

8 Anhang

A Inhaltsstoffe von *Zanthoxylum schinifolium* gemäss Literatur

Gruppe	Substanz Trivialname	Formel	IUPAC Name	Pflanzenteil	Wirkung	Bemerkung	Referenz
Coumarin	aurapten			bark, leave	APA		1a [20]
Coumarin	collinin			bark, leave	APA/AHBV		1a 1b[21]
Coumarin	epoxyauraptin						1a [22]
Coumarin	hydrangetin		7-hydroxy-8-methoxy coumarine	leave			1a [23]
Coumarin	umbelliferon		7-hydroxy coumarine	leave			1a [20]
Coumarin	(-)-acetoxycollinin			bark, leave	APA		1a [15]
Coumarin	aesculetin dimethyl ether			leave			1a [24]
Alkaloid (benzo[c]-phenanthridine)	norcheleerythrine			leave			1a [24]
Alkaloid (Furoquinolines)	dictamnine			bark, leave	APA		1a [24]
Alkaloid (Furoquinolines)	skimmianine			leave			1a [24]
Triterpenoid	beta-amyrin						1a [25]
Triterpenoid	friedelin			leave			1a [26]
Coumarin	schinicooumarin	$C_{12}H_{12}O_5$	3,7,8-trimethoxycoumarin	bark, leave	APA		1a (1)
Coumarin	acetoxyaauraptin	$C_{21}H_{24}O_5$	7-(5'-acetoxygeranyl)oxy-8-methoxy coumarine	bark, leave	APA		1a (2)
Coumarin	epoxycollinin		7-(6',7'-epoxygeranyl)oxy-8-methoxy coumarine	bark, leave			1a (3)
Coumarin	schininallylol		7-(3',7'-dimethyl-6'-hydrox-2',7'-octadienyl)oxy-8-methoxy coumarine	bark, leave	APA		1a (4)

Gruppe	Substanz Trivialnamen	Formel	IUPAC	Pflanzenteil	Wirkung	Bemerkung	Referenz
Coumarin	schinilenol		7-(3',7'-dimethyl-7'-hydroxy-2',5'-octadienyl)oxy-8-methoxy coumarin	bark, leave	APA		1a (5)
Coumarin	schinindiol		7-(6',7'-dihydroxy-3',7'-dimethyl-2'-octenyl)oxy-8-methoxy coumarin	bark, leave			1a (6)
Terpenylcoumarin	7-(5',6'-dihydroxy-2',7',dienyloxy)-coumarin	$C_{19}H_{22}O_5$	7-(2',6'-dihydroxy-7-methyl-3'-methyleneocta-7'-enyl)-8-methoxy coumarin	bark			1b (1)
Terpenylcoumarin	anisocoumarin H	$C_{20}H_{24}O_6$	7-[(E)-7'-hydroxy-3',7'-dimethylocta-2',5'-dienyloxy]-coumarin	bark, leave	APA		1b (2)
Coumarin	scopoletin		4-methoxy-1-methyl-2-quinolone oxynitidine	root bark			1b (3) [4]
Coumarin	7-[(E)-7'-hydroxy-3',7'-dimethylocta-2',5'-dienyloxy]-coumarin		7-[(E)-7'-hydroxy-3',7'-dimethylocta-2',5'-dienyloxy]-coumarin	bark, leave	APA		1b (4) [5]
Coumarin	scopoletin		7-[(E)-7'-hydroxy-3',7'-dimethylocta-2',5'-dienyloxy]-coumarin	bark, leave			1b (5) [6]
Alkaloid	4-methoxy-1-methyl-2-quinolone		4-methoxy-1-methyl-2-quinolone	root bark			1b (6) [7]/ 1c [19]
Alkaloid	oxynitidine		4-methoxy-1-methyl-2-quinolone	bark, leave	AHBV		1b (7) [8]
Lignan	(+)-matairesinol			bark			1b (8) [9]
Coumarin	methylschinilenol	$C_{21}H_{27}O_5$		root bark, leave			1c (1)
Coumarin	hydroxyepoxycollinin I	$C_{20}H_{24}O_6Na$		root bark, leave			1c (2)
Coumarin	8-methoxyanisocoumarin H	$C_{20}H_{24}O_5Na$		root bark	APA		1c (3)
Coumarin	hydroxyschininallylol	$C_{20}H_{24}O_6Na$		root bark			1c (4)
Coumarin	hydroxyepoxycollinin II	$C_{20}H_{24}O_6Na$		root bark			1c (5)
Coumarin	schinitrienin			root bark			1c (6)
Coumarin	schininallylone			root bark			1c (7)

Gruppe	Substanz Trivialname	Formel	IUPAC-Name	Pflanzenteil	Wirkung	Bemerkung	Referenz
Coumarin	isoschinilenol	$C_{20}H_{24}O_5Na$		root bark			1c [8]
Alkaloid (Furoquinolines)	robustin			root bark, leave			1c [13]
Alkaloid (Furoquinolines)	y-fagarine			root bark, leave			1c [13]
Alkaloid (Furoquinolines)	platydesmine			root bark, leave			1c [14]
Coumarin	6-methoxyaurapten			root bark			1c [12]
Amides, Alkaloide	arnottianamide			root bark, leave			1c [15]
Amides, Alkaloide	isoarnottianamid			root bark, leave			1c [16]
benzenoide	tetracosyl ferulate			root bark, leave			1c [17]
Andere	methyl p-hydroxycinnamate			root bark			1c[18]
steroids	beta-sitosterol			root bark, leave			1c [19]
Alkaloide	4-methoxy-1-methyl-2-quinolone			root bark, leave			1c [19]
Coumarin	lacinartin			stem	MAO I		1d
Fettsäure	Palmitinsäure			Samenöl		<i>F. schinifolia</i>	1e
Fettsäure	Ölsäure			Samenöl		<i>F. schinifolia</i>	1e
Fettsäure	Linolsäure			Samenöl		<i>F. schinifolia</i>	1e
Fettsäure	Linolensäure			Samenöl		<i>F. schinifolia</i>	1e
Fettsäure	Elaeostearinsäure			Samenöl		<i>F. schinifolia</i>	1e
Coumarin	cis-Fagaramide	$C_{14}H_{17}NO_3$		leaves			1f
Coumarin	herniarin			leaves			1f [13]
Coumarin	5,7,8, trimethoxycoumarin			leaves			1f
Coumarin	xanthyletin			leaves			1f
Coumarin	bergapten			leaves			1f
Alkaloide	trans-fagaramid			leaves			1f
Furan	5-hydroxymethyl-furfural			leaves			1f
benzenoide	p-hydroxycinnamate			leaves			1f
benzenoide	p-hydroxybenzaldehyde			leaves			1f
benzenoide	docosanyl ferulate			leaves			1f
chlorophyll	pheophytin-a			leaves			1f
chlorophyll	13-hydroxy-(13-S)-pheophytin-a			leaves			1f
chlorophyll	aristophyll-c			leaves			1f
Triterpenoid	friedelinol			leaves			1f
Triterpenoid	beta-amyrinacetat			leaves			1f

Gruppe	Substanz Trivialname	Formel	IUPAC Name	Pflanzenteil	Wirkung	Bemerkung	Referenz
Triterpenoid	lupenon			leaves			1f
Diterpenoid	phytol			leaves			1f
sesquiterpenoid	caryophyllene oxide			leaves			1f
steroids	stigmasterol			leaves			1f
steroids	campesterol			leaves			1f
steroids	beta-sitosterol-3-O-beta-D-glucosid			leaves			1f
Terpen	7-octatriene	C ₁₀ H ₁₆		oil			4h
Terpen	3-carene	C ₁₀ H ₁₆		oil			4h
Terpen	1-octanol	C ₈ H ₁₈ O		oil			4h
Terpen	2,2-dimethyl-4-ethyl-hexane	C ₁₀ H ₁₆		oil			4h
Terpen	cis-carveyl-acetate	C ₁₂ H ₁₈ O ₂		oil			4h
Terpen	estragol	C ₁₀ H ₁₈ O		oil			4h
Terpen	nerol	C ₁₀ H ₁₈ O		oil			4h
Terpen	1-methoxy-4-(1propenyl)-benzene	C ₁₀ H ₁₂ O		oil			4h
Terpen	2-undecanon	C ₁₁ H ₂₂ O		oil			4h
Terpen	1,2-dimethoxy-4-(2-Propenyl)-benzen	C ₁₁ H ₁₄ O		oil			4h
sesquiterpenoid	4,1,1,1-trimethyl-8-methylene-bicyclo [7,2,0]	C ₁₅ H ₂₄		oil			4h
sesquiterpenoid	beta-selinen	C ₁₅ H ₂₄		oil			4h
Terpen	1,5-p-menthadien-7-ol	C ₁₀ H ₁₆ O		oil			4h

Legende:

APA Antiplatelet Activity
 AHBV Anti Hepatitis B Virus
 MAO I Monoaminoxidase-Inhibitor
 Fagara Subgenus of Zanthoxylum

B GC - Retentionszeiten der Referenzen und Analyse der CO₂-Extrakte

Tabelle mit den Retentionszeiten der Referenzsubstanzen am GC und am GC-MS Gerät gemessen. Methoden siehe Kapitel 3.8.2 und 3.8.3

Referenz	RT GC-MS	RT GC
1-R- α -Pinen	6.453	4.464
(+)- β -Pinen	7.471	5.088
R-Limonen	8.762	5.843
(+) Terpinen-4-ol	12.543	8.242
α -Bisabolol	23.958	15.15
(+)- α -Pinen	6.467	4.42
Myrcen	7.799	5.081
Cineol	8.825	5.879
α -Terpineol	12.8	8.368
Geraniol	14.424	9.386
Anethol	15.18	9.859
α -Terpinen	8.481	5.616
β -Linalool	10.603	7.012
α -Thujone	10.727	7.095
α -Terpinylacetat	16.791	10.744
β -Caryophyllen	18.585	11.915

Zanthoxylum schinifolium, S1

Retentionszeit	Match	Masse	Name nach Nist
6.453	851		α -Thujen
7.371	915		Sabinen/ 4-(10) Thujen
7.780	810		β -Myrcen
8.752	879		Limonen
8.800	892		Cineol/Eucalyptol
9.709	885		Z- β -Terpineol
10.501	902		Z- β -Terpineol
10.816	941		β -Phenylethanol
11.117	906		2-Cyclohexen-1-ol, 1 methyl-4-(1methylethyl)-trans
11.388	669		E- oder Z-Sabinenhydrat
12.534	917		L-4-Terpineol
12.662	757		Crypton
12.850	886		α -Terpineol
13.310	734		E-Piperitol
13.581	852		α -Terpineolacetat
13.581	838		4-Terpineolacetat
13.583	847		α -Terpineolacetat
14.382	857		Piperiton
14.400	763		4-Thujanol
14.816	730		Farnesenepoxid
15.137	747		Anethol
15.549	739		4-Thujanol
16.718	930		α -Terpineolacetat
16.891	903		3,7-Octadiene-2,6-diol,2-6 dimethyl-
18.525	907		β -Caryophyllen
20.558	901		Cadinen/Murolen
21.807	800		Germacren
21.905	911		Spathulenol
22.041	928		Caryophyllenoxid
23.163	827		β -Cadinen

Zanthoxylum bungeanum; B1

RT	Match	Masse	Substanz nach NIST
6.461	942	136	1R- α -Pinen
6.307	907	136	α -Thujen
7.398	930	136	Sabinen
7.398	912	136	β -Phellandren
7.811	905	136	β -Myrcen
7.811	903	136	β -Pinen
8.653	945	134	β -Cymene
8.784	882	136	Limonen
8.837	919	154	Cineol
8.971	959	136	β - <i>E</i> Ocimen
9.243	943	136	β - <i>Z</i> Ocimen
9.533	930	136	α -Terpinen
9.738	924	154	β - <i>Z</i> Terpeneol
10.537	894	154	β -Linalool
11.413	705	154	<i>Z</i> -Sabinenhydrat
11.413	708	154	β - <i>Z</i> Terpeneol ?
12.185	674	154	<i>Z</i> oder <i>E</i> Sabinenhydrat
12.556	924	154	L-4-Terpeneol od. 4-Terpeneol
12.686	919	138	Crypton
13.619	833	196	4-Terpeneolacetat
14.404	811	152	Piperiton
15.165	942	148	Anethol
16.487	826	154	<i>E</i> --Piperitol
16.745	909	196	α -Terpeneolacetat/ α -Terpinylacetat
17.445	876	196	Nerolacetat/Geraniolacetat?
17.857	867	204	β -Elemen
18.542	944	204	β -Caryophyllen
19.892	900	204	Germacrene D
20.58	919	204	Naphtalen/ α -Cadinen
20.751	905	204	S-Cadinen

Zanthoxylum bungeanum Gansu; G1

Retentionszeit	Match	m/z	Name nach Nist
7.833		876	β -Pinen
8.167		933	α -Phellandren
8.825		794	Limonen
8.86		876	Cineol
8.97		945	β -trans-Ocimen
9.234		947	β -cis-Ocimen
9.521		955	α -Terpinen
9.728		924	β -Z Terpeneol
10.278		915	4 Caren
10.278		904	2 Caren
10.278		899	Terpinolen
10.54		842	β -Linalool
10.785		964	
12.525		916	L-4-Terpeneol
12.649		795	Crypton
12.847		941	α -Terpeneol
13.604		812	α -Terpeneolacetat
14.477		724	Dihydrocarveol
14.479		763	Linalylanthranilat
14.371		806	Piperiton
14.375		760	Piperiton
14.476		921	Linalylanthranilat
15			
15.541		836	4-Terpeneolacetat
16.717		931	α -Terpeneolacetat
16.982		624	Z Geraniol/ Nerolacetat
17.417		926	Geraniolacetat
17.821		784	β -Elemen
18.506		949	β -Caryophyllen
19.274		910	α -Caryophyllen
19.725		895	Murolene /Naphthalen
19.865		690	Germacrene
19.865		676	β -Cubeben
19.983		901	Z-E-a-Farnesen
19.983		884	α -Bergamotene
20.547		913	α -Cadinen = α -Murolen
20.714		914	S-Cadinen
21.508		895	α -Elemen
21.849		676	β -Bourbonen
21.849		797	Germacrene D-4 ol
22.021		901	Caryophyllen oxide
23.42		624	α -Eudesmol
23.593		902	Xanthoxylin
24.199		783	all E Farnesol
24.602		881	all E Farnesol
26.765		900	Farnesylacetat (all E Farnesylacetat)
28.648		950	226 Z-11-Hexadecenoic acid

C Rohdaten GC

*Zanthoxylum schinifolium**Zanthoxylum schinifolium* Öl - Rohdaten

RT A	Area A	% A	RT B	Area B	% B	RT C	Area C	% C	Durchschnitt	D. Summe	D. Korr	D. Summe	
5.773	916700	21.7466%	0.003	5.776	920647	21.31%	-0.012	5.761	1079686	22.05%	21.70%	21.70%	21.31% Limonen
8.084	614468	14.5769%	0.008	8.092	645217	14.94%	-0.008	8.076	717765	14.66%	14.72%	36.43%	14.46% 35.77% 4-Terpineol
6.174	254823	6.0451%	0.006	6.18	258002	5.97%	-0.013	6.161	299280	6.11%	6.04%	42.47%	5.93% 41.71% α-Terpinen
10.552	225986	5.3610%	0.012	10.564	232867	5.39%	-0.005	10.547	246063	5.02%	5.26%	47.73%	5.16% 46.87% Terpinylacetat
5.084	214907	5.0982%	0	5.084	215554	4.99%	-0.014	5.07	263381	5.38%	5.16%	52.88%	5.06% 51.93% β-Pinen
6.74	183214	4.3463%	0.005	6.745	193576	4.48%	-0.013	6.727	233319	4.76%	4.53%	57.41%	4.45% 56.38% β-Linalool
8.237	193087	4.5806%	0.008	8.245	166558	3.86%	-0.009	8.228	188411	3.85%	4.09%	61.51%	4.02% 60.41% α-Terpineol
5.528	115949	2.7506%	0.004	5.532	115867	2.68%	-0.015	5.513	134094	2.74%	2.72%	64.23%	2.67% 63.08% α-Terpinen
5.624	98567	2.3383%	0.003	5.627	99226	2.30%	-0.015	5.609	117450	2.40%	2.34%	66.58%	2.30% 65.38% p-Cimen
4.893	82344	1.9534%	0.002	4.895	84523	1.96%	-0.014	4.879	104645	2.14%	2.02%	68.59%	1.98% 67.36% Sabinen
9.168	83399	1.9785%	0.01	9.178	91067	2.11%	-0.005	9.163	95829	1.96%	2.01%	70.61%	1.98% 69.34% Piperiton
12.991	91097	2.1611%	0.012	13.003	87152	2.02%	-0.009	12.982	87977	1.80%	1.99%	72.60%	1.96% 71.30% Cadinol
9.603	84007	1.9929%	0.01	9.613	89160	2.06%	-0.006	9.597	78777	1.61%	1.89%	74.49%	1.85% 73.15% Anethol
11.715	81311	1.9289%	0.012	11.727	80795	1.87%	-0.009	11.706	87054	1.78%	1.86%	76.35%	1.83% 74.98% β-Caryophyllen
6.633	63138	1.4978%	0.003	6.636	65249	1.51%	-0.018	6.615	73490	1.50%	1.50%	77.85%	1.48% 76.45%
14.65	40382	0.9580%	0.015	14.665	64598	1.50%	-0.008	14.642	73029	1.49%	1.31%	79.16%	1.29% 77.74% α-Cadinol
5.935	46522	1.1036%	0.003	5.938	56691	1.31%	-0.015	5.92	69988	1.43%	1.28%	80.45%	1.26% 79.00% β-cis Ocimen
14.481	51434	1.2202%	0.014	14.495	48156	1.11%	-0.009	14.472	53106	1.08%	1.14%	81.59%	1.12% 80.12% α-Cadinol
11.246	48065	1.1402%	0.011	11.257	50201	1.16%	-0.01	11.236	51458	1.05%	1.12%	82.70%	1.10% 81.22% Elemen
4.364	43943	1.0424%	0	4.364	42055	0.97%	-0.015	4.349	50542	1.03%	1.02%	83.72%	1.00% 82.22% α-Pinen
12.707	47078	1.1168%	0.012	12.719	48085	1.11%	-0.009	12.698	38668	0.79%	1.01%	84.73%	0.99% 83.21%
9.099	39731	0.9425%	0.009	9.108	42559	0.99%	-0.007	9.092	51055	1.04%	0.99%	85.72%	0.97% 84.18%
12.911	39345	0.9334%	0.012	12.923	40523	0.94%	-0.009	12.902	45329	0.93%	0.93%	86.65%	0.92% 85.09%
9.829	35137	0.8335%	0.011	9.84	37537	0.87%	-0.008	9.821	39449	0.81%	0.84%	87.48%	0.82% 85.92%
12.514	36582	0.8678%	0.011	12.525	36456	0.84%	-0.01	12.504	38868	0.79%	0.84%	88.32%	0.82% 86.74% Germacren
7.143	23839	0.5655%	0.006	7.149	33083	0.77%	-0.014	7.129	44251	0.90%	0.75%	89.07%	0.73% 87.47%
13.358	29314	0.6954%	0.012	13.37	28549	0.66%	-0.008	13.35	30600	0.62%	0.66%	89.73%	0.65% 88.12%
14.686	26486	0.6283%	-14.686				-14.686			0.63%	0.63%	90.35%	0.62% 88.73%
7.412	22792	0.5407%	0.007	7.419	27803	0.64%	-0.013	7.399	33404	0.68%	0.62%	90.98%	0.61% 89.34%
10.894	26538	0.6296%	0.01	10.904	27555	0.64%	-0.008	10.886	28948	0.59%	0.62%	91.60%	0.61% 89.95% Geraniolacetat
			8.32	8.32	25617	0.59%	8.302	8.302	29023	0.59%	0.59%	92.19%	0.58% 90.53%
12.167	25896	0.6143%	0.011	12.178	25679	0.59%	-0.011	12.156	27769	0.57%	0.59%	92.78%	0.58% 91.12%
8.715	19993	0.4743%	0.009	8.724	26906	0.62%	-0.01	8.705	29496	0.60%	0.57%	93.35%	0.56% 91.67% cis-Geraniol
13.847	23673	0.5616%	0.012	13.859	22902	0.53%	-0.01	13.837	26255	0.54%	0.54%	93.89%	0.53% 92.21% Caryophyllenepoxid
5.34	23404	0.5552%	0.003	5.343	23309	0.54%	-0.016	5.324	25627	0.52%	0.54%	94.43%	0.53% 92.73% α-Phellandren
15.278	23031	0.5464%	0.012	15.29	22859	0.53%	-0.011	15.267	26351	0.54%	0.54%	94.97%	0.53% 93.26%
12.403	23019	0.5461%	0.014	12.417	23285	0.54%	-0.007	12.396	25310	0.52%	0.53%	95.50%	0.52% 93.79%
15.473	20747	0.4922%	0.015	15.488	20988	0.49%	-0.009	15.464	23258	0.47%	0.48%	95.99%	0.48% 94.26%
13.748	19889	0.4718%	0.012	13.76	20325	0.47%	-0.01	13.738	23350	0.48%	0.47%	96.46%	0.46% 94.73%
7.587	19591	0.4648%	-7.587				-7.587			0.46%	0.46%	96.92%	0.46% 95.18%
14.836	19574	0.4643%	0.013	14.849	18980	0.44%	-0.011	14.825	21172	0.43%	0.45%	97.37%	0.44% 95.62%
8.467	10765	0.2554%	0.008	8.475	22578	0.52%	-0.011	8.456	26083	0.53%	0.44%	97.81%	0.43% 96.05% trans-Piperitol
12.602	20038	0.4754%	0.012	12.614	19083	0.44%	-0.011	12.591	19206	0.39%	0.44%	98.24%	0.43% 96.48%
16.658	17546	0.4162%	0.017	16.675	17769	0.41%	-0.009	16.649	19807	0.40%	0.41%	98.65%	0.40% 96.88% Farnesylacetat
							9.642	9.642	16706	0.34%	0.34%	98.99%	0.34% 97.22%
13.526	15340	0.3639%	0.014	13.54	14606	0.34%	-0.009	13.517	15617	0.32%	0.34%	99.33%	0.33% 97.55%
15.439	14493	0.3438%	0.014	15.453	13863	0.32%	-0.009	15.43	16201	0.33%	0.33%	99.67%	0.33% 97.88%
4.236	13043	0.3094%	0.001	4.237	14059	0.33%	-0.015	4.221	16808	0.34%	0.33%	99.99%	0.32% 98.20% α-Thujen
15.042	12877	0.3055%	0.014	15.056	12207	0.28%	-0.009	15.033	13791	0.28%	0.29%	100.28%	0.28% 98.48%
			8.629	8.629	11936	0.28%	8.61	8.61	14088	0.29%	0.28%	100.56%	0.28% 98.76%
12.268	11410	0.2707%	0.013	12.281	12011	0.28%	-12.268				0.27%	100.84%	0.27% 99.03%
18.495	11302	0.2681%	0.02	18.515	11745	0.27%					0.27%	101.11%	0.27% 99.29%
							12.658	12.658	12113	0.25%	0.25%	101.36%	0.24% 99.54%
			6.289	6.289	9697	0.22%	6.269	6.269	13013	0.27%	0.25%	101.60%	0.24% 99.78%
14.337	9549	0.2265%	-14.337				-14.337				0.23%	101.83%	0.22% 100.00%
	4215365	100.00%		4319715	100.00%			4896960	100.00%		101.83%	100.00%	

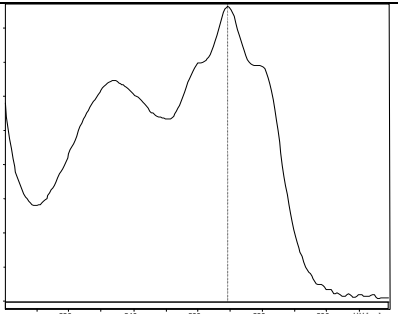
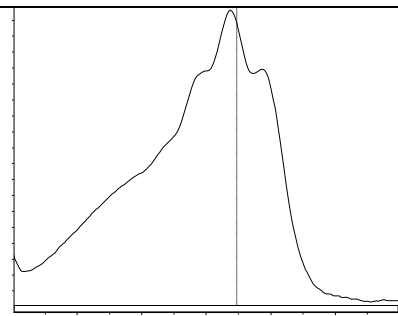
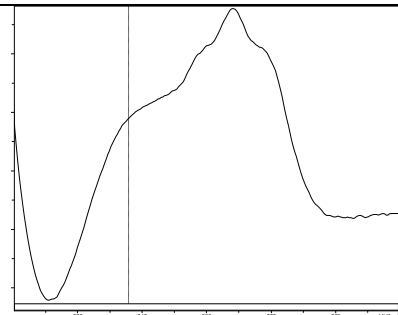
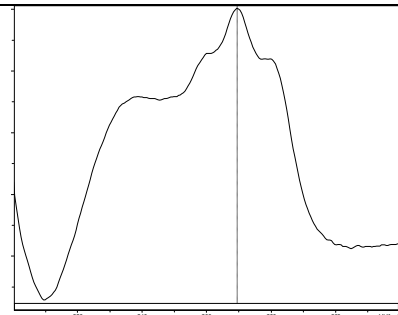
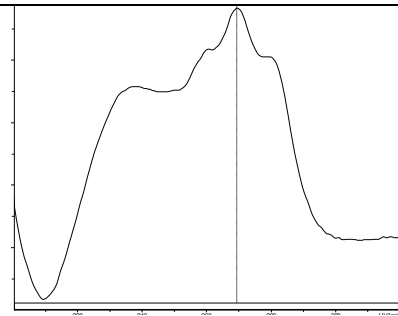
Zanthoxylum bungeanum

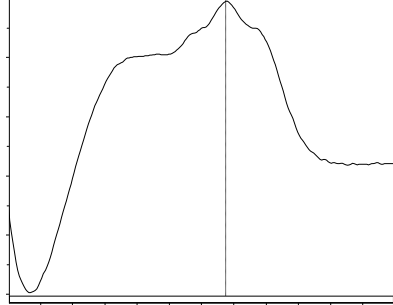
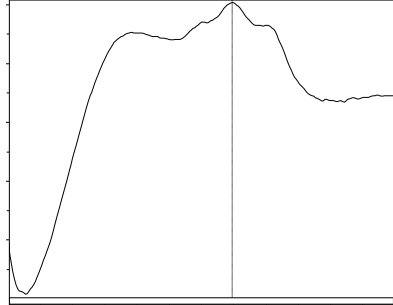
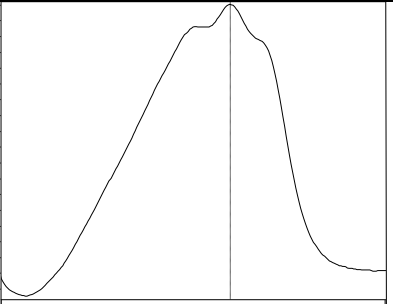
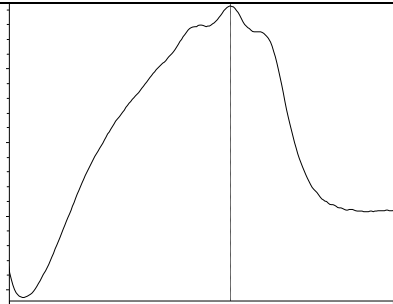
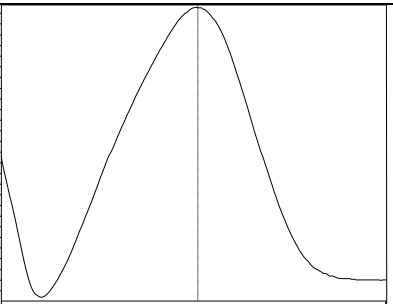
Zanthoxylum bungeanum Öl			Rohdaten															
RT A	Area A	% A	RT B	Area B	% B	RT C	Area C	% C	D.	D. Addiert	D. Korr	D. Add	Substanzen					
5.781	1867294	28.47%	0.028	5.809	1852836	28.03%	0.025	5.806	1605523	28.81%	28.44%	28.44%	28.16%	28.16% Limonen*				
8.079	834724	12.73%	0.03	8.109	837226	12.67%	0.027	8.106	698286	12.53%	12.64%	41.08%	12.52%	40.68% 4-Terpineol				
5.083	608686	9.28%	0.027	5.11	598281	9.05%	0.026	5.109	523870	9.40%	9.24%	50.32%	9.16%	49.84% β-Pinen?				
5.662	347868	5.30%	-0.012	5.65	342858	5.19%	-0.012	5.65	299734	5.38%	5.29%	55.61%	5.24%	55.08% p-Cymen				
4.885	310979	4.74%	0.025	4.91	307074	4.65%	0.026	4.911	272016	4.88%	4.76%	60.37%	4.71%	59.79% Sabinen				
10.54	251545	3.84%	0.028	10.568	292590	4.43%	0.029	10.569	237175	4.26%	4.17%	64.54%	4.13%	63.92% Terpeneolacetat				
6.727	264065	4.03%	0.032	6.759	260804	3.95%	0.032	6.759	223246	4.01%	3.99%	68.53%	3.95%	67.87% β-Linalool				
8.226	205124	3.13%	0.03	8.256	207518	3.14%	0.03	8.256	172837	3.10%	3.12%	71.66%	3.09%	70.97% α-Terpineol				
6.153	176010	2.68%	0.028	6.181	181367	2.74%	0.029	6.182	150076	2.69%	2.71%	74.36%	2.68%	73.65%				
4.3949	176780	2.70%	-0.0239	4.371	173933	2.63%	-0.0239	4.371	151800	2.72%	2.68%	77.05%	2.66%	76.31% α-Pinen				
9.158	117713	1.80%	0.03	9.188	135767	2.05%	0.032	9.19	96820	1.74%	1.86%	78.91%	1.84%	78.15% Piperiton				
12.972	86101	1.31%	0.027	12.999	78341	1.19%	0.027	12.999	62372	1.12%	1.21%	80.11%	1.19%	79.34% Naphthalen?				
11.696	77694	1.18%	0.031	11.727	80255	1.21%	0.029	11.725	53663	0.96%	1.12%	81.24%	1.11%	80.45% β-Caryophyllen				
9.088	66235	1.01%	0.029	9.117	68844	1.04%	0.032	9.12	53787	0.97%	1.01%	82.24%	1.00%	81.45%				
5.924	62762	0.96%	0.029	5.953	62157	0.94%	0.03	5.954	54358	0.98%	0.96%	83.20%	0.95%	82.40% β-cis Ocimen				
6.611	61984	0.95%	0.031	6.642	60212	0.91%	0.035	6.646	50239	0.90%	0.92%	84.12%	0.91%	83.31%				
5.505	59286	0.90%	0.027	5.532	56194	0.85%	0.03	5.535	48956	0.88%	0.88%	85.00%	0.87%	84.18% α-Terpinen				
7.128	52408	0.80%	0.031	7.159	56436	0.85%	0.034	7.162	49449	0.89%	0.85%	85.84%	0.84%	85.02%				
12.894	52397	0.80%	0.028	12.922	53598	0.81%	0.026	12.92	43062	0.77%	0.79%	86.64%	0.79%	85.80%				
8.141	49404	0.75%	0.03	8.171	51799	0.78%	0.029	8.17	45397	0.81%	0.78%	87.42%	0.78%	86.58%				
14.629	46059	0.70%	0.025	14.654	51131	0.77%	0.025	14.654	42471	0.76%	0.75%	88.17%	0.74%	87.32%				
14.462	44527	0.68%	0.026	14.488	49623	0.75%	0.026	14.488	41640	0.75%	0.73%	88.89%	0.72%	88.04% α-Cadinol				
12.493	40887	0.62%	0.03	12.523	46531	0.70%	0.03	12.523	31611	0.57%	0.63%	89.52%	0.63%	88.66% Germacren				
7.397	38574	0.59%	0.033	7.43	36789	0.56%	0.035	7.432	32286	0.58%	0.57%	90.10%	0.57%	89.23%				
12.686	29949	0.46%	0.028	12.714	43393	0.66%	-12.686				0.56%	90.65%	0.55%	89.78%				
8.688	35045	0.53%	0.032	8.72	35783	0.54%	0.032	8.72	28775	0.52%	0.53%	91.19%	0.53%	90.31% cis-Geraniol				
9.812	33213	0.51%	0.028	9.84	35959	0.54%	0.032	9.844	28678	0.51%	0.52%	91.71%	0.52%	90.82%				
6.271	30414	0.46%	0.028	6.299	39310	0.59%	0.029	6.3	27118	0.49%	0.52%	92.22%	0.51%	91.33% Terpeneol				
10.483	33501	0.51%					-10.483				0.51%	92.73%	0.51%	91.84%				
9.584	32353	0.49%	0.029	9.613	35310	0.53%	0.032	9.616	27905	0.50%	0.51%	93.24%	0.50%	92.34% Anethol				
11.224	33708	0.51%	0.031	11.255	33985	0.51%	0.032	11.256	27729	0.50%	0.51%	93.75%	0.50%	92.85% β-Elementen				
13.825	36344	0.55%	0.026	13.851	32479	0.49%	0.026	13.851	26088	0.47%	0.50%	94.26%	0.50%	93.35% Caryophyllenepoxid				
8.299	31528	0.48%	0.031	8.33	31634	0.48%	0.033	8.332	26822	0.48%	0.48%	94.74%	0.48%	93.82%				
13.727	32297	0.49%	0.028	13.755	30770	0.47%	0.028	13.755	25644	0.46%	0.47%	95.21%	0.47%	94.29%				
8.453	29402	0.45%	0.032	8.485	30371	0.46%	0.034	8.487	24987	0.45%	0.45%	95.66%	0.45%	94.74%				
4.215	27712	0.42%	0.023	4.238	27285	0.41%	0.022	4.237	25415	0.46%	0.43%	96.09%	0.43%	95.17%				
12.644	13268	0.20%					0.07	12.714	34265	0.61%	0.41%	96.50%	0.40%	95.57%				
5.322	27206	0.41%	0.027	5.349	25861	0.39%	0.029	5.351	21913	0.39%	0.40%	96.90%	0.40%	95.97%				
8.377	26404	0.40%	0.03	8.407	26479	0.40%	0.035	8.412	21614	0.39%	0.40%	97.30%	0.39%	96.36%				
10.876	25089	0.38%	0.03	10.906	26187	0.40%	0.032	10.908	20884	0.37%	0.38%	97.68%	0.38%	96.74%				
9.637	22019	0.34%	0.031	9.668	24703	0.37%	0.035	9.672	19263	0.35%	0.35%	98.03%	0.35%	97.09%				
15.454	19719	0.30%	0.022	15.476	24257	0.37%	0.024	15.478	15999	0.29%	0.32%	98.35%	0.32%	97.40%				
12.145	23904	0.36%	0.03	12.175	22360	0.34%	0.031	12.176	12855	0.23%	0.31%	98.66%	0.31%	97.71%				
12.382	19910	0.30%	0.031	12.413	20600	0.31%	0.031	12.413	13157	0.24%	0.28%	98.95%	0.28%	97.99%				
4.959	17700	0.27%	0.025	4.984	17656	0.27%	0.026	4.985	15370	0.28%	0.27%	99.22%	0.27%	98.26%				
16.639	17519	0.27%	0.023	16.662	17562	0.27%	0.021	16.66	15189	0.27%	0.27%	99.48%	0.27%	98.53% Farnesylacetat				
15.257	16479	0.25%	0.022	15.279	17387	0.26%	0.023	15.28	14285	0.26%	0.26%	99.74%	0.25%	98.78%				
8.601	16202	0.25%	0.031	8.632	15764	0.24%	0.034	8.635	13393	0.24%	0.24%	99.98%	0.24%	99.02%				
8.967	15773	0.24%	0.031	8.998	16684	0.25%	0.033	9	12696	0.23%	0.24%	100.22%	0.24%	99.26%				
			7.542	7.542	12174	0.18%	7.544	7.544	11720	0.21%	0.20%	100.42%	0.20%	99.45%				
							18.493	18.493	10437	0.19%	0.19%	100.61%	0.19%	99.64%				
10.055	11925	0.18%	0.031	10.086	12131	0.18%	0.033	10.088	10580	0.19%	0.19%	100.79%	0.18%	99.82%				
			14.839	14.839	11829	0.18%	0				0.18%	100.97%	0.18%	100.00%				

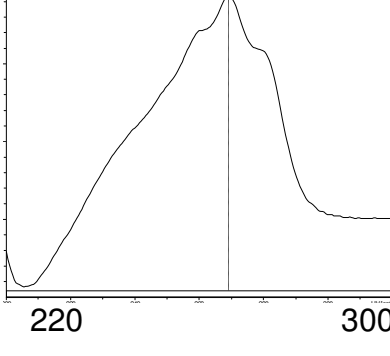
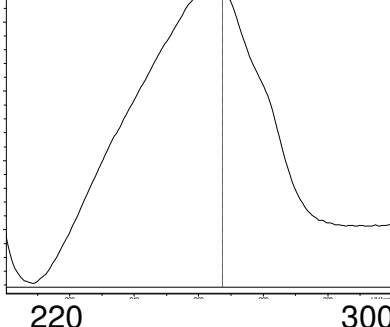
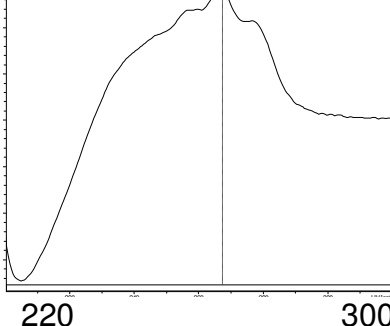
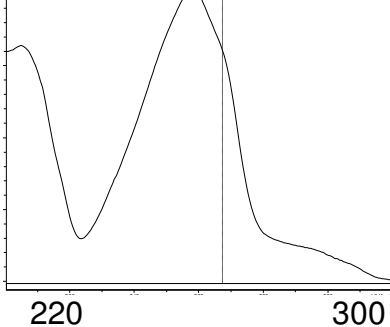
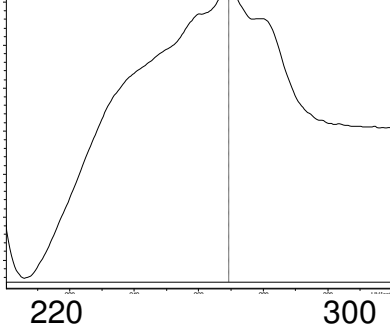
Zanthoxylum bungeanum Gansu**Zanthoxylum bungeanum Gansu Öl**

RT A	Area A	% A	RT B	Area B	% B	RT C	Area C	% C	D.	D. Summe	D. Korr.	D. Summe	Substanzen	
5.761	989386	48.13%	-0.003	5.758	463687	47.56%	0.039	5.8	1046639	49.64%	48.44%	48.44%	47.96%	Limonen
5.069	216069	10.51%	0.010	5.079	97986	10.05%	0.036	5.105	231853	11.00%	10.52%	58.96%	10.41%	β-Pinen
9.125	169050	8.22%	0.011	9.136	79190	8.12%	0.036	9.161	165988	7.87%	8.07%	67.03%	7.99%	Linalylanthranilat
6.746	139820	6.80%	0.010	6.756	62879	6.45%	0.038	6.784	143859	6.82%	6.69%	73.72%	6.62%	β-Linalool
8.057	109518	5.33%	0.010	8.067	52908	5.43%	0.037	8.094	109928	5.21%	5.32%	79.04%	5.27%	L-4-Terpineol
4.878	48010	2.34%	0.012	4.89	21516	2.21%	0.033	4.911	51431	2.44%	2.33%	81.37%	2.30%	Sabinen
6.167	42182	2.05%	0.013	6.18	19247	1.97%	0.035	6.202	43794	2.08%	2.03%	83.40%	2.01%	γ-Terpinen
8.229	34363	1.67%	0.014	8.243	17065	1.75%	0.034	8.263	33648	1.60%	1.67%	85.08%	1.66%	α-Terpineol
5.94	29226	1.42%	0.015	5.955	13798	1.42%	0.036	5.976	32590	1.55%	1.46%	86.54%	1.45%	85.68% β-cis-Ocimen
12.526	25668	1.25%	0.013	12.539	14915	1.53%	0.030	12.556	21452	1.02%	1.27%	87.80%	1.25%	86.94% Germacren
10.548	23580	1.15%	0.016	10.564	12736	1.31%	0.033	10.581	22567	1.07%	1.17%	88.98%	1.16%	88.10% Terpineolacetat
5.527	20356	0.99%	0.012	5.539	9589	0.98%	0.034	5.561	22224	1.05%	1.01%	89.99%	1.00%	89.10% α-Terpinen
12.996	13483	0.66%	0.013	13.009	9556	0.98%	0.029	13.025	12805	0.61%	0.75%	90.73%	0.74%	89.84% δ-Cadinen
6.645	15111	0.74%	0.016	6.661	7089	0.73%	0.036	6.681	16042	0.76%	0.74%	91.48%	0.73%	90.57%
4.336	14745	0.72%	0.010	4.346	6862	0.70%	0.030	4.366	16596	0.79%	0.74%	92.21%	0.73%	91.30% α-Pinen
10.91	12978	0.63%	0.017	10.927	6403	0.66%	0.030	10.94	11495	0.55%	0.61%	92.82%	0.61%	91.91% Geraniolacetat
10.651	11280	0.55%	0.019	10.67	5352	0.55%	0.032	10.683	9619	0.46%	0.52%	93.34%	0.51%	92.42% Nerolacetat
5.34	9766	0.48%	0.014	5.354	4610	0.47%	0.034	5.374	10976	0.52%	0.49%	93.83%	0.48%	92.90% α-Phellandren
11.725	8841	0.43%	0.015	11.74	5370	0.55%	0.031	11.756	8449	0.40%	0.46%	94.29%	0.46%	93.36% Caryophyllen
12.722	8035	0.39%	0.013	12.735	5332	0.55%	0.030	12.752	7591	0.36%	0.43%	94.72%	0.43%	93.79%
6.297	10046	0.49%	0.015	6.312	3576	0.37%	0.035	6.332	8163	0.39%	0.41%	95.14%	0.41%	94.20% β-cis Terpineol
14.663	6311	0.31%	0.007	14.67	5678	0.58%	0.027	14.69	6212	0.29%	0.39%	95.53%	0.39%	94.59% α-Eudesmol
12.919	6978	0.34%	0.013	12.932	4964	0.51%	0.029	12.948	6673	0.32%	0.39%	95.92%	0.38%	94.97%
7.161	7181	0.35%	0.017	7.178	3029	0.31%	0.036	7.197	7166	0.34%	0.33%	96.25%	0.33%	95.30%
14.493	5356	0.26%	0.011	14.504	4715	0.48%	0.026	14.519	5321	0.25%	0.33%	96.59%	0.33%	95.63% α-Cadinol
8.323	12792	0.62%	0.017	8.34	1347	0.14%	0.033	8.356	1104	0.05%	0.27%	96.86%	0.27%	95.90% trans-Piperitol
12.18	4956	0.24%	0.014	12.194	3176	0.33%	0.031	12.211	4691	0.22%	0.26%	97.12%	0.26%	96.16% α-Caryophyllen
16.678	3522	0.17%	0.013	16.691	3632	0.37%	0.028	16.706	3566	0.17%	0.24%	97.36%	0.24%	96.40% Farnesylacetat
8.756	5100	0.25%	0.031	8.787	1928	0.20%	-8.756			0.00%	0.22%	97.58%	0.22%	96.62% cis-Geraniol
5.627	4248	0.21%	0.013	5.64	2035	0.21%	0.035	5.662	4281	0.20%	0.21%	97.79%	0.20%	96.82%
13.539	3742	0.18%	0.013	13.552	2481	0.25%	0.029	13.568	3114	0.15%	0.19%	97.98%	0.19%	97.01% γ-Elemen
11.486	3850	0.19%	-11.486			0.00%	-11.486			0.00%	0.19%	98.17%	0.19%	97.20%
			12.678	2141	0.22%	12.693	12.693	3194	0.15%	0.19%	98.35%	0.18%	97.38%	
13.76	3220	0.16%	0.012	13.772	2450	0.25%	0.028	13.788	3097	0.15%	0.18%	98.54%	0.18%	97.56%
10.093	3798	0.18%	0.027	10.12		0.00%	-10.093			0.00%	0.18%	98.72%	0.18%	97.75%
7.432	3448	0.17%	0.018	7.45	1708	0.18%	0.034	7.466	3609	0.17%	0.17%	98.89%	0.17%	97.92%
4.208	3348	0.16%	0.010	4.218	1640	0.17%	0.030	4.238	3797	0.18%	0.17%	99.07%	0.17%	98.09% α-Thujen
8.485	3365	0.16%	-8.485			0.00%	-8.485			0.00%	0.16%	99.23%	0.16%	98.25%
			0.000			8.788	8.788	3442	0.16%	0.16%	99.39%	0.16%	98.41%	
9.845	2910	0.14%	0.017	9.862	1544	0.16%	0.033	9.878	2895	0.14%	0.15%	99.54%	0.14%	98.55%
11.256	2780	0.14%	0.015	11.271	1477	0.15%	0.031	11.287	2350	0.11%	0.13%	99.67%	0.13%	98.69%
15.3	1980	0.10%	0.005	15.305	2000	0.21%	0.021	15.321	2019	0.10%	0.13%	99.80%	0.13%	98.82%
7.826	2575	0.13%				0.00%	-7.826			0.00%	0.13%	99.93%	0.12%	98.94%
12.416	1912	0.09%	0.014	12.43	1207	0.12%	0.030	12.446	1781	0.08%	0.10%	100.03%	0.10%	99.04%
4.963	1507	0.07%	0.015	4.978	1126	0.12%	0.035	4.998	2132	0.10%	0.10%	100.13%	0.10%	99.14%
			8.503	8.503	881	0.09%	8.519	8.519	1727	0.08%	0.09%	100.21%	0.09%	99.22%
13.864	1459	0.07%	0.013	13.877	1151	0.12%	0.028	13.892	1432	0.07%	0.09%	100.30%	0.08%	99.31%
13.378	1736	0.08%	-13.378			0.00%	-13.378			0.00%	0.08%	100.38%	0.08%	99.39%
			9.191	9.191	727	0.07%	0.000			0.00%	0.07%	100.46%	0.07%	99.46%
8.65	1640	0.08%	-8.650			0.00%	0.032	8.682	1128	0.05%	0.07%	100.52%	0.07%	99.53%
13.322	1254	0.06%	-13.322			0.00%	-13.322			0.00%	0.06%	100.58%	0.06%	99.59%
			20.892	20.892	575	0.06%	0.000			0.06%	0.06%	100.64%	0.06%	99.65%
9.668	1242	0.06%	0.019	9.687	585	0.06%	0.035	9.703	1099	0.05%	0.06%	100.70%	0.06%	99.70%
			18.534	18.534	747	0.08%	18.553	18.553	746	0.04%	0.06%	100.76%	0.06%	99.76%
			12.481	12.481	622	0.06%	12.496	12.496	969	0.05%	0.05%	100.81%	0.05%	99.81%
10.436	1126	0.05%	0.019	10.455	585	0.06%	0.033	10.469	1020	0.05%	0.05%	100.87%	0.05%	99.87%
12.284	993	0.05%	0.016	12.3	631	0.06%	0.031	12.315	891	0.04%	0.05%	100.92%	0.05%	99.92%
			0.000		544	0.06%	10.128	10.128	773	0.04%	0.05%	100.96%	0.05%	99.97%
			0.000				11.117	11.117	733	0.03%	0.03%	101.00%	0.03%	100.00%
	2055842	100.00%			974992	100.00%			2108671	100.00%	101.00%		100.00%	

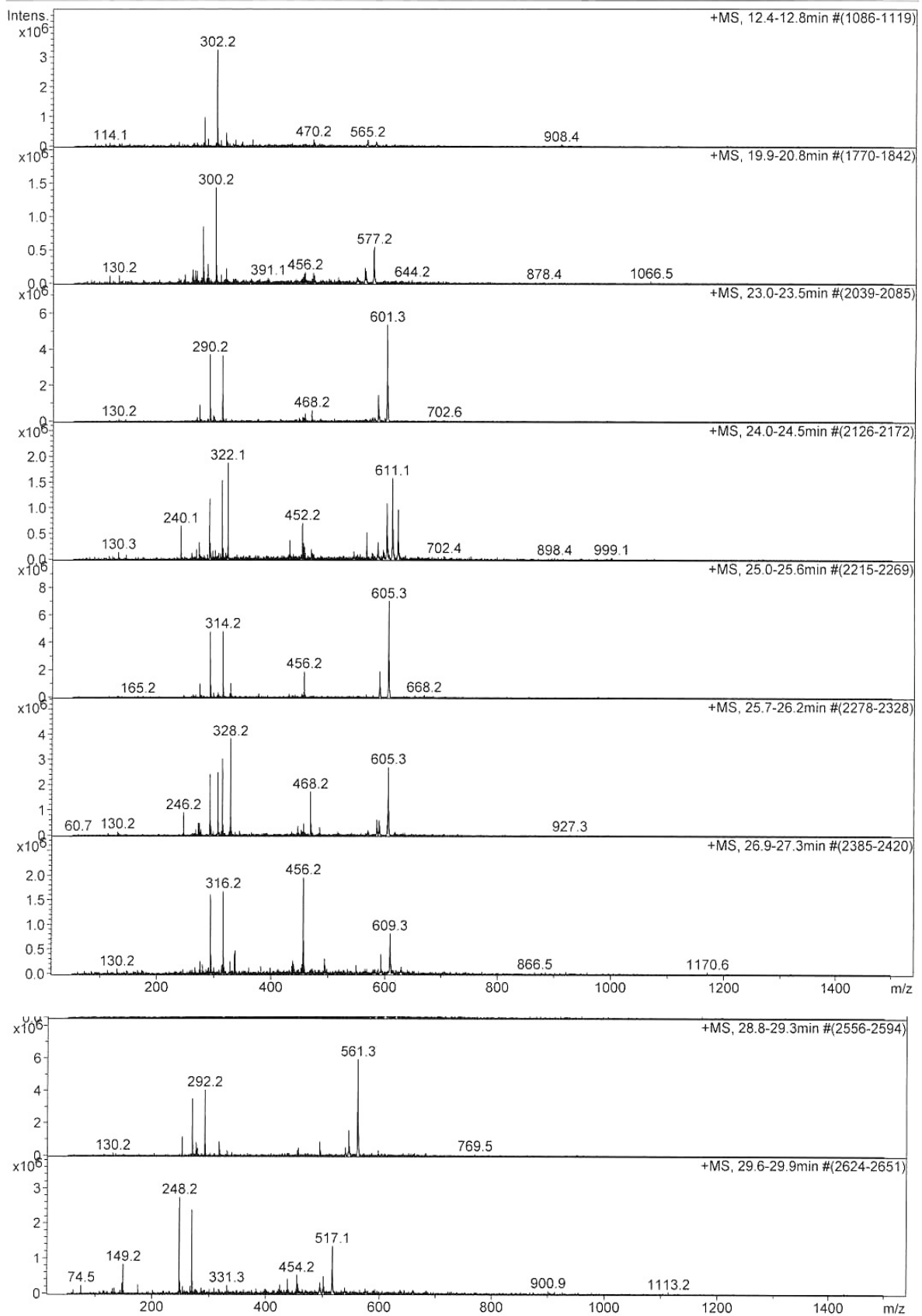
D HPLC-UV Spektren mit Strukturideen

	RT: 15.49min UV _{max} : 269; 270; 281 Signalstärke: 8mAU m/z: vielleicht 191	
	RT: 18.70min UV _{max} : 265; 277; 259 Signal: 18mAU m/z: 321	
	RT: 20.02min UV _{max} : 258 Schulter: 262; 275 Signal: 7mAU m/z: 279	
	RT: 20.54min UV _{max} : 261; 268; 281 Signal: 8mAU m/z: 277	
	RT: 20.57min UV _{max} : 260, 270; 280 Signal: 7mAU m/z: 277	

	<p>RT: 21.40min UV_{max}: 265; 280 Schulter: 261 Signal: 4mAU m/z: 277</p>	
	<p>RT: 22.04min UV_{max}: 260; 269; 281 Signal: 3mAU m/z: 277</p>	
	<p>RT: 23.15min UV_{max}: 260; 270 Schulter: 279 Signalstärke: 34mAU m/z: 289</p>	<p>Hydroxy-γ-Isosanshool oder Hydroxy-γ-Sanshool</p>
	<p>RT: 24.15min UV_{max}: 259;270;282 Signalstärke: 24mAU m/z: 289</p>	<p>Hydroxy-γ-Isosanshool oder Hydroxy-γ-Sanshool</p>
	<p>RT: 25.18min UV_{max}: 260 Signalstärke: 25mAU m/z: 291</p>	<p>Bungeanool oder Isobungeanool; nur ein Maximum spricht für ein Bungeanool</p>

	<p>RT: 25.69min UV_{max}: 259; 270; 280 Singalstärke: 15mAU m/z: 305</p>	
	<p>RT: 25.83min UV_{max}: 260; 270 Singalstärke: 17mAU m/z: 291 oder 293</p>	<p>Bungeanool oder Isobungeanool für m/z 291</p> <p>m/z 293 kann Dihydro- bungeanool sein</p>
	<p>RT: 26.51min UV_{max}: 255; 265; 278 Singalstärke: 65mAU m/z: 305 oder 293</p>	<p>m/z 293 könnte Dihydrobungeanool sein</p>
	<p>RT: 29.19min UV_{max}: 259 Singalstärke: 40mAU m/z: 269</p>	<p>ein Bungeanool mit C₁₂⁻ Kette</p>
	<p>RT: 29.67min UV_{max}: 260; 270; 281 Singalstärke: 75mAU m/z: 247</p>	<p>α-Sanshool oder β-Sanshool</p>

E HPLC-MS Spektren



F LC-NMR Protonenspektren

