

Supplementary Materials

In silico analysis of bioactive compounds from ethanolic amber extract targeting BACE1: Potential implications for glucose metabolism

Eugenio Ragazzi^{1,2*} , Giuseppe Zagotto²  and Giovanni Sartore³ 

1. Studium Patavinum, University of Padova, 35122 Padova, Italy.
2. Department of Pharmaceutical and Pharmacological Sciences, University of Padova, 35131 Padova, Italy.
3. Department of Medicine-DIMED, University of Padova, 35122 Padova, Italy.

Corresponding Author

Prof. Dr. Eugenio Ragazzi

Studium Patavinum, University of Padova, 35122 Padova, Italy.

And

Department of Pharmaceutical and Pharmacological Sciences, University of Padova, 35131 Padova, Italy.

E-mail: eugenio.ragazzi@unipd.it, Tel: +393491016016

List of material

Table S1. Chemical components of Baltic amber (succinite), according to current literature



Table S1. Chemical components of Baltic amber (succinite), according to current literature.


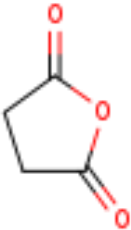
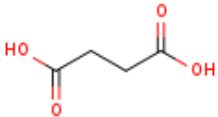
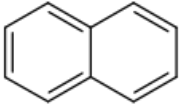
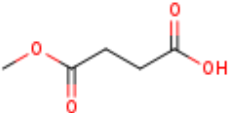
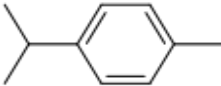
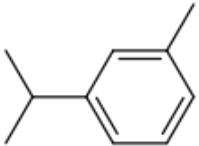
Chemical structure	Compound	Molecular formula	Molecular weight	Presence in ethanol extract *	Database ID **	Ref.
	Norbornene	C ₇ H ₁₂	96.172		279-23-2	[1]
	Succinic Acid Anhydride	O(COCH ₂) ₂	100.074		108-30-5	[2]
	Succinic Acid	(CH ₂ C(O)OH) ₂	118.089	Yes	110-15-6	[1-5]
	Naphthalene	C ₁₀ H ₈	128.174	Yes	91-20-3	[3, 6]
	Monomethyl succinate	C ₂ H ₄ COOHCOOCH ₃	132.116	Yes	3878-55-5	[3]
	4-Methylisopropylbenzene	CH ₃ C ₆ H ₄ CH(CH ₃) ₂	134.221	yes	99-87-6	[3]
	m-Cymene	C ₁₀ H ₁₄	134.221	yes	535-77-3	[3]

Table S1. (Continued)

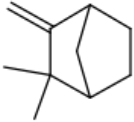
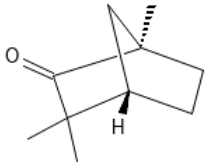
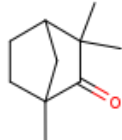
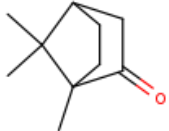
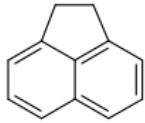
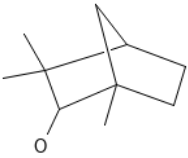
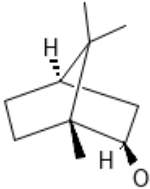
Chemical structure	Compound	Molecular formula	Molecular weight	Presence in ethanol extract *	Database ID **	Ref.
	Camphene	$C_7H_8(CH_3)_2CH_2$	136.237	Yes	79-92-5	[3, 7]
	L-Fenchone	$C_{10}H_{16}O$	152.23	Yes	7787-20-4	[3]
	1,3,3-Trimethyl-2-norbornanone	$C_{10}H_{16}O$	152.236		1195-79-5	[5]
	Camphor	$C_{10}H_{16}O$	152.236	Yes	21368-68-3	[3, 7]
	Acenaphthene	$C_{12}H_{10}$	154.211		83-32-9	[4, 6]
	2-Fenchanol	$C_{10}H_{18}O$	154.25	Yes	1632-73-1	[3, 7]
	Isoborneol	$C_{10}H_{18}O$	154.25	Yes	10334-13-1	[3]

Table S1. (Continued)

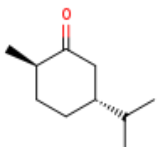
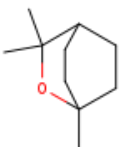
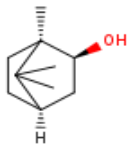
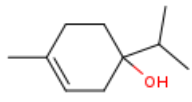
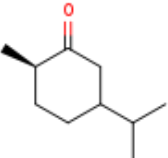
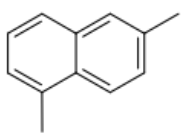
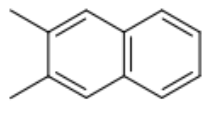
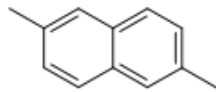
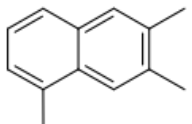
Chemical structure	Compound	Molecular formula	Molecular weight	Presence in ethanol extract *	Database ID **	Ref.
	(-)-Carvomenthone	C ₁₀ H ₁₈ O	154.252		13163-73-0	[7]
	1,8-Cineole	C ₁₀ H ₁₈ O	154.252		470-82-6	[5]
	Borneol	(CH ₂) ₃ (CH) ₂ (CH ₃) ₃ -C ₂ (OH)	154.252	yes	124-76-5	[3, 5, 7]
	Terpinen-4-ol	C ₁₀ H ₁₈ O	154.252	yes	562-74-3	[3, 5]
	Trans-carvomenthon	C ₁₀ H ₁₈ O	154.252		1933680-55-7	[5]
	1,6-Dimethylnaphthalene	CH ₃ C ₁₀ H ₆ CH ₃	156.227		575-43-9	[4, 6]
	2,3-Dimethylnaphthalene	(CH ₃) ₂ C ₁₀ H ₆	156.227		581-40-8	[4, 6]
	2,6-Dimethylnaphthalene	(CH ₃)C ₁₀ H ₆ (CH ₃)	156.227		581-42-0	[4, 6]
	1,6,7-Trimethylnaphthalene	C ₁₃ H ₁₄	170.254		2245-38-7	[6]

Table S1. (Continued)

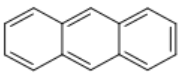
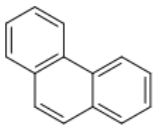
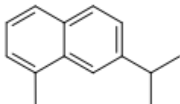
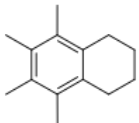
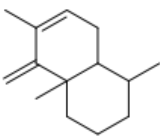
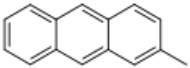
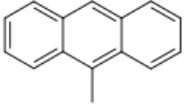
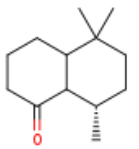
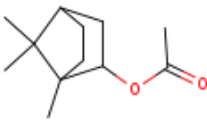
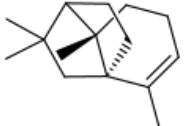
Chemical structure	Compound	Molecular formula	Molecular weight	Presence in ethanol extract *	Database ID **	Ref.
	Anthracene	$C_{14}H_{10}$	178.233		120-12-7	[4, 6]
	Phenanthrene	$(C_6H_4)_2(CH)_2$	178.233		85-01-8	[4, 6]
	1-Methyl-7-Isopropynaphthalene	$C_{14}H_{16}$	184.281		490-65-3	[6]
	5,6,7,8-Tetramethyl-1,2,3,4-tetrahydro-naphthalin	$C_{14}H_{20}$	188.313	yes	19063-11-7	[3]
	1,2,3,4,4a,5,8,8a-Octahydro-5-methylene-1,4a,6-trimethyl-naphthalene	$C_{14}H_{22}$	190.329		1350535-32-8	[1]
	2-Methylantracene	$(C_{14}H_9)CH_3$	192.26		613-12-7	[6]
	9-Methylantracene	$C_{14}H_9CH_3$	192.261		779-02-2	[6]
	5,5,8a-Trimethyldecalin-1-One	$C_{13}H_{22}O$	194.317	yes	36100142 (Reaxys ID)	[3]
	Isobornyl Acetate	$C_{12}H_{20}O_2$	196.29	yes	71424-71-0	[3]
	Neoclovene	$C_{15}H_{24}$	204.356	yes	1217497-62-5	[7]

Table S1. (Continued)

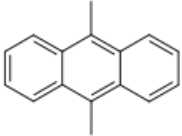
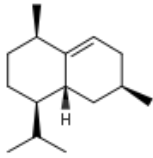
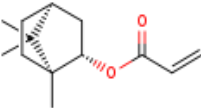
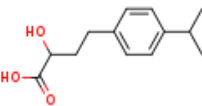
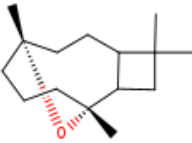
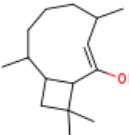
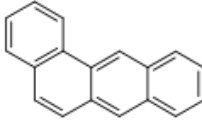
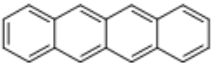
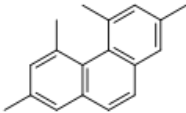
Chemical structure	Compound	Molecular formula	Molecular weight	Presence in ethanol extract *	Database ID **	Ref.
	9,10-Dimethylanthracene	C ₁₄ H ₈ (CH ₃) ₂	206.287		781-43-1	[6]
	λ-Cadinene	C ₁₅ H ₂₆	206.371		21643-00-5	[2]
	Isobornyl acrylate	C ₁₃ H ₂₀ O ₂	208.301		136374-53-3	[3]
	2-hydroxy-4-(4-isopropylphenyl) butanoic acid	C ₁₃ H ₁₈ O ₃	222.284		1779773-44-2	[1]
	Beta-Caryophyllan-2,6-Oxide	C ₁₅ H ₂₆ O	222.371		57067232 (Reaxys ID)	[5]
	Caryophyllenyl alcohol	C ₁₅ H ₂₆ O	222.371	Yes	38284-26-3	[3]
	Benz[a]anthracene	C ₁₈ H ₁₂	228.293		56-55-3	[4]
	Tetracene	C ₁₈ H ₁₂	228.293		92-24-0	[4]
	2,4,5,7-Tetramethylphenanthrene	C ₁₈ H ₁₈	234.341		7396-38-5	[6]

Table S1. (Continued)

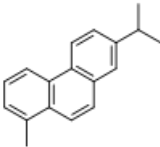
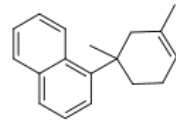
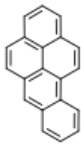
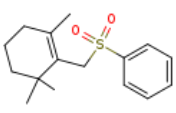
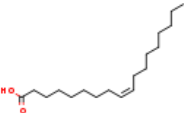
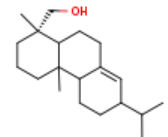
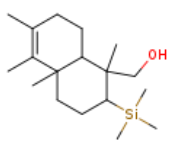
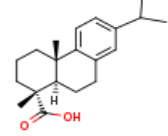
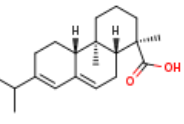
Chemical structure	Compound	Molecular formula	Molecular weight	Presence in ethanol extract *	Database ID **	Ref.
	Retene	C ₁₈ H ₁₈	234.341		483-65-8	[6]
	1-(1,3-dimethyl-3-cyclohexen-1-yl)naphthalene	C ₁₈ H ₂₀	236.357		59761325 (Reaxys ID)	[1]
	3,4-Benzopyrene	C ₂₀ H ₁₂	252.315		50-32-8	[6]
	{[(2,6,6-Trimethyl-1-cyclohexen-1-yl)methyl]sulfonyl} benzene	C ₁₆ H ₂₂ O ₂ S	278.415	Yes	56691-74-8	[3]
	Cis-octadecenoic acid	C ₁₈ H ₃₄ O ₂	282.467	Yes	112-80-1	[3]
	Dihydroabietyl alcohol	C ₂₀ H ₃₄ O	290.489		127-36-6	[5]
	1,2,3,4,4a,7,8,8a-octahydro-1,4a,5,6-tetramethyl-TMS-1-naphthalenemethanol	C ₁₈ H ₃₄ OSi	294.553		59761327 (Reaxys ID)	[1]
	Dehydroabietic acid	C ₂₀ H ₂₈ O ₂	300.441	yes	1740-19-8	[3, 5]
	Abietic acid	C ₂₀ H ₃₀ O ₂	302.457	yes	514-10-3	[3, 5, 6]

Table S1. (Continued)

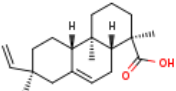
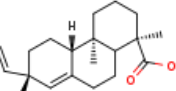
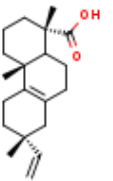
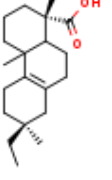
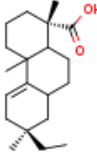
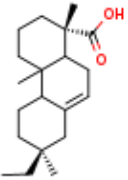
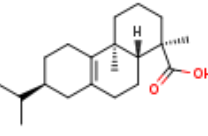
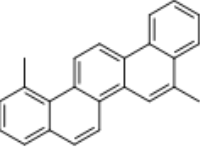
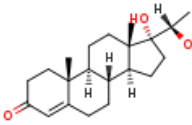
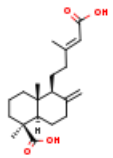
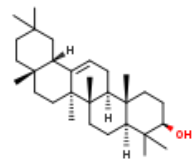
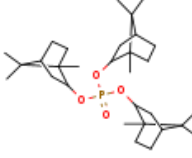
Chemical structure	Compound	Molecular formula	Molecular weight	Presence in ethanol extract *	Database ID **	Ref.
	Isopimaric acid	C ₂₀ H ₃₀ O ₂	302.457	Yes	5835-26-7	[3]
	Pimaric acid	C ₂₀ H ₃₀ O ₂	302.457	Yes	909256-80-0	[3]
	8,15-Isopimaradien-18-oic acid	C ₂₀ H ₃₀ O ₂	302.5		3625-01-2	[5]
	8-Pimarenic acid	C ₂₀ H ₃₂ O ₂	304.473		7715-77-7	[5]
	(13R)-5β-Pimar-9(11)-en-18-oic acid	C ₂₀ H ₃₂ O ₂	304.473		3148521 (Reaxys ID)	[5]
	(9β)-Pimar-7-en-18-oic acid	C ₂₀ H ₃₂ O ₂	304.473		142699-15-8 (for the methyl ester)	[5]
	Δ8-Dihydroabietic acid	C ₂₀ H ₃₂ O ₂	304.473	Yes	19402-28-9	[3]
	1,8-Dimethylpicene	C ₂₄ H ₁₈	306.407		60411-10-1	[6]

Table S1. (Continued)

Chemical structure	Compound	Molecular formula	Molecular weight	Presence in ethanol extract *	Database ID **	Ref.
	4-Pregnene-17 α ,20 α -diol-3-one	C ₂₁ H ₃₂ O ₃	332.483	yes	652-69-7	[3]
	Agathic acid	C ₂₀ H ₃₀ O ₄	334.456	yes	640-28-8	[3]
	Beta-amyrin	C ₃₀ H ₅₀ O	426.726		559-70-6	[6]
	Phosphoric acid tribornyl ester	C ₃₀ H ₅₁ O ₄ P	506.706	yes	104420-49-7 74469-66-2	[3]

* In this column the components detected by GC-MS analysis on ethanol extract of amber are indicated (according to [3]). The alcohol extraction was obtained by authors dissolving 5 g of amber in 100 ml of ethanol, under stirring for 24 h.

** Reaxys® ID or CAS RN (when not specified).

References

- Li, Y.; Li, J.; Liu, Q.; Li, Q. Ageing characterization and origin traceability of archaeological amber artefacts via FTIR spectroscopy and pyrolysis-gas chromatography/mass spectrometry. *Journal of Cultural Heritage*. 2024, 69, 37-46. <https://doi.org/10.1016/j.culher.2024.07.005>
- Pipatmanomai, S.; Islas, C.A.; Suelves, I.; Herod, A.A.; Dugwell, D.R.; Kandiyoti, R. Pyrolysis of Baltic amber in a wire-mesh pyrolysis reactor: structural comparison of the tars with amber extracts in NMP. *Journal of Analytical and Applied Pyrolysis*. 2001, 58-59, 299-313
- Al-Tamimi, W.H.; Malik Al-Saadi, S.A.A.; Burghal, A.A. Antibacterial activity and GC-MS analysis of Baltic amber against pathogenic bacteria. *International Journal of Advanced Science and Technology*. 2020, 29 (11s), 611-618
- Kundalevich, A.; Zyubin, A.; Matveeva, K.; Samusev, I.; Lyatun, I. Determination of Anthracene Derivatives in Baltic Amber Using SERS. *Sensors*. 2023, 23, 2161. <https://doi.org/10.3390/s23042161>
- Wagner-Wysiecka, E. Succinite, Baltic Amber: A Chemical Masterpiece of Nature. *Journal of Gems & Gemmology*. 2023, 25(4), 69-87. <https://doi.org/10.15964/j.cnki.027jgg.2023.04.007>
- Matuszewska, A.; Czaja, M. Aromatic compounds in molecular phase of Baltic amber—synchronous luminescence analysis. *Talanta*. 2002, 56 (6), 1049-1059. [https://doi.org/10.1016/S0039-9140\(01\)00610-5](https://doi.org/10.1016/S0039-9140(01)00610-5)
- Chorny, V.; Krúma, Z.; Mysiura, T.; Popova, N.; Zavialov, V. Comparative Extraction of Components from Ukrainian and Baltic Ambers. *Proceedings of the Latvian Academy of Sciences. Section B*. 2023, 77 (5/6, 746/747), 244–249