cashmiriana* Hedlung, (Monog tree) is considered to be helpful in controlling nausea and its fruit is used to cure scurvy and a rich source of vitamin C (Kazmi *et al*., 2009). Traditionally, the fruits of *S. domestica L*. have antioxidant properties, and used as a remedy against long term diabetic complications.

Most of the Sorbus species depicts antioxidant behavior due to the presence of phenolic constituents, which are mainly phenolic acid, esters with quinic acid, flavonols (quercetin, kaempferol and sexangularetin), anthocyanincs (cyaniding and pelargonidin derivatives) and tannin-type proanthocyanidins (Hukkanen *et al*., 2006, Termentzi *et al*., 2006, Olszewskaand Michel, 2009, Olszewska, 2012). Presence of phenolic compounds in the fruits of *S. domestica* causes aldose reductase inhibitory activity which reduces diabetic complications (Termentzi *et al*., 2008). In Xinjiang, *S. tianschanica Rupr* has been used as a pharmacologically important plant for the treatment of tuberculosis, asthma, cough and gastritis for a long time (Yu *et al*., 2012). Various parts of the *S. pohuashanensis Hance* such as fruits, stems and bark have been extensively used in Chinese ethno- medicine for the treatment of edema, tuberculosis and chronic tracheitis (Huiyong *et al*., 2012). Genus Sorbus L. contains Caffeoylquininc acid possess cardio protective, neuro protective, antidiabetic and hepatoprotective effects (Zymone *et al*., 2018).

Secondary Metabolites

From 13 species of the genus *Sorbus*, 180 secondary metabolites have been report up till now. These compounds are presented in Table1.

Table 1. Summarized account of various secondary metabolites reported from *Sorbus* species up to Dec 2018.

Species	**Compounds**	**References**
S. aucuparia	Sorbikortal I	Lawrie *et al*. (1960)
	Sorbikortal II	Lawrie *et al*. (1960)
	β-Xyloside	Arya *et al*. (1962)
	S-Parasorbic acid	Wilhelm (1963)
	Isoquercitrin	Borisov and Zhuravl'ov (1965)
	Spireoside	Borisov and Zhuravl'ov (1965)
	Ursolic acid	Shavva *et al*., (1969)
	Sexangularetin 3-glucoside	Jerzmanowska and Kamecki (1973)
	Sorbic acid	Pyysalo and Kuusi (1974)
	Dihydrosinapic aldehyde	Malterud and Opheim (1989)
	Aucuparin	Kokubun *et al*. (1995)
	2'-Methoxyaucuparin	Kokubun *et al*. (1995)
	4'-Methoxyaucuparin	Kokubun *et al*. (1995)
	2'-Hydroxyaucuparin	Kokubun *et al*. (1995)
	Isoaucuparin	Kokubun *et al*. (1995)
	L-Iditol	Izumori (2006)
	Caproicacid	Krivoruchko *et al*. (2013)
	3-Hexenoicacid	Krivoruchko *et al*. (2013)
	Caprylicacid	Krivoruchko *et al*. (2013)
	Oxalic acid	Krivoruchko *et al*. (2013)
	Pelargonic acid	Lawrie *et al*. (1960)
	Malonic acid	Lawrie *et al*. (1960)
	Fumaric acid	Arya *et al*. (1962)
	Succinic acid	Wilhelm (1963)
	Capric acid	Borisov and Zhuravl'ov (1965)
	Benzoic acid	Borisov and Zhuravl'ov (1965)
	Methoxysuccinic acid	Shavva *et al*. (1969)
	Phenylacetic acid	Jerzmanowska and Kamecki (1973)
	Salicylic acid	Pyysalo and Kuusi (1974)
	Lauric acid	Malterud and Opheim (1989)
	Myristic acid	Kokubun *et al*. (1995)
	Pentadecanoicacid	Kokubun *et al*. (1995)
	Azelaicacid	Kokubun *et al*. (1995)
	Palmiticacid	Kokubun *et al*. (1995)
	Palmitoleicacid	Kokubun *et al*. (1995)
	Margaricacid	Izumori (2006)
	Citricacid	Krivoruchko *et al*. (2013)
	Stearic acid	Krivoruchko *et al*. (2013)
	Oleic acid	Krivoruchko *et al*. (2013)
	Vaccenic acid	Krivoruchko *et al*. (2013)
	Linoleic acid	Krivoruchko *et al*. (2013)
	Linolenic acid	Krivoruchko *et al*. (2013)
	Arachic acid	Krivoruchko *et al*. (2013)
	11-Eicosenic acid	Krivoruchko *et al*. (2013)
	11,13-Eicosadienoic acid	Krivoruchko *et al*. (2013)
	Heneicosanoic acid	Krivoruchko *et al*. (2013)
	Behenic acid	Krivoruchko *et al*. (2013)
	Erucic acid	Krivoruchko *et al*. (2013)
	Lignocerinic acid	Krivoruchko *et al*. (2013)
	Ferulic acid	Krivoruchko *et al*. (2013)
	Kerotinic acid	Krivoruchko *et al*. (2013)

(Continued)

Table 1.*(Continued)*.

Species	Compounds	References
S. aria	Ursolic acid	Rolland and Raynaud (1979)
	Oleanolic acid	Rolland and Raynaud (1979)
	Quercetin acid	Rolland and Raynaud (1979)
	Cyanidin acid	Rolland and Raynaud (1979)
	Leucocyanidin	Rolland and Raynaud (1979)
	Isorhamnetin3-*O*-β-D-glucopyrano- side	Olszewska and Michel (2012)
	Astragalin	Olszewska and Michel (2012)
	Isoquercitrin	Olszewska and Michel (2012)
	Hyperoside	Olszewska and Michel (2012)
	Kaempferol 3-*O*-β-D-glucopyranos-ide-7-*O*-α-rhamnopyranoside	Olszewska and Michel (2012)
	Quercetin 3-*O*-β-D-glucopyranoside-7-*O*-α-rhamnopyranoside	Olszewska and Michel (2012)
	Rutin	Olszewska and Michel (2012)
	Chlorogenic acid	Olszewska and Michel (2012)
	Neochlorogenic acid	Olszewska and Michel (2012)
	Caproic acid	Krivoruchko *et al*. (2013)
	3-Hexenoic acid	Krivoruchko *et al*. (2013)
	2-Hexenoic acid	Krivoruchko *et al*. (2013)
	Oxalic acid	Krivoruchko *et al*. (2013)
	Malonic acid	Krivoruchko *et al*. (2013)
	Fumaric acid	Krivoruchko *et al*. (2013)
	Succinic acid	Krivoruchko *et al*. (2013)
	Benzoic acid	Krivoruchko *et al*. (2013)
	Lauric acid	Krivoruchko *et al*. (2013)
	Myristic acid	Krivoruchko *et al*. (2013)
	Pentadecanoic acid	Krivoruchko *et al*. (2013)
	Azelaic acid	Krivoruchko *et al*. (2013)
	Palmitic acid	Krivoruchko *et al*. (2013)
	Palmitoleic acid	Krivoruchko *et al*. (2013)
	Margaric acid	Krivoruchko *et al*. (2013)
	Citric acid	Krivoruchko *et al*. (2013)
	Stearic acid	Krivoruchko *et al*. (2013)
	Oleic acid	Krivoruchko *et al*. (2013)
	Linoleic acid	Krivoruchko *et al*. (2013)
	Linolenic acid	Krivoruchko *et al*. (2013)
	Arachic acid	Krivoruchko *et al*. (2013)
	Behenic acid	Krivoruchko *et al*. (2013)
	Lignocerinic acid	Krivoruchko *et al*. (2013)
	Ferulic acid	Krivoruchko *et al*. (2013)
S. cashmiriana	Sorbinol A	Kazmi *et al*. (2007)
	Sorbinol B	Kazmi *et al*. (2007)
	Cashmirol A	Kazmi *et al*. (2007)
	Cashmirol B	Kazmi *et al*. (2007)
	Sorbicin A	Kazmi *et al*. (2007)
	Sorbicin B	Kazmi *et al*. (2007)
	Sorbusin	Rizvi *et al*. (2013)
	Lyonoside	Rizvi *et al*. (2013)
	β-Sitosterol	Rizvi *et al*. (2013)
	Benzyl- β-D-glucoside	Rizvi *et al*. (2013)
	Methyl- β-D-glucoside	Rizvi *et al*. (2013)
	2(R)-Prunasin	Rizvi *et al*. (2013)
	(2R/2S)-Prunasin	Rizvi *et al*. (2013)

(Continued)

Table 1.*(Continued)*.

Species	Compounds	References
	Betulin	Rizvi *et al*. (2013)
	Anemosapogenin	Rizvi *et al*. (2013)
	Ursolic acid	Rizvi *et al*. (2013)
	Rutin	Rizvi *et al*. (2013)
	Isoquercitrin	Rizvi *et al*. (2013)
	Ursolic acid	Khan *et al*. (2013)
	Stigmasterol	Khan *et al*. (2013)
	Myricadiol	Khan *et al*. (2013)
	Taraxerol	Khan *et al*. (2013)
	Butanolic acid	Khan *et al*. (2013)
	Betulinic acid	Khan *et al*. (2013)
	5α, 8α-Epidioxyergosta-6, 22-diene-3β-ol	Khan *et al*. (2013)
	3β, 5α-Dihydroxy-6-β-methoxy- ergosta-7, 22-diene	Khan *et al*. (2013)
	β-Sitosteryl acetate	Khan *et al*. (2013)
	5α, 8α-Epidioxyergosta-6, 9 (11),22-trien-3β-ol	Rizvi *et al*. (2013)
	Stigmasterol 3-*O*-β-D-glucopyrano- side	Rizvi *et al*. (2013)
	Cashmin A	Khan *et al*. (2015)
	Cashmin B	Khan *et al*. (2015)
S. commixta	Sorbic acid	Asahina and Shinoda (1930)
	Sorbitol (II)	Asahina and Shinoda (1930)
	Prunasin	Takaishi and Kuwajima (1976)
	Amygdalin	Takaishi and Kuwajima (1976)
	Luteolin 7-glucoside	Bylka *et al*. (1977)
	Quercetin 3-glucoside	Bylka *et al*. (1977)
	Quercetin 3-glucoxyloside	Bylka *et al*. (1977)
	Quercetin	Bylka *et al*. (1977)
	Catechin 7-apioside	Na *et al*. (2002)
	Catechin 7-xyloside	Na *et al*. (2002)
	Lupenone	Na *et al*. (2009)
	Lupeol	Na *et al*. (2009)
	Chalcone glycoside	Bhatt *et al*. (2009)
	β-sitosteryl-3-*O*-β-D-glucopyrano- side	Gabsik and Hyo-Jin (2014)
	1,2,4-trimethoxydibenzofuran-3,9-diol	Choi *et al.* (2018)
	Sorcomisides A	Kim *et al.* (2018)
	Sorcomisides B	Kim *et al.* (2018)
S. cortex	Lupenone	Lee and Lee (1999)
	Lupeol	Lee and Lee (1999)
S. decora	Aucuparin	Kokubun *et al*. (1995)
	2′-Methoxyaucuparin	Kokubun *et al*. (1995)
	3β, 23, 28-Trihydroxy-12-ursene	Guerro-Analco *et al*. (2010)
	23, 28-Dihydroxyursan-12-ene-3β-caffeate	Guerro-Analco *et al*. (2010)
	23, 28-Dihydroxylupan-20(29)-ene-3β-caffeate	Guerro-Analco *et al*. (2010)
	23-Hydroxybetulin	Guerro-Analco *et al*. (2010)
	Uvaol	Guerro-Analco *et al*. (2010)
	Betulin	Guerro-Analco *et al*. (2010)
	α-Amyrin	Guerro-Analco *et al*. (2010)
	Betulinic acid	Guerro-Analco *et al*. (2010)
	(+)-Catechin	Guerro-Analco *et al*. (2010)
	(-)-Epicatechin	Guerro-Analco *et al*. (2010)
S. domestica	Vannilic acid 4-*O*-α-L-rhamnopyra- noside	Termentzi *et al*. (2009)
	Protocateuic acid anhydride	Termentzi *et al*. (2009)

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Table 1.*(Continued)*.

Species	**Compounds**	**References**
	Trivanilloyl-(1,3,4-trihydroxybenzol) ester	Termentzi *et al*. (2009)
	Quercetin 3-*O*-β-D-glucopyranosyl (1'''→2'')-α-L-rhamnosyl	Termentzi *et al*. (2009)
	3-{4-(Bis[4-hydroxy-3-(5-hydroxy-pentanoyloxy)phenyl)-methoxy]-3,5-dihydroxyphenyl}propanoic acid	Termentzi *et al*. (2009)
	(1'''→3'')-α-L-rhamnosyl(1''''→3''')-α-L-arabinofuranoside	Termentzi *et al*. (2009)
	Quercetin 3-*O*-α-L-rhamnosyl- (1'''→3'')-β-D-glucopyranoside	Termentzi *et al*. (2009)
	5,7,3',6'-tetrahydroxyflavanol 7-*O*-β-D-glucopyranoside	Termentzi *et al*. (2009)
	(7-*O*-4''',4'-*O*-7'') Quercetin dimer	Termentzi *et al*. (2009)
	[2,2'-dihydroxy, 4-(propionic acid hexyl ester), 4'-(propionic acid heptyl ester)] biphenyl	Termentzi *et al*. (2009)
	[2,6,2',6'-tetrahydroxy,4,4'-bis-(propionic acid hexyl ester)] biphenyl	Termentzi *et al*. (2009)
S. lanata	β-Pyrufuran	Yousuf *et al*. (2010)
	1,2,4-Trimethoxydibenzo[*b*,*d*]furan-3-ol	Yousuf *et al*. (2010)
	Sorlanin	Uddin *et al*. (2013)
	Sorbanin	Uddin *et al*. (2013)
	Sorbalanin	Uddin *et al*. (2013)
	Polystachyol	Uddin *et al*. (2013)
	Isolariciresinol	Uddin *et al*. (2013)
	Dihydrodehydrodiconiferyl alcohol	Uddin *et al*. (2013)
	Tuberculation	Uddin *et al*. (2013)
	Ovafolinin E	Uddin *et al*. (2013)
	Aucuparin	Uddin *et al*. (2013)
	2'-Methoxyaucuparin	Uddin *et al*. (2013)
	Tetracosyl-3-(3,4-dihydroxyphenyl)- acrylate	Uddin *et al*. (2013)
	SorbanolicAcid	Latif *et al*. (2014)
	3β,23-Dihydroxy-lup-20(29)ene-28-oic acid-23-caffeate	Latif *et al*. (2014)
	3β,23-Dihydroxy-lup-20(29)ene-28-oic acid-3β-caffeate	Latif *et al*. (2014)
	Lyoniside	Latif *et al*. (2014)
S. pendula	Quercetin	Pavlii *et al*. (1966)
	Galactose	Pavlii *et al*. (1966)
	Hyperoside	Pavlii *et al*. (1966)
	Sorboside	Makarova (1967)
	Kaempferol 3-gentiobioside	Wagner *et al*. (1968)
	Quercetin 3-gentiobioside	Wagner *et al*. (1968)
S. pohuashanensis	Stigma-5-en-3-*O*-β-glucoside	Huiyong *et al*. (2012)
	Quercetin	Huiyong *et al*. (2012)
	Rutin	Huiyong *et al*. (2012)
	1-Caffeoylquinic acid	Huiyong *et al*. (2012)
	Phenylmethanol α-L-arabinofuran- osyl-(1/6)-β-D-glucopyranoside	Huiyong *et al*. (2012)

(Continued)

Table 1.*(Continued)*.

Species	Compounds	References
	Prunasin	Huiyong *et al*. (2012)
	Amygdalin	Huiyong *et al*. (2012)
	Butanedioic acid	Huiyong *et al*. (2012)
	(3S,5S)-3-(β-D-glucopyranosyloxy)-5-hydroxyhexonic acid ethyl ester	Huiyong *et al*. (2012)
	Parasorboside	Huiyong *et al*. (2012)
	1-Glyceryl linolate	Huiyong *et al*. (2012)
	3S,5S)-3-(β-D-glucopyranosyloxy)-5-hydroxyhexonic acid ethyl ester	Huiyong *et al*. (2012)
	Parasorboside	Huiyong *et al*. (2012)
	1-Glyceryl linolate	Huiyong *et al*. (2012)
	Pomolic acid	Li *et al*. (2014)
	Pomolic acid-3β-acetate	Li *et al*. (2014)
	3β-Acetoxy-urs-12-ene-28-oic acid	Li *et al*. (2014)
	Ursolaldehyde	Li *et al*. (2014)
	Euscaphic acid	Li *et al*. (2014)
	3β-Acetoxy-urs-11-en-28,13-olide	Li *et al*. (2014)
	Betulinic acid	Li *et al*. 92014)
S. quercifolia	Quercetin 3-gentiobioside	Wagner *et al*. (1968)
	Quercetin 3-β-gentiobioside	Pavlii and Makarova (1970)
	Quercetin 3-β-D-galactopyranoside	Pavlii and Makarova (1970)
	Quin 3-rutinoside	Pavlii and Makarova (1970)
	Apigenin 7-glucoside	Pavlii and Makarova (1970)
	Caffeic acid	Pavlii and Makarova (1970)
	Chlorogenic acid	Pavlii and Makarova (1970)
	Rutin	Pavlii and Makarova (1970)
	Hyperin	Pavlii and Makarova (1970)
	Chlorogenic acid	Pavlii and Makarova (1970)
	Caffeic acid	Pavlii and Makarova (1970)
	Neochlorogenic acid	Pavlii and Makarova (1970)
S. tianschanica	Quirzutrin	Zapesochnaya *et al*. (1973)
	Chlorogenic acid	Zapesochnaya *et al*. (1973)
	Benzoic acid	Chang *et al*. (2009)
	Benzyl-*O*-β-D-glucopyranoside	Chang *et al*. (2009)
	Ursolic acid	Chang *et al*. (2009)
	2α-Hydroxyursolic acid	Chang *et al*. (2009)
	Hyperoside	Chang *et al*. (2009)
	Quercetin-3-*O*-glucoside	Chang *et al*. (2009)
	Chlorogenic acid	Yu *et al.* (2012)
	Quercetin-3-*O*-(6"-*O*-malonyl)-β-D-glucoside	Yu *et al.* (2012)
	Kaempferol-3-*O*-(6"-*O*-malonyl)-β-D-glucopyranoside	Yu *et al.* (2012)
	Kaempferol-3-*O*-β-D-glucopyranoside	Yu *et al.* (2012)
S. torminalis	Ursolic acid	Ivanovskaya *et al*. (1963)
	Cholesterol	Tsitsa-Tzardi *et al*. (1991)
	Campesterol	Tsitsa-Tzardi *et al*. (1991)
	Stigmasterol	Tsitsa-Tzardi *et al*. (1991)
	Sitosterol	Tsitsa-Tzardi *et al*. (1991)
	Myristic acid	Tsitsa-Tzardi *et al*. (1991)
	Palmitic acid	Tsitsa-Tzardi *et al*. (1991)
	Palmitoleic acid	Tsitsa-Tzardi *et al*. (1991)
	Stearic acid	Tsitsa-Tzardi *et al*. (1991)

(Continued)

Table 1.*(Continued)*.

Species	Compounds	References
	Oleic acid	Tsitsa-Tzardi *et al*. (1991)
	Linoleic acid	Tsitsa-Tzardi *et al*. (1991)
	Linolenic acid	Tsitsa-Tzardi *et al*. (1991)
	p-Coumaric acid	Tsitsa-Tzardi *et al*. (1992)
	Caffeic acid	Tsitsa-Tzardi *et al*. (1992)
	Quercetin	Tsitsa-Tzardi *et al*. (1992)
	Chlorogenic acid	Tsitsa-Tzardi *et al*. (1992)
	Luteolin-7-*O*-glycoside	Tsitsa-Tzardi *et al*. (1992)
	Apigenin-7-*O*-glycoside	Tsitsa-Tzardi *et al*. (1992)
	Torminaloside	Olszewska and Roj (2011)
	Hyperoside	Olszewska and Roj (2011)
	Isoquercitrin	Olszewska and Roj (2011)
	Chlorogenic acid	Olszewska and Roj (2011)
	Neochlorogenic acid	Olszewska and Roj (2011)
	5,7,4'-Trihydroxy-3'-methoxyflavone-7-*O*-β-D-glucopyranoside	Olszewska and Roj (2011)
	3,5,7,4'-Tetrahydroxy-8,3'-dimethoxy- flavone-3-*O*-β-D-glucopyranoside	Olszewska and Roj (2011)
	3,5,7,4'-Tetrahydroxy-8-methoxy- flavone-3-*O*-β-D-glucopyranoside	Olszewska and Roj (2011)
	3,5,7,4'-Tetrahydroxy-3'-methoxy- flavone-3-*O*-β-D-galactopyranoside	Olszewska and Roj (2011)
	3,5,7,4'-Tetrahydroxy-3′-methoxy- flavone-3-*O*-β-D-glucopyranoside	Olszewska and Roj (2011)

Pharmacological studies

Studies on the sapwood tissue of *S. aucuparia* depicted that aucuparin and its derivatives are basically not present in the healthy tissues, and are only formed as phytoalexins after the fungal infection (Kokubun *et al*., 1995). A significant antidiabetic activity has been elucidated by 23, 28-Dihydroxylupan-20(29)-ene-3β-caffeate which was isolated from *S. decora* (Guerro-Analco *et al*., 2010). The lupene type triterpenes sorbicins A and B extracted from *S. cashmiriana* illustrated strong inhibitory activity against the enzymes urease and α-chymotrypsin (Kazmi *et al*., 2011). The triterpenes Cashmirols A and B are isolated from *S. cashmiriana,* are lanostane type which displayed characteristics of inhibitory potential enzyme, lipoxygenase (Kazmi *et al*., 2009). The phenolic secondary metabolites namely tuberculatin, dihydrodehydrodiconiferyl alcohol, 20-methoxyaucuparin and tetracosyl-3-(3,4-dihydroxyphenyl) acrylate, isolated from *S. lanata (D. Don.) Schauer* have expressed radical scavenging activity through DPPH assay (Uddin *et al*., 2013). Significant antioxidant properties were also observed in Sorbanolic acid along with three known compounds 3β, 23-dihydroxy-lup-20(29)ene-28-oic acid-23-caffeate, 3β, 23-dihydroxy-lup-20(29)ene-28-oic acid-3β-caffeateandlyoniside attained from *S. lanata* (Latif *et al*., 2014). Two more triterpenes, lupenone and lupeol extracted from *S. commixta* exhibited inhibition of protein tyrosine phosphatase 1B (PTP1B) (Na *et al*., 2009). Likewise, β-sitosteryl-3-*O*-β-glucopyranoside also obtained from *S. commixta* possess anti-inflammatory activity (Gabsik and Hyo-Jin, 2014). Moreover, following compounds isolated from *S. aria* (L.) Crantz have also shown strong free radical-scavenging activity; isoquercitrin, quercetin 3-*O*-β-glucopyranoside-7-*O*-α-rhamnopyranoside, rutin, chlorogenic acid and neochlorogenic acid (Olszewska and Michel, 2012).

CONCLUSIONS

Hence it is concluded from the foregoing brief that genus *Sorbus* has tremendous phytochemical and pharmacological value. Nevertheless, still numerous species have not been analyzed in respect to systematic phytochemical screening.

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