









ORIGINAL ARTICLE

## The effects of biotic and abiotic stress on the emission of volatile organic compounds by sugar beet plants

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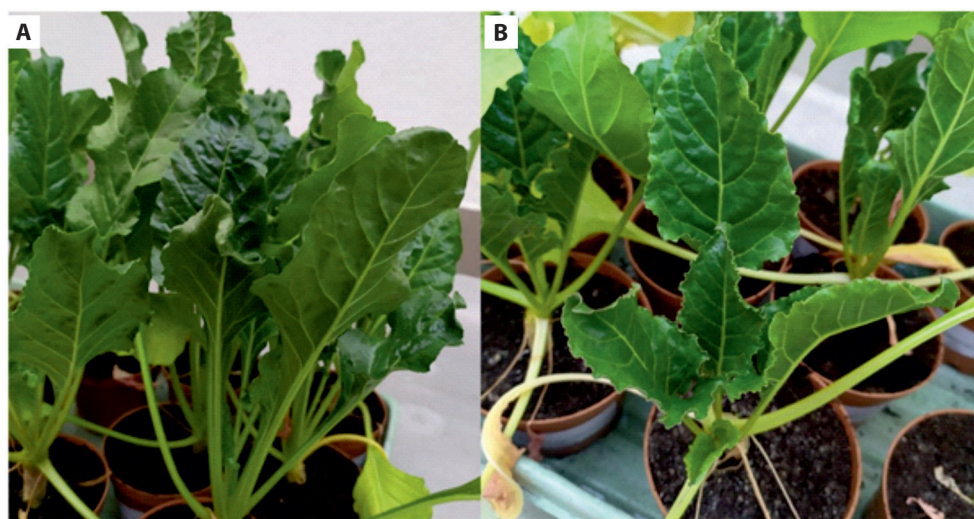
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### SUPPLEMENTARY MATERIAL

The authors are fully responsible for both the content and the formal aspects of the supplementary material. No editorial adjustments were made.



**Fig. S1.** Sugar beet plants: A – unstressed (control, watered twice a week with 1400 ml of water), and B – subjected to drought stress (watered twice a week with 800 ml of water) over a period of 2 weeks

**Table S1.** Raw data obtained from the GC-MS analyses of volatile samples collected from sugar beet plants depending on the stress type (i.e., drought conditions (800 mL of water twice a week), mite attack, and drought plus mite attack) for samples collected on sampling days 2, 3, and 6 following mite feeding. The controls were unstressed sugar beet plants (1400 mL of water twice a week). (Z)-3-HAL = (Z)-3-hexenal, (Z)-3-HOL = (Z)-3-hexen-1-ol, (E)-2-HOL = (E)-2-hexen-1-ol,  $\beta$ -PIN =  $\beta$ -pinene, (Z)-3-HAC = (Z)-3-hexen-1-yl acetate, (Z)-OCl = (Z)-ocimene, LIN = linalool, BAC = benzyl acetate,  $\beta$ -CAR =  $\beta$ -caryophyllene, and (E)- $\beta$ -FAR = (E)- $\beta$ -farnesene

Plant treatment/volatile compounds	(Z)-3-HAL	(Z)-3-HOL	(E)-2-HOL	$\beta$ -PIN	(Z)-3-HAC	(Z)-OCl	LIN	BAC	$\beta$ -CAR	(E)- $\beta$ -FAR
Drought and mites – day 2										
1	499.25	1256	1486.25	2173.25	1738.75	1560.5	1638.75	3493.25	3282.25	622.75
2	486.25	1339	1504.25	2159.25	1694.75	1511.25	1573.75	3348.25	3902.75	590
3	411.75	1163.5	1341.25	1914	1524.25	1613.75	1441	3119.5	3183.75	465.75
4	418.25	1131.25	1248.25	1689.5	1294.25	1193.5	1247.75	2725	3259.75	492.75
5	427	1224.25	1356.5	1908.25	1456.25	1357	1418.75	3089.25	3615.25	543.5
6	353.5	932	1043.75	1416.75	1079.5	1004.5	1044	2296	2728	410.75
7	290	800.25	878	1238	962	898.25	892.5	1985.75	2457	374.75
8	293	889	1001.25	1374.5	1031	969	989.5	2170.25	2559.25	384
Mites – day 2										
1	315.5	977.75	1068.75	1494.75	1115.25	1047.5	1066.75	2347.25	2695.25	488.25
2	339.5	995	1108.5	1601	1198.5	1139	1167.75	2579	3036.5	476
3	355.75	935.25	1034.75	1508	1131.75	1083.25	1106.5	2487.25	3020.5	409.75
4	374.25	1014.75	1117.25	1598	1183.75	1134.75	1156.25	2613.25	3171	406
5	322.5	959.25	1043	1504.75	1062.75	1004	1006.75	2240	2727	332.75
6	387	1139.5	1267.25	1752	1294.25	1233.75	1257.25	2793.5	3316.75	380
7	295.5	747.25	850	1220.75	923	890.25	918.5	2086	2614.5	324
8	248.5	586.5	925.5	1065.25	780.5	837.25	773.75	2050.25	3094	560
Drought – day 2										
1	235	582	646.5	977	707.25	621	673.5	1804.75	2949.5	685.5
2	215.75	488.5	549.5	812.25	592	578.25	570	1323.75	2387.75	537.75
3	281.25	625.5	706.75	1152.5	842.5	840.5	840.75	1939.75	3393.5	106.75
4	211.5	430.75	491.75	776.5	572.75	564.5	561.5	1310.25	2356.25	453.75

**Table S1.** Raw data obtained from the GC-MS analyses of volatile samples collected from sugar beet plants depending on the stress type (i.e., drought conditions (800 mL of water twice a week), mite attack, and drought plus mite attack) for samples collected on sampling days 2, 3, and 6 following mite feeding. The controls were unstressed sugar beet plants (1400 mL of water twice a week). (Z)-3-HAL = (Z)-3-hexenal, (Z)-3-HOL = (Z)-3-hexen-1-ol, (E)-2-HOL = (E)-2-hexen-1-ol,  $\beta$ -PIN =  $\beta$ -pinene, (Z)-3-HAC = (Z)-3-hexen-1-yl acetate, (Z)-OCI = (Z)-ocimene, LIN = linalool, BAC = benzyl acetate,  $\beta$ -CAR =  $\beta$ -caryophyllene, and (E)- $\beta$ -FAR = (E)- $\beta$ -farnesene – continuation

Plant treatment/volatile compounds	(Z)-3-HAL	(Z)-3-HOL	(E)-2-HOL	$\beta$ -PIN	(Z)-3-HAC	(Z)-OCI	LIN	BAC	$\beta$ -CAR	(E)- $\beta$ -FAR
5	204	442.25	502.5	722	530	512.5	500.25	1159.5	2030.75	163.5
6	318.75	684.75	769.75	1210.25	899.5	864.75	859	2079.25	3445.5	317.5
7	264.25	543.5	622.25	809.5	689.5	576.5	570.5	1327.75	2499.5	531.25
8	308.75	594.75	664	901	768.75	647.75	648.25	1518	2972	381.5
Drought and mites – day 3										
1	279	539	609.75	845	728	627.25	628	1455	2790.25	67
2	243.25	436.75	489	661	574.75	487.25	492	1142.5	2265.5	131
3	345	680.75	784.5	1138	964.25	824.25	845.25	1944	3639.25	39.5
4	228	458	518.25	681	584.5	494	498	1141.75	2198.25	89.25
5	81.75	92	110	223.75	176.75	163.5	147.75	401	579.25	78.5
6	51.75	88.75	97.5	162	133	119.25	102.75	261.25	365.5	48.25
7	64.25	113	135	206.75	164.5	148.5	130.25	328.5	452	58.75
8	66.25	95.25	113	178.75	141	130	112.75	300	433.25	49.25
Mites – day 3										
1	65.25	124.75	142	236.5	185.75	164.75	142	364.75	498.25	72.5
2	111	113.75	133	257.25	204.75	192	176.25	447.5	718.5	80
3	67.25	102.25	123.75	215.75	163.5	157.75	134	361.5	497.5	76
4	66.75	90.25	106.25	169.5	135.75	124.5	110.25	283	427.5	49.25
5	57.25	92	104.75	186	146.75	133.75	118.75	295.75	416.75	56.5
6	55.25	142	155	256.75	216.25	200.75	149.75	354	460.25	62.75
7	61	97	110.75	182.25	143	129.75	115.25	289	406.75	53.5
8	162.25	142.75	158.75	345.25	288	270.75	219.5	702.75	1100.25	150
Drought – day 3										
1	94.75	106	118	211.25	170.75	156.25	144.25	360.25	549.5	85
2	87.75	136	159.5	260.75	204	190.75	173.75	435.5	595.75	64.75
3	80.5	143.5	154.75	259.5	202.75	185	167.25	407.25	540.25	61.75
4	30	45	50.25	80.5	63	65.75	48.75	129	187	24.75
5	25.75	41.5	45.75	81.75	62.5	67	48.5	125.75	178.5	24
6	36.75	48.75	52.5	95.25	72.5	79.5	58.25	157	228	28.5
7	31.5	43.25	45	83	64	69.25	50.5	135.25	200.25	23.5
8	25.5	45.25	48.75	82.25	63.25	66.25	47.25	126	171	21.5
Drought and mites – day 6										
1	47.75	53	56	121.5	107	101.5	87.5	183.25	311	38.75
2	26	47.5	51.5	88	63.75	75.25	51.75	137.75	191.75	27
3	69.25	58.75	68	161	119.75	134	104.75	269	418.5	49.25
4	48	63	67	122.5	93.75	101.25	82	195.25	316	40.25
5	22	35.25	33	59.25	45.75	47.5	35.25	92.5	138	20.5
6	37	53.5	58.75	96	73.25	79.5	59.5	156.5	231.5	29
7	24.25	37	39	64	49.5	52.5	39.25	104.25	155.25	20.25
8	25	37.5	38	68.25	53.25	56.25	41.75	111.5	159.75	21

**Table S1.** Raw data obtained from the GC-MS analyses of volatile samples collected from sugar beet plants depending on the stress type (i.e., drought conditions (800 mL of water twice a week), mite attack, and drought plus mite attack) for samples collected on sampling days 2, 3, and 6 following mite feeding. The controls were unstressed sugar beet plants (1400 mL of water twice a week). (Z)-3-HAL = (Z)-3-hexenal, (Z)-3-HOL = (Z)-3-hexen-1-ol, (E)-2-HOL = (E)-2-hexen-1-ol,  $\beta$ -PIN =  $\beta$ -pinene, (Z)-3-HAC = (Z)-3-hexen-1-yl acetate, (Z)-OCI = (Z)-ocimene, LIN = linalool, BAC = benzyl acetate,  $\beta$ -CAR =  $\beta$ -caryophyllene, and (E)- $\beta$ -FAR = (E)- $\beta$ -farnesene – continuation

Plant treatment/volatile compounds	(Z)-3-HAL	(Z)-3-HOL	(E)-2-HOL	$\beta$ -PIN	(Z)-3-HAC	(Z)-OCI	LIN	BAC	$\beta$ -CAR	(E)- $\beta$ -FAR
Mites – day 6										
1	22.75	35.5	40.25	62.5	48.25	51.75	37.5	103	149.5	18
2	8.25	7.25	8.5	19.25	15.25	15.5	11.5	37.25	50	6.75
3	4.25	8	7	15	12	10.75	8	25	31.75	3
4	3.25	3	1.75	9.25	7.25	6.25	4.5	16	22	2
5	3.75	4	5	10.5	8.5	7.5	5.5	19	25.75	2.5
6	8.75	8.75	8.75	20.25	16.5	15.75	11.75	40.25	53.25	4.5
7	7.25	9.5	10.75	24	18	17.25	13.25	38.75	57.25	6.5
8	8	7.75	8.5	14.5	14.75	10.25	10	10.75	11.75	6.5
Drought – day 6										
1	4.5	5	5.5	12.5	10	8.75	6.25	21.25	29.75	3.5
2	4	6.5	7.5	15	12	10.5	7.75	24.75	33.25	5
3	3.5	4.25	4.25	10	7.75	7	5	17	24	2.5
4	3.75	3.75	5.75	11	8	7	5	19	25.25	3.25
5	5	7	8.5	16	12.5	11.5	8.75	28	36.75	4.25
6	4	4.25	4	10.25	8.25	7.25	5.5	18.75	25.75	2.5
7	10.75	11	13.25	55	20.75	20.75	17.5	48	73	9
8	4.75	5.5	7.25	13.25	10.5	9.25	7.25	24.5	31.5	3.25
Control before the experiment										
1	2.5	3.5	2.4	0.6	6.4	0.4	0.9	1.2	1.6	1.4
2	2.3	2.1	2.1	0.5	4.3	0.5	1.2	1.3	1.1	1.2
3	3.5	0.5	0.5	0.4	5.0	0.5	1.1	0.5	0.5	0.5
4	4.2	0.9	0.6	0.2	3.5	0.4	0.5	0.9	1.2	0.6
5	6.2	0.4	2.1	1.6	4.1	2.1	0.9	0.4	0.6	0.8
6	0.9	0.5	1.5	1.8	6.0	0.5	2.1	0.5	1.2	0.1
7	2.6	1.0	1.6	0.5	3.2	0.6	1.5	2.1	0.6	2.1
8	4.0	1.2	1.4	0.8	3.5	0.4	1.0	1.2	0.4	0.5
Control after the experiment										
1	3.2	2.5	0.9	0.8	6.4	0.4	0.5	0.9	0.5	0.8
2	2.1	2.1	1.2	0.2	4.3	0.5	0.6	0.5	0.6	0.6
3	2.2	1.5	1.5	0.4	5.0	0.5	0.4	0.6	0.1	2.1
4	3.6	3.2	2.1	0.5	3.5	0.4	0.5	0.2	2.3	0.6
5	2.5	0.8	0.5	0.6	4.1	2.1	0.9	1.2	5.2	0.5
6	2.4	0.4	0.4	0.1	6.0	0.5	1.0	0.8	0.0	3.2
7	0.6	0.6	0.6	0.2	3.2	0.6	2.1	0.4	0.5	1.4
8	0.8	1.0	1.2	0.5	3.5	0.4	0.0	1.0	3.2	1.3

**Table S2.** Two-way analyses of variance (ANOVA) carried out to determine the effects of stress type and sampling day as well as stress type  $\times$  sampling day interaction on the variability of the observed volatile organic compounds emitted by sugar beet plants. (*Z*)-3-hexenal = (*Z*)-3-HAL, (*Z*)-3-hexen-1-ol = (*Z*)-3-HOL, (*E*)-2-hexen-1-ol = (*E*)-2-HOL, (*Z*)-3-hexen-1-yl acetate = (*Z*)-3-HAC, (*Z*)-ocimene = (*Z*)-OCI, linalool = LIN,  $\beta$ -pinene =  $\beta$ -PIN, (*E*)- $\beta$ -farnesene = (*E*)- $\beta$ -FAR,  $\beta$ -caryophyllene =  $\beta$ -CAR, and benzyl acetate = BAC

Source of variation	Stress type	Sampling day	Stress type $\times$ sampling day
d.f.	2	2	4
( <i>Z</i> )-3-HAL	58675***	619085***	7453*
( <i>Z</i> )-3-HOL	450423***	4736072***	149657***
( <i>E</i> )-2-HOL	577509***	6098907***	196570***
$\beta$ -PIN	1060980***	11959013***	314526***
( <i>Z</i> )-3-HAC	712825***	6819218***	185791***
( <i>Z</i> )-OCI	598908***	6109460***	169147***
LIN	614567***	6401569***	187842***
BAC	2637193***	31820651***	706407***
$\beta$ -CAR	2431118***	52199929***	767179*
( <i>E</i> )- $\beta$ -FAR	13826 ns	1274556***	3560 ns

\* $p < 0.05$ ; \*\*\* $p < 0.001$ ; ns – not significant