

Supporting Information

Bee products: an emblematic example of underutilized sources of bioactive compounds

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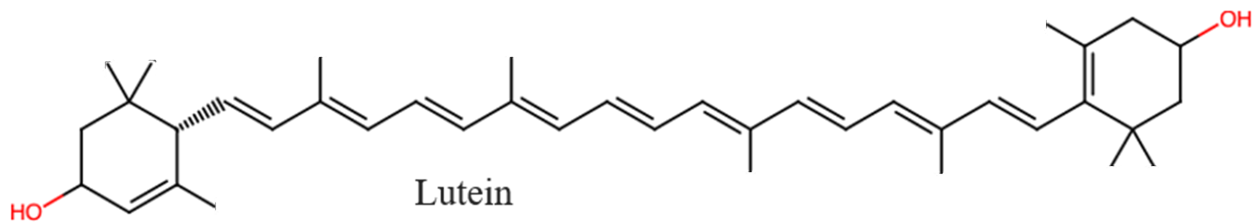
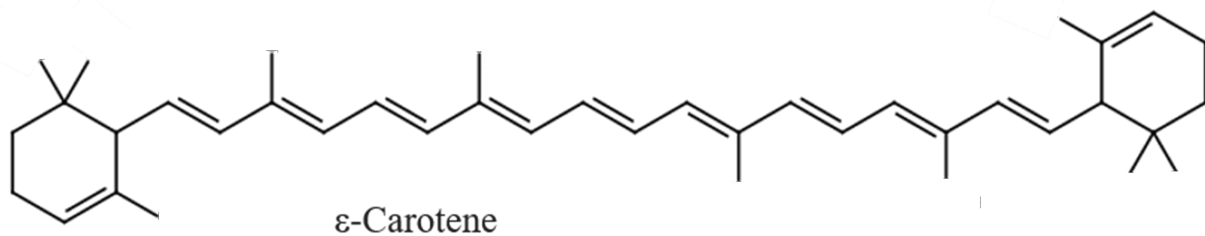
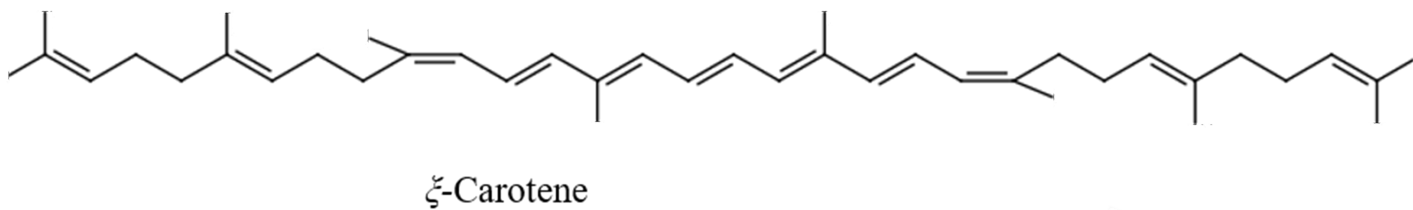
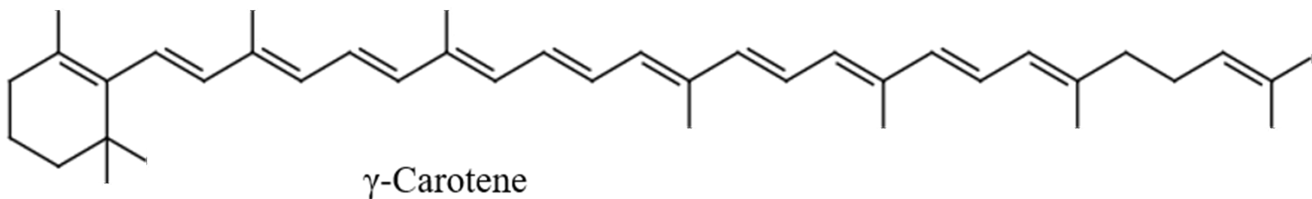
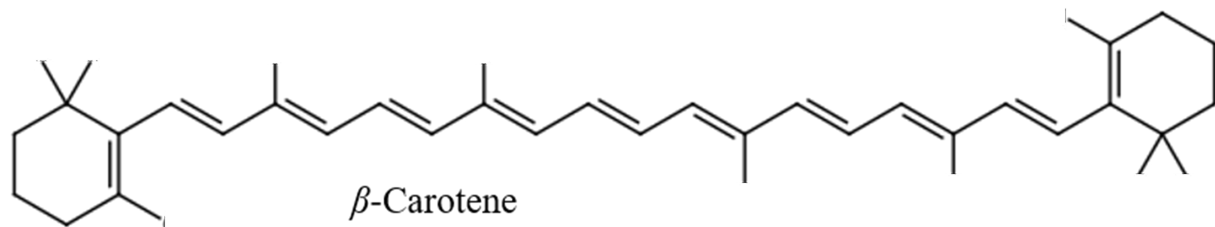
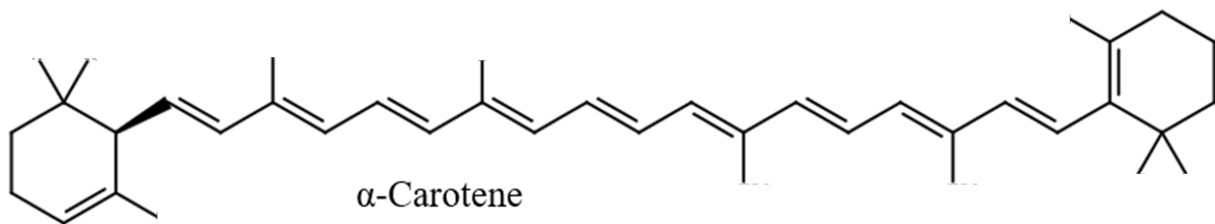


Table S1. Main (poly)phenols and other relevant compounds described in bee pollen from different botanical and geographical origins. ^{9–12}

Chemical Family	Compounds identified
Phenolic acids and derivatives	Caffeic acid, <i>o</i> -, <i>p</i> -coumaric acid, ferulic acid, gallic acid, syringic acid, chlorogenic acid, vanillic acid, coumaroyl quinic acid, protocatechuic acid, tertcinnamic acid, rosmarinic acid, 5- <i>O</i> -caffeoylquinic acid, β -resorcylic acid, synaptic acid, cinnamic acid, tri-caffeoyl- and caffeoyl-di- <i>p</i> -coumaroyl spermidine derivatives, isopimpinellin, hydroxycaffeic acid, benzoic acid, 4- hydroxybenzoic acid, trihydroxycinnamic acid, 3,4-dimethoxycinnamic acid, 2-hydroxycinnamic acid, protocatechuic acid, abscisic acid, trans-cinnamic acid, 3-hydroxytyrosol, isoferulic acid, methoxy-cinnamic acid, tri- <i>p</i> -coumaroyl spermidine, tri- <i>p</i> -coumaroyl spermidine (isomer), 1-sinapoyl-2-feruloyl gentiobiose, 5- <i>O</i> -caffeoylquinic acid, hydroxycinnamic acid amide derivatives
Flavonoids and derivatives	Quercetin, isoquercetin, tricetin, kaempferol myricetin, luteolin, naringenin, selagin, isorhamnetin, epicatechin, hesperetin, rutin, catechin, ampelopsin, eriodictyol, taxifolin, acacetin, genkwanin, apigenin, 3- <i>O</i> -methylquercetin, quercetin diglucoside, quercetin-3- <i>O</i> -arabinoside, quercetin-3- <i>O</i> -rutinoside, quercetin-3- <i>O</i> -galactoside, quercetin-3- <i>O</i> -rhamnoside, quercetin rutinoside (isomer), quercetin-3-methyl ether, quercetin- <i>O</i> -dihexoside, bis-methylated quercetin, dihydroquercetin-3- <i>O</i> -rhamnoside, quercetin- <i>O</i> -hexosyl-pentoside, quercetin- <i>O</i> -rutinoside isomer 1, quercetin- <i>O</i> -rutinoside isomer 2, quercetin- <i>O</i> -(malonyl)-rutinoside, dihydroquercetin, quercetin-3- <i>O</i> -xylosyl-glucuronide, quercetin-3- <i>O</i> -sophoroside, quercetin- <i>O</i> -(malonyl)hexoside, quercetin- <i>O</i> -rhamnoside, quercetin- <i>O</i> -acetyl hydroxybenzoyl protocatechuic acid isomer 1, quercetin 3- <i>O</i> -galactoside-7- <i>O</i> -rhamnoside, quercetin-3- <i>O</i> -rhamnosyl-galactoside, quercetin- <i>O</i> -acetyl hydroxybenzoyl hydrobenzoic acid isomer 1, quercetin- <i>O</i> -acetyl hydroxybenzoyl hydrobenzoic acid isomer 2, 3,7-dimethylquercetin, quercetin-3- <i>O</i> - β -D-glucosyl-(2 \rightarrow 1)- β -glucoside, isorhamnetin- <i>O</i> -rutinoside, isorhamnetin- <i>O</i> -dihexoside, isorhamnetin-3- <i>O</i> -methyl hexuronide, isorhamnetin-3- <i>O</i> -rhamnosyl-glucoside, isorhamnetin-3- <i>O</i> -rhamnosyl-glucoside (isomer), isorhamnetin-3- <i>O</i> -diglucoside, isorhamnetin-3- <i>O</i> -rutinoside-7- <i>O</i> -glucoside, isorhamnetin-3- <i>O</i> -glucoside, isorhamnetin- <i>O</i> -(malonyl)hexoside isomer 1, isorhamnetin- <i>O</i> -(malonyl)hexoside isomer 2, myricetin- <i>O</i> -(malonyl)-hexoside, myricetin- <i>O</i> -rutinoside, myricetin- <i>O</i> -hexoside, myricetin-3- <i>O</i> -glucoside, myricetin- <i>O</i> -(malonyl)-rutinoside, hydroxybenzoyl myricetin, myricetin- <i>O</i> -dihydroferuloyl, myricetin- <i>O</i> -acetyl hydroxybenzoyl protocatechuic acid-isomer 1, myricetin- <i>O</i> -acetyl hydroxybenzoyl protocatechuic acid isomer 2, myricetin- <i>O</i> -acetyl hydroxybenzoyl hydrobenzoic acid isomer 2, kaempferol-3- <i>O</i> -rhamnosyl-glucoside, kaempferol 3- <i>O</i> -sophoroside, kaempferol-3- <i>O</i> -glucoside, kaempferol-3- <i>O</i> -acetulglucoside, kaempferol 3- <i>O</i> -glucuronide, kaempferol-3- <i>O</i> -(4''-rhamnosyl)-neohesperidoside, kaempferol-3,4'-di- <i>O</i> - β -D-glucoside, kaempferol-3- <i>O</i> - β -D-glucosyl-(2 \rightarrow 1)- β -D-glucoside, naringin-6'-malonate, naringin-4'- <i>O</i> -glucoside, naringenin-7- <i>O</i> -glucoside, naringenin hexoxide, luteolin-7- <i>O</i> -glucuronide, luteolin- <i>O</i> -dihexoside, luteolin- <i>O</i> -(malonyl)-hexoside, luteolin-di- <i>O</i> -hexosyl-rhamnoside, luteolin- <i>O</i> -dihexoside, luteolin-7- <i>O</i> -6''-acetylglucoside, apigenin-7- <i>O</i> -(6'-malonyl-apiosyl-glucoside), apigenin-6-C-

	glucoside, 4',5-dihydroxy-7-methoxyflavanone, pinobanksin-5-methylether-3- <i>O</i> -acetate
Anthocyanins	Delphinidin-3- <i>O</i> -(6''- <i>p</i> -coumaroyl glucoside), delphinidin-3- <i>O</i> -glucoside, delphinidin-3- <i>O</i> -glucosylglucoside, delphinidin-3- <i>O</i> -rutinoside, cyanidin-3- <i>O</i> -xyloside/arabinoside, cyanidin-3- <i>O</i> -sophoroside, cyanidin-3-rutinoside, petunidin-3- <i>O</i> -arabinoside, petunidin-3- <i>O</i> -glucoside, petunidin-3- <i>O</i> -rutinoside, petunidin-3- <i>O</i> -galactoside, malvidin-3- <i>O</i> -rutinoside, pelargonidin-3- <i>O</i> -glucoside
Stilbenoids	Resveratrol, <i>trans</i> -resveratrol, <i>cis</i> -resveratrol, <i>trans</i> -piceid, <i>cis</i> -piceid
Other relevant compounds	Curcumin, 4-aminobenzoic acid, catechol, caffeine, coumarin, salicylic acid, 2,6-dihydroxy-6-methylbenzaldehyde, 2-formyloxy-1-phenylethanone, anthraquinone derivative, 5-methoxy-7-methyl-1,2-naphthoquinone, 7-hydroxy-1-indanone, methyl benzoate, 2-methyl-5-hydroxybenzofuran, 5-methoxy-7-methyl-1,2-naphthoquinone, 1,2,3,4-tetrahydro-2-(2-hydroxy-3-phenoxypropyl)-6,7-dimethoxyisoquinoline, 1-(2-methoxyphenyl)-9,10-anthracenedione, N',N'',N'''-tris- <i>p</i> -feruloylspermidine, glucoraphanin, rosmarinic acid dihexoside derivative, N',N'',N'''-tris- <i>p</i> -coumaroylspermidine, pyrogallol, aesculin, tetramethylscutellarein, <i>O</i> -dihydroxybenzoyl acetyl malonyl coumaric acid flavonoid derivative

Table S2. Main (poly)phenols and volatiles described in royal jelly from different botanical and geographical origins. ^{78,90-94}

Chemical Family	Compounds identified
Flavonoids and derivatives	Acacetin, apigenin, apigenin-6-C-glucoside, apigenin-7-O-glucoside, apigenin-7-O-neohesperidoside, apigenin-7-O-rutinoside, apigenin-8-C-glucoside, biochanin A, chrysin, coumestrol, daidzein, daidzin, eriocitrin, eriodictyol, fisetin, formononetin, galangin, genistein, genistin, glycitein, glycitin, hesperetin, hesperidin, isosakuranetin, isorhamnetin, isorhamnetin-3-O-glucoside, isorhamnetin-3-O-rutinoside, isosakuranetin, kaempferol, kaempferol-3-O-glucoside, kaempferol-3-O-rutinoside, luteolin, luteolin-4'-O-glucoside, luteolin-6-C-glucoside, luteolin-7-O-glucoside, luteolin-8-C-glucoside, naringenin, narirutin, neoeriocitrin, neohesperidin, phloridzin, pinocembrin, pinobanksin, quercetin 3-O-glucoside, quercetin-3-O-galactoside, quercetin-3-O-rhamnoside, quercetin-3-O-rutinoside, sakuranetin, tamarixetin.
Phenolic and organic acids	Caffeic acid, ferulic acid, p-coumaric acid, 4-hydroxybenzoic acid, 4-hydroxyhydrocinnamic acid, 4-hydroxy-3-methoxyphenylethanol, sinapic acid, syringic acid, dodecanoic acid, octanoic acids and 1,2-benzenedicarboxylic acid.
Volatiles	Ethanol, acetone, methyl acetate, 2-Butanone, ethyl acetate, acetic acid, 3-Methylbutanal, 2-Methylbutanal, 2-Pentanone, 2-Methyl-2-butenal, toluene, butyric acid, hexanal, 2-Heptanone, benzaldehyde, phenol, 2-Methoxyphenol 2-Nonanone, methyl benzoate, octanoic acid, benzoic acid, 2-Methoxy-p-cresol, methyl salicylate, 1-Pentadecene, carbonyls, phenols, aliphatic acids

Table S3. Main (poly)phenols and volatiles described in propolis from different botanical and geographical origins. ^{110,118,121–124,126}

Chemical Family	Compounds identified
Flavonoids and derivatives	Pinocembrin, pinocembrin-5-methyl-ether, pinobanksin, pinobanksin-3- <i>O</i> -acetate, pinobanksin-3- <i>O</i> -propionate, pinobanksin-2- <i>O</i> -butyrate, pinobanksin-3- <i>O</i> -pentanoate, pinobanksin-5-methyl-ether, pinobanksin-5-methyl-ether-3-pentanoate, pinostrobin, naringenin, naringenin-glucoside, sakuranetin, isosakuranetin, liquiritigenin, galangin, chrysin, chrysin-5-methyl-ether, chrysin-6-methyl-ether, tectochrysin, isalpinin, alnustinol, 5-methoxy-3-hydroxyflavanone, hesperetin dimethylated derivatives, propolin A, propolin B, propolin E, sigmoidin B, geranylflavanone derivatives, solophenol A, sophoraflavanone A, isosakuranetin, acacetin, catechin, apigenin, izalpinin, quercetin, quercetin 3- <i>O</i> -rutinoside, rutin, kaempferol, kaempferol rutinoside, kaempferide, myricetin, fisetin, pectolinarigenin, luteolin, luteolin glucoside, isorhamnetin-3- <i>O</i> -rutinoside, macarangin, daidzein, formononetin, pterocarpins, xenognosin B, vestitone, calycosin, vestitol, mucronulatol, neovestitol.
Phenolic acids and derivatives	Gallic acid, gentisic acid, chlorogenic acid, cinnamic acid, protocatechuic acid, salicylic acid, vanillic acid, p-coumaric acid, caffeic acid, ferulic acid, caffeic acid phenethyl ester, 4-hydroxybenzoic acid, 4-hydroxyhydrocinnamic acid, and 4-hydroxybenzoic acid-methyl ester, artemillin C, chromenes.
Lignans, stilbenes, coumarins	Syringaresinol, pinoresinol and their dimethyl ether derivatives; schweinfurthin A, schweinfurthin B, 5-farnesyl-3'-hydroxyresveratrol, pterostilbene, pinosylvin, O-prenylated tetrahydroxystilbenes and C-prenylated tetrahydroxystilbenes; coumarin, daphnetin and suberosin 1.
Volatiles	β -Eudesmol, guaiol, tricosane, thymol, calamine, cis-verbenol, caryophyllene oxide, bisabolol, eucalyptol, γ -cadinene, α -cadinol, T-cadinol, δ -cadinene, α -pinene, allo-aromadendrene, cedrol, 13-nor-Ambreinolide, 15-nor-Labdan-8-ol, 8-epi-13-nor-Ambreinolide, ambroxide, eicosanol, ethyl linoleate, labd-8-en-15-ol, pinocarvone, eicosane, heneicosane, heptadecane, labd-7-en-15-ol, viridiflorol, nonadecane, pentacosane.