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Yield and Oil Composition of 38 Basil (*Ocimum basilicum* L.) Accessions Grown in Mississippi

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A field experiment was conducted to assess yield, oil content, and composition of 38 genotypes of sweet basil (*Ocimum basilicum* L.). Overall, biomass yields were high and comparable to those reported in the literature. However, basil genotypes differed significantly with respect to oil content and composition. Oil content of the tested accessions varied from 0.07% to 1.92% in dry herbage. On the basis of the oil composition, basil accessions were divided into seven groups: (1) high-linalool chemotype [19–73% (−)-linalool], (2) linalool−eugenol chemotype [six chemotypes with 28–66% (−)-linalool and 5–29% eugenol], (3) methyl chavicol chemotype [six accessions with 20–72% methyl chavicol and no (−)-linalool], (4) methyl chavicol−linalool chemotype [six accessions with 8–29% methyl chavicol and 8–53% (−)-linalool], (5) methyl eugenol–linalool chemotype [two accessions with 37% and 91% methyl eugenol and 60% and 15% (−)-linalool], (6) methyl cinnamate–linalool chemotype [one accession with 9.7% methyl cinnamate and 31% (−)-linalool], and (7) bergamotene chemotype [one accession with bergamotene as major constituent, 5% eucalyptol, and <1% (−)-linalool]. Our results demonstrated that basil could be a viable essential oil crop in Mississippi. The availability of various chemotypes offers the opportunity for production of basil to meet the market requirements of specific basil oils or individual compounds such as (−)-linalool, eugenol, methyl chavicol, methyl cinnamate, or methyl eugenol.

KEYWORDS: Basil; *Ocimum basilicum*; essential oil composition; chemotypes; oil content; yields

INTRODUCTION

Sweet basil (*Ocimum basilicum* L.) is a widely grown aromatic crop cultivated either for production of essential oil, dry leaves for the fresh market, or as an ornamental (*1, 2*). Within this species, there is a significant variation in phenotype and chemotype in terms of oil content and oil composition (*2–4*).

Historically, due to its pleasant aroma that suppresses other scents, basil has been widely used in religious rituals in various cultures and times (*2, 5, 6*). Fresh basil is used as an ingredient in various dishes and food preparations, especially in the Mediterranean cuisine. Due to its antimicrobial (*7–10*) and insecticidal (*11*) activity and very pleasant aroma, basil essential oil is widely used in the food, pharmaceutical, cosmetic, and aromatherapy industries. Although there has been substantial research on basil essential oil content and composition, most studies in other countries have been limited to either locally grown cultivars (*3*) or (in the case of the United States) mostly in the northern United States (*4*). It is well-known that environmental conditions and agricultural practices may significantly modify productivity, oil content, and composition of sweet basil (*2, 3, 12*).

Long-term traditional uses and wide distribution throughout the world, as well as traditional selection and breeding efforts, have resulted in a great variation in the essential oil composition among basil cultivars currently on the international market. Most of the sweet basil chemotypes grown in Europe are characterized by a very fine aroma with linalool and methyl chavicol as major oil constituents (*1, 13*). The Reunion basil (another chemotype) is distinguished by a high concentration of methyl chavicol, while most tropical chemotypes of basil have methyl cinnamate as a main constituent of the essential oil. Another frequent chemotype high in eugenol is grown in North Africa, Russia, Eastern Europe, and parts of Asia (*13*). Breeding programs for basil in the United States have explored the natural diversity and the presence of chemotypes in sweet basil to develop basil cultivars with specific aromas and fragrances for niche markets (*1, 14, 15*).

Comparative studies of a large number of pheno- and genotypes of sweet basil (*O. basilicum* L.) in the southeastern United States in general are lacking. There is a significant interest in sweet basil as a prospective new high-value essential oil crop in the southeastern United States; however, there are

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Table 1. Standard Curve Data of the Commercial Standards Run on a Varian CP-3800 GC Coupled to a Varian Saturn 2000 MS/MS

standard[a]	R^2 from standard curve	retention index[b]	range (mg/mL)	limit of detection (mg/mL)
(−)-linalool	1.00	1099	1.00:0.100	0.0100
(−)-camphor	0.994	1146	1.00:0.00100	0.000100
α-humulene	0.994	1453	1.00:0.000100	0.0000100
eucalyptol	0.995	1035	1.00:0.00100	0.000100
eugenol	0.995	1356	1.00:0.100	0.0100
(−)-bornyl acetate	0.996	1285	1.00:0.00100	0.000100
methyl chavicol	0.997	1197	1.00:0.100	0.0100
methyl cinnamate	0.996	1380	1.00:0.100	0.0100
methyl eugenol	0.992	1401	1.00:0.100	0.0100
(−)-*trans*-caryophyllene	0.995	1418	1.00:0.000100	0.0000100

[a] All standards were commercially available. [b] Retention index computed as described previously by Kovats (*25*).

no reports on basil productivity, essential oil content, and composition in this region. The hypothesis of this study was that certain basil genotypes may be better suited to be grown in Mississippi as a high-value essential oil crop. This is the first study on productivity, oil content, and composition of a large number of basil (*O. basilicum* L.) accessions originating from various parts of the world.

MATERIALS AND METHODS

Plant Materials and Growing Conditions. Thirty-seven accessions of sweet basil (*O. basilicum* L.) have been acquired from the USDA-ARS National Plant Germplasm System. In addition, a basil (*O. basilicum*) breeding line with a known productivity and essential oil content and composition was included as a check (control). The check basil line represented typical essential oil composition and biomass productivity of basil chemotypes grown in southeastern European countries, one of the traditional basil essential oil producing regions in the world. A field experiment was conducted in 2006 at the North Mississippi Research and Extension Center (NMREC) in Verona, MS, using a randomized complete block design with four replications. Basil transplants from all accessions and the breeding line were produced in a greenhouse in April. Basil was seeded in 48-cell plastic trays, filled with Metromix 300 (The Scotts Co., Marysville, OH) growth medium. The trays were placed in a greenhouse in March and grown for 45 days with a day temperature of 22–25 °C and night temperature of 18 °C without supplemental light. After emergence, basil plants were irrigated daily and fertilized weekly with easily soluble and available forms of N, P, and K (1.8 g of 20−20−20 N−P_2O_5−K_2O dissolved in 300 mL of water).

The soil at the experimental site was Quitman sandy loam (fine-loamy, siliceous, semiactive, thermic, Aquic Paleudult) with 1.15% organic matter, 6% clay, 55% silt, and 38% sand, pH of 6.4, and concentration of available nutrients in kg ha^{-1} as follows: P, 63; K, 59; Ca, 1912; Mg, 81; Zn, 1.4; S, 130; and Na, 118. The previous crop was a perennial grass. The grass was burned down with a glyphosate at 2 kg ha^{-1} in early spring; land preparation was accomplished with disking 2 weeks after the application of the herbicide. Raised beds were prepared shortly after disking using a press-pan-type bed shaper machine that covered the beds with black plastic mulch and positioned a drip tape irrigation tube at 2–3 cm soil depth under the plastic in the middle of the bed. Basil seedlings were transplanted in the field in previously prepared holes (made with a propane burner) in the black plastic. Black plastic covered raised beds reflect the common horticultural practices in the southeastern United States; such systems provide improved surface drainage, efficient irrigation, and weed control. Individual research plots were 2.1 m × 6 m with 40 basil plants in each plot. Basil was transplanted on two rows on each bed in an offset pattern, with 30 cm in row and 30 cm between row spacing.

The average maximum daily temperatures for the months of April, May, and June were 25.9, 27.5, and 32.2 °C, while the average minimum daily temperatures were 13.3, 15.7, and 18.7 °C, respectively.

Table 2. Dry Matter Yields, Oil Content, and Yield of 38 Basil (*O. basilicum* L.) Accessions

accession no. (BA)	origin no.	dry matter yields, kg/ha	SD	oil content, %	oil yield, kg/ha
1	PI172997	4504.4	189	0.36	16.28
2	PI176646	4467.1	731	0.36	16.11
3	PI172998	4592.9	655	0.35	15.95
4	Pi253157	5492.6	1125	0.40	22.08
5	Pi174284	4435.6	260	0.37	16.68
6	Pi414200	5127.7	315	0.27	13.81
7	Ames7772	5033.4	675	0.57	28.79
8	Pi174285	3304.1	64	0.31	10.13
9	Pi358468	4278.3	272	0.34	14.72
10	NSL15586	1812.0	163	0.47	8.6
11	Pi172996	4687.3	362	0.43	20.19
12	Pi358468	4058.1	280	1.29	52.19
13	Pi368472	3907.1	226	0.11	4.22
14	Pi531396	4687.3	298	0.34	16.12
15	Pi197442	3051.5	279	1.927	58.79
16	Pi173746	5347.9	559	0.40	21.61
17	Pi182246	2359.4	292	0.48	11.39
18	Pi358467	4270.5	249	0.68	29.07
19	Ames24983	4655.8	272	0.61	28.34
20	Pi211586	4121.0	362	1.01	41.57
21		3704.2	161.4	0.24	8.79
22	Pi358465	4058.1	315	0.34	13.85
23	Pi170579	6165.8	937	0.54	33.30
24	Pi358471	4693.4	215	0.54	25.19
25	Pi170578	4346.9	241	0.22	9.65
26	Pi368695	4063.4	345	0.48	19.50
27	Pi175793	4882.4	416	0.68	33.14
28	Pi358469	5102.9	519	0.24	12.21
29	Pi358470	4283.9	412	0.07	3.113
30	Pi368700	3709.1	465	0.44	16.44
31	Pi368698	3968.9	401	0.63	24.87
32	Pi379412	4276.1	249	0.81	34.46
33	Pi263870	4315.4	538	0.93	39.99
34	Pi296391	5638.4	315	0.33	18.76
35	Pi296390	4441.3	236	0.37	16.43
36	Pi358464	5102.9	409	0.64	32.66
37	Pi379413	3748.4	518	0.46	17.24
38	Pi170578	5102.9	477	0.58	29.70

Also, the total monthly precipitation for April, May, and June was 946, 1170, and 535 mm, respectively. The relative humidity for April, May, and June was 91.3%, 91.8%, and 93.0%, respectively, with daily variations from 77% to 97%.

Basil plants at the experimental site were irrigated weekly to maintain sufficient soil moisture through the subsurface drip irrigation tape. Water-soluble fertilizers [greenhouse brand 20–20–20 (NPK), calcium nitrate (15.5–0–0), and potassium sulfate (0–0–50)] were applied with the irrigation water through the drip tape to provide a total of 120, 80, and 100 kg ha^{-1} of available forms of N, P_2O_5, and K_2O over the growing season. During the growing season, no pests or diseases were observed on any of the basil accessions. Basil plants were harvested at the same time, in full flowering, when the essential oil content is highest and the composition is most desirable (*1, 2*). The harvested biomass was dried at 40 °C, and the dry weight was recorded.

The essential oil from dried basil samples (150 g of representative subsamples) from each plot was extracted via steam distillation (90 min) using a modified Clevenger collector apparatus (*5, 16*) from Scientific Glass, CA. The oil obtained was measured by direct weighing. The oil content was calculated as the amount (g) of oil per weight (g) of dry basil tissue, while the oil yield per area was calculated from the biomass yields per area and oil content of every basil accession and replicate. Three individual samples from every accession were collected in the manner described above; measurements were made independently and analyzed separately.

GC-MS Sample Preparation and Analysis. Using a micropipet, 100 μL of oil from each sample was transferred into a 10 mL volumetric flask. Samples were brought to volume with $CHCl_3$. A 1 mL aliquot of each oil sample was placed by glass pipet into a GC vial for analysis.

Table 3. Chemical Composition of 38 Basil (*O. basilicum* L.) Accessions: Percent Analyte[a] in Basil Oil Samples

accession no.	(−)-linalool	(−)-camphor	α-humulene	eucalyptol	eugenol	(−)-bornyl acetate	methyl chavicol	methyl cinnamate	methyl eugenol	(−)-*trans*-caryophyllene
1			0.240 ± 0.0123	0.100 ± 0.0450			71.5 ± 3.90		0.840 ± 0.188	2.14 ± 0.0658
2	15.1 ± 7.23	0.588 ± 0.291	0.225 ± 0.123	1.70 ± 0.491		0.401 ± 0.392	0.247 ± 0.0805		91.1 ± 9.40	0.524 ± 0.111
3			0.191 ± 0.0361	0.0820 ± 0.0143			62.1 ± 12.5		1.02 ± 0.122	1.79 ± 0.380
4			0.462 ± 0.186	0.125 ± 0.0214			25.7 ± 8.7		1.73 ± 0.741	2.15 ± 0.520
5			0.144 ± 0.0170	0.0540 ± 0.0120			40.1 ± 10.2		0.651 ± 0.0930	1.14 ± 0.0744
6	21.5 ± 9.92	1.50 ± 0.429	0.481 ± 0.0871	3.64 ± 1.27		0.935 ± 0.606	29.2 ± 5.54			1.04 ± 0.365
7	43.0 ± 5.15	0.204 ± 0.0210	0.708 ± 0.147	0.909 ± 0.120		0.0977 ± 0.0293				3.19 ± 0.320
8	52.6 ± 6.52	1.21 ± 0.559	0.433 ± 0.153	1.57 ± 0.285		0.250 ± 0.101	11.8 ± 3.40			0.335 ± 0.0338
9	34.9 ± 5.01	0.676 ± 0.618	1.91 ± 0.518	3.91 ± 0.361		1.68 ± 1.16	14.5 ± 4.10			0.840 ± 0.134
10	65.5 ± 3.10	0.866 ± 0.230	0.406 ± 0.0315	7.11 ± 0.0430	10.9 ± 2.56	0.339 ± 0.140				1.35 ± 0.0861
11			0.222 ± 0.0220				67.1 ± 1.62		0.891 ± 0.134	1.89 ± 0.120
12	57.1 ± 8.10		0.713 ± 0.0440				0.174 ± 0.020			0.423 ± 0.0491
13	20.3 ± 1.08		2.03 ± 0.866	0.251 ± 0.182			24.7 ± 4.40			0.751 ± 0.199
14	71.3 ± 2.89	0.417 ± 0.331	0.916 ± 0.0350	1.78 ± 0.568		1.05 ± 0.375	1.92 ± 3.30			0.452 ± 0.060
15	65.9 ± 14.3		0.0890 ± 0.0250	4.91 ± 1.35		0.340 ± 0.119				0.406 ± 0.112
16	73.2 ± 5.19		0.450 ± 0.116	1.16 ± 0.356						1.80 ± 0.608
17	59.0 ± 3.54	1.91 ± 0.168	0.807 ± 0.290	4.94 ± 2.73	10.8 ± 2.49	0.636 ± 0.142				2.74 ± 0.831
18	62.1 ± 4.33		0.540 ± 0.268	2.75 ± 1.60						0.492 ± 0.250
19	57.5 ± 4.70	0.703 ± 0.191	0.497 ± 0.106	8.27 ± 2.38	29.0 ± 1.03	1.96 ± 0.639				0.282 ± 0.0522
20	60.1 ± 3.56		0.309 ± 0.0530	4.85 ± 0.586					36.6 ± 1.51	3.17 ± 0.214
21	49.2 ± 1.94		0.559 ± 0.0639	9.75 ± 1.48	2.50 ± 0.391					0.423 ± 0.0636
22	26.4 ± 1.85		0.390 ± 0.0630	0.852 ± 0.134						0.376 ± 0.0672
23	31.3 ± 2.60		0.424 ± 0.184	4.24 ± 2.21				9.72 ± 1.49		0.336 ± 0.0757
24	54.0 ± 5.26	1.12 ± 0.454	0.393 ± 0.0818	8.86 ± 3.58		0.398 ± 0.347				0.363 ± 0.0217
25	23.1 ± 14.2	3.41 ± 0.654	1.76 ± 0.866			0.980 ± 0.528				0.688 ± 0.353
26	54.2 ± 5.54	0.380 ± 0.345	0.992 ± 0.129	7.11 ± 1.05						0.643 ± 0.105
27	66.2 ± 9.38	0.191 ± 0.0270	0.318 ± 0.0230	4.93 ± 1.02		0.508 ± 0.0930				0.196 ± 0.0220
28	50.0 ± 13.1	0.506 ± 0.134	2.44 ± 0.364	4.02 ± 0.356		0.337 ± 0.237	8.02 ± 8.41			1.07 ± 0.217
29	0.256 ± 0.145		1.96 ± 1.98	5.07 ± 3.15			0.767 ± 0.448			0.965 ± 0.894
30	27.8 ± 6.66	0.368 ± 0.00270	0.158 ± 0.0403		4.87 ± 2.81	0.354 ± 0.119	1.55 ± 1.046			0.126 ± 0.0232
31	19.1 ± 1.38	0.173 ± 0.200	0.205 ± 0.0133	1.73 ± 0.484		0.070 ± 0.00570	4.22 ± 1.60			0.191 ± 0.0512
32	18.8 ± 0.364	0.175 ± 0.101	0.188 ± 0.0352	1.43 ± 0.325			1.67 ± 1.80			0.135 ± 0.0162
33	33.4 ± 0.136		0.0919 ± 0.00890	1.31 ± 0.130	10.2 ± 3.22	0.370 ± 0.0696				0.0814 ± 0.00870
34			0.682 ± 0.189				19.7 ± 5.67		0.464 ± 0.169	2.45 ± 0.383
35	8.18 ± 1.33	1.32 ± 0.254	0.220 ± 0.0987	1.42 ± 0.163		0.0774 ± 0.0334	14.8 ± 5.70			0.387 ± 0.101
36	28.1 ± 3.82	0.626 ± 0.189	0.162 ± 0.0436	1.28 ± 0.641		0.118 ± 0.0590				0.797 ± 0.0406
37	27.0 ± 6.45	1.18 ± 0.132	0.270 ± 0.0363	1.59 ± 0.835		0.419 ± 0.142	0.108 ± 0.113			0.165 ± 0.0233
38	28.8 ± 1.90	0.583 ± 0.179	0.294 ± 0.0213	1.83 ± 1.04	4.74 ± 3.27	1.30 ± 0.163				0.361 ± 0.190

[a] All compounds were identified on the basis of comparison of mass spectrometry and retention index data with that of commercially available standards. Quantification was performed using response factors determined from commercially available standards.

Basil oil from the field experiment samples and chemical standards were analyzed by GC-MS on a Varian CP-3800 GC coupled to a Varian Saturn 2000 MS/MS. The GC was equipped with a DB-5 fused silica capillary column (30 m × 0.25 mm, with film thickness of 0.25 μm) operated under the following conditions: injector temperature, 240 °C; column temperature, 60–240 °C at 3 °C/min and then held at 240 °C for 5 min; carrier gas, He; injection volume, 1 μL (splitless).

Quantitative Analysis. Commercial standards eugenol, methyl chavicol, methyl eugenol, and (−)-*trans*-caryophyllene were purchased from Aldrich (St. Louis, MO) while (−)-linalool, (−)-camphor, α-humulene, eucalyptol, (−)-bornyl acetate, and methyl cinnamate were purchased from Fluka (Switzerland). With five concentration points, an external standard least-squares regression for quantification was performed. All 16 analytes were used to formulate separate calibration curves. Linearity was imposed by using response factors and regression coefficients independently. The response factors were calculated using the equation RF = DR/*C*, where DR is the detector response in peak area (PA) and *C* is the analyte concentration (**Table 1**).

The chromatograms of each of the oils from the field experiments and the commercial basil oil samples were compared to the chromatograms from standard injections. The target peaks were confirmed by both retention time and mass spectra. Confirmed integrated peaks were then used to determine the percentage of each chemical constituent in the essential oil. The RF of the target chemical constituent was used to determine the "percent of oil" for each sample using the equation PA/RF/*C* = % (peak area/response factor/concentration) in oil.

Data analyses of oil content, dry matter, and essential oil yield data sets were performed in Quattro Pro.

RESULTS AND DISCUSSION

The yield of dry herbage from the 38 basil accessions was relatively high and varied from 1812 (BA10) to 6165 (BA23) kg ha^{-1} (**Table 2**), with most of the accessions having yields greater than the check (BA21). The yield variation reflects different genetic backgrounds and is within the yield variations reported from other studies (*2, 12, 17, 18*). Most of the accessions had yields greater than 4000 kg ha^{-1} dry herbage, which are considered very high. Our results suggest that most basil accessions can provide high yields under Mississippi climate with irrigation.

There was a great variation in the essential oil content among the basil accessions, ranging from 0.07% (BA29) to 1.92% (BA15) (**Table 2**). Most of the accessions had essential oil content above the oil content of the check. In general, the essential oil content of basil accessions in this study was within the usual content reported in other studies (*2, 12, 17, 19–21*). For example, some authors (*19*) reported basil oil content from 0.6 to 1.7 mL/100 g dry herbage, while others (*1*) reported oil content from 0.04% to 0.70% (v/fresh weight) in a study of a large number of basil accessions. However, the overall range of essential oil content of *O. basilicum* in this study is large (**Table 2**) and, to our knowledge, has not been reported previously. Differences in basil essential oil content between this study and another report from research conducted in Indiana (*1*) could be due to differential environmental conditions in

Indiana and Mississippi. It has been demonstrated that basil essential oil can vary depending on growth conditions (*2, 3, 22*).

Basil oil yield is a function of basil herbage yields and essential oil content. As such, oil yields varied from 3.1 kg ha^{-1} (BA29) to 58.8 kg ha^{-1} (BA15) (**Table 2**). Again, such wide basil herbage yield variation has not been reported previously. Noteworthy, eight of the basil accessions had yields above 30 kg ha^{-1}, and only three of the basil accessions had yields equal to or lower than our check (BA21), which represented typical basil oil yields in southeastern Europe. This finding is important in two ways: (1) the availability of a large number of accessions that could be used for basil essential oil production in Mississippi; (2) most basil accessions can provide very high essential oil yields under Mississippi climate with irrigation.

The concentration of (−)-linalool in the essential oil of the tested accessions varied from undetectable amounts (BA1, 3–5, 11), through a low of 0.26% (BA29) to around 70% (BA14 and BA16) (**Table 3**). Most of the basil accessions had relatively high (−)-linalool content, which is typical for the European sweet basil chemotypes (*1, 13*). (−)-Camphor concentration in the oil varied from undetectable amounts (BA3–5, 11–13, 15, 16, 20–23, 29, 33, 34) to 1.9% (BA17). The concentration of α-humulene ranged from <0.1% (BA15, 33) to around 2% (BA9, 13, 28, and 29). Eucalyptol concentration ranged from undetectable (BA11, 12, 25, 30, 34), through a low of around 0.05 (BA5) to 8–10% (BA19, 21). Eugenol concentration was undetected in most accessions; however, some accessions can be characterized as eugenol chemotypes (BA10, 17, 19, 21, 30, 33, 38) with one accession having eugenol up to 29% (BA19). (−)-Bornyl acetate varied from undetectable amounts to 2% (BA19). Methyl chavicol chemotype included BA1, 3–5, 11, and 34. The methyl chavicol−linalool chemotype had both methyl chavicol and (−)-linalool as major constituents and included BA6, 8, 9, 13, 28, and 35. Methyl cinnamate was found only in the oil of one accession (BA23). Methyl eugenol−linalool chemotype included BA2 and BA20, with 91% and 36% methyl eugenol, respectively. (−)-*trans*-Caryophyllene varied from 0.08% (BA33) to over 3% (BA1, 4, 7, 17, 20, 34) (**Table 3**). Unfortunately, BA29 contained bergamotene as the major constituent, which was not quantified in this study due to the lack of a commercially available standard. Overall, most of the accessions were high in (−)-linalool, methyl chavicol, and eugenol, which is typical for commercially grown cultivars of sweet basil (*1*). On the basis of the oil composition, basil accessions were divided into seven groups: (1) high-linalool chemotype, (2) linalool−eugenol chemotype [six chemotypes with 28–66% (−)-linalool and 5−29% eugenol], (3) methyl chavicol chemotype [six accessions with 20–72% methyl chavicol and no (−)-linalool], (4) methyl chavicol−linalool chemotype [six accessions with 8–29% methyl chavicol and 8–53% (−)-linalool], (5) methyl eugenol–linalool chemotype [two accessions with 36% and 91% methyl eugenol and 60% and 15% (−)-linalool], (6) methyl cinnamate–linalool chemotype [one accession with 9.7% methyl cinnamate and 31% (−)-linalool], and (7) bergamotene chemotype [one accession with 5% eucalyptol, less than 1% (−)-linalool, and significant bergamotene].

The tested accessions had various phenotypes, ranging in color from purple to green, with various shapes and sizes of inflorescences, leaves, and plant height (data not shown). Most of the basil accessions would have a significant ornamental value and/or could be used for the fresh basil market. Overall, our results confirm a general understanding of high variation in productivity, oil content, and composition and the presence of various chemotypes in *O. basilicum* (*1, 13*).

Many of the basil oil constituents quantified in this study have found applications as medicinal ingredients, flavors, fragrance, etc. (−)-Linalool, for example, is commonly used as a scent in domestic products such as soaps, detergents, shampoos, and lotions and serves as a valuable reactant in the synthesis of vitamin E and other important compounds (*23*). (−)-Camphor is used as a plasticizer for cellulose nitrate, as a moth repellent, as an antimicrobial substance, in embalming, and in fireworks. (−)-Camphor is also the active ingredient (along with menthol) in vapor-steam products and is effective as a cough suppressant (*24*).

This is the first study on productivity, oil content, and composition on such a large number of *O. basilicum* accessions in Mississippi and in the southern U.S. Our results demonstrated the availability of seven different chemotypes and the availability of a number of high-yielding basil accessions. This study also demonstrated that all of these basil accessions can be successfully grown as an essential oil crop under the environmental conditions of Mississippi and possibly other southern states, as long as the basil crop is provided with sufficient water and nutrients. The availability of various chemotypes offers the opportunity for production of basil to meet the market requirements of specific basil oils or individual compounds such as (−)-linalool, eugenol, methyl chavicol, methyl cinnamate, or methyl eugenol.

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