American Journal of Essential Oils and Natural Products

Available online at www.essencejournal.com

AJEONP American Journal of Essential Oils and Natural Products

ISSN: 2321-9114
AJEONP 2019; 7(4): 15-17

Received: 07-08-2019
Accepted: 10-09-2019

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Chemical composition of the essential oil from the aerial parts of *Boltonia asteroides* from North Alabama

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Abstract
The aerial parts of *Boltonia asteroides*, growing wild in north Alabama, have been collected, the essential oil obtained by hydrodistillation, and the essential oil analyzed by gas chromatography – mass spectrometry. The major components of *B. asteroides* were germacrene D (47.4%), dehydrolachnophyllum ester A (15.4%), and β-pinene (7.3%).

Keywords: False aster, false chamomile, Asteraceae, germacrene D, dehydrolachnophyllum ester

1. Introduction
Boltonia asteroides (L.) L'Hér. (false aster or false chamomile, Asteraceae, tribe Astereae) is a rhizotomaceous perennial herb native to eastern North America, and is found from the Dakotas south through Louisiana, Mississippi, and Alabama [1]. The plant has small (ca. 2 cm) daisy-like flowers with white ray florets with yellow disk florets (Figure 1) [2, 3]. A phytochemical study by Díaz and co-workers from plants collected from South Carolina revealed the aerial parts to contain several menthane and acyclic monoterpenoids, cadinane sesquiterpenoids, and acetylenic lactones [4]. As part of our continuing investigations on the essential oils of north Alabama Asteraceae [5–7] we have collected and analyzed the essential oil from the aerial parts of *B. asteroides*. To our knowledge, the essential oil from this plant has not been previously examined.

Fig 1: *Boltonia asteroides* (L.) L’Her. Photograph by S.K. Lawson.

2. Materials and Methods
2.1 Plant Material
The aerial parts of *B. asteroides* were collected on 12 August 2018 from the Flint River Greenway in north Alabama (34°38′40″N, 86°27′22″W, elev. 180 m). The plant was identified by S.K. Lawson; a voucher specimen (20180812-110757) has been deposited in the University of Alabama in Huntsville herbarium. The fresh plant material (49.09 g) was hydrodistilled using a Likens-Nickerson apparatus, with continuous extraction with CH_2Cl_2, for 3 h to give a pale-yellow essential oil (1.0 mg).

2.2 Gas Chromatographic – Mass Spectral Analysis
The essential oil of *B. asteroides* was analyzed by GC-MS, as described previously [8,9], using a Shimadzu GC-MS-QP2010 Ultra fitted with a Phenomenex ZB-5ms column. Identification of the essential oil components was determined by comparison of their retention indices and

their mass spectral fragmentation patterns with those in the literature [10] or in our in-house library.

3. Results and Discussion

The essential oil from hydrodistillation of the aerial parts of *B. asteroides* was obtained in very low yield (0.002%). The chemical composition of *B. asteroides* essential oil is compiled in Table 1. The essential oil was dominated by sesquiterpene hydrocarbons, including germacrene D (47.4%), the diacetylene (*Z*,*E*)-matricaria ester (15.4%), and the monoterpene β-pinene (7.3%). The presence of the diacetylenic compounds (*Z*)-lachnophyllum ester and (*Z*,*E*)-matricaria ester is consistent with the acetylenic compounds matricaria lactone, 8-decen-6-yn-4-olide, and 9-hydroxy-7-decen-5-yn-4-olide, that were previously characterized by Díaz and co-workers[4]. Diacetylenes have been found in several species of the Asteraceae, particularly in the tribes Anthemideae, Astereae, and Lactuceae[11]. The C_{10} diacetylenes lachnophyllum ester and matricaria ester have been reported in the genera *Conyza*[12], *Erigeron*[13], and*Matricaria*[14].Additionally, germacrene D has been found to dominate the leaf essential oils of several species of Asteraceae[5,7,15–17]. In spite of the common name of *B. asteroides*, false chamomile, the essential oil chemistry of *B. asteroides* is very different from chamomile, *Matricaria chamomilla*[18]. On the other hand, there are species of *Aster* that are rich in germacrene D, including *A. novae-angliae*[5], *A. spathulifolius*[19], and *A. albanicus*[20].

Table 1: Chemical composition of the essential oil from the aerial parts of *Boltonia asteroides* (L.) L'Her.

RI	Compound	%	RI	Compound	%
795	2-Methylhept-2-ene	0.2	1494	Bicyclogermacrene	1.3
802	Hexanal	0.9	1502	(*E*,*E*)-α-Farnesene	0.6
851	(2*E*)-Hexenal	2.6	1514	(*Z*)-Lachnophyllum ester	0.8
932	α-Pinene	1.0	1517	δ-Cadinene	0.9
977	β-Pinene	7.3	1524	(*Z*,*E*)-Matricaria ester	15.4
988	Myrcene	1.4	1559	(*E*)-Nerolidol	3.0
1024	*p*-Cymene	0.4	1580	Caryophyllene oxide	2.2
1028	Limonene	0.9	1654	α-Cadinol	0.7
1112	(*E*)-4,8-Dimethylnona-1,3,7-triene	1.3		Green leaf volatiles	3.4
1388	β-Elemene	4.4		Monoterpene hydrocarbons	11.0
1417	β-Ylangene	0.7		Sesquiterpene hydrocarbons	60.8
1418	β-Caryophyllene	2.9		Oxygenated sesquiterpenoids	5.9
1429	β-Copaene	0.6		Diacetylenes	16.2
1431	*trans*-α-Bergamotene	1.3		Others	1.6
1454	α-Humulene	0.7		Total identified	98.8
1480	Germacrene D	47.4			

4. Conclusions

This is the first report of the essential oil composition from *Boltonia asteroides*, and, as far as we are aware, the first report of an essential oil from any *Boltonia* species. The essential oil of *B. asteroides* was rich in sesquiterpene hydrocarbons and C_{10}diacetylenes, but the essential oil yield was very poor.

5. Acknowledgments

This work was carried out as part of the activities of the Aromatic Plant Research Center (APRC, https://aromaticplant.org/).

6. Conflicts of Interest

The authors declare no conflicts of interest

7. References

1. Kartesz JT. BONAP's North American Plant Atlas. Available online: http://bonap.net/MapGallery/County/Boltonia asteroides.png (accessed on Aug 7, 2019).
2. Radford AE, Ahles HE, Bell CR. Manual of the Vascular Flora of the Carolinas. University of North Carolina Press, Chapel Hill, North Carolina, USA, 1968, ISBN 0-8078-1087-8.
3. Missouri Botanical Garden. *Boltonia asteroides*. Available online: http://www.missouribotanicalgarden.org/PlantFinder/PlantFinderDetails.aspx?kempercode=b730 (accessed on Jul 5, 2019).
4. Díaz JG, Barba B, Herz W. Acetylenic and terpenoid constituents of *Boltonia asteroides*. Phytochemistry**.** 1994; 36(3):703-707.
5. Stewart CD, Jones CD, Setzer WN. Leaf essential oil compositions of *Rudbeckia fulgida* Aiton, *Rudbeckia hirta* L., and *Symphyotrichum novae-angliae* (L.) G.L. Nesom (Asteraceae). American Journal of Essential Oils and Natural Products. 2014; 2(1):36-38.
6. Lawson SK, Sharp LG, Powers CN, McFeeters RL, Satyal P, Setzer WN. Essential oil compositions and antifungal activity of sunflower (*Helianthus*) species growing in north Alabama. Applied Sciences. 2019; 9(15):3179.
7. Craft JD, Lawson SK, Setzer WN. Leaf essential oil compositions of bear's foot, *Smallanthus uvedalia* and *Polymnia canadensis*. American Journal of Essential Oils and Natural Products. 2019; 7(3):31-35.
8. DeCarlo A, Johnson S, Okeke-Agulu KI, Dosoky NS, Wax SJ, Owolabi MS *et al*. Compositional analysis of the essential oil of *Boswellia dalzielii* frankincense from West Africa reveals two major chemotypes. Phytochemistry. 2019; 164:24-32.
9. Vargas Suarez A, Satyal P, Setzer WN. The wood essential oil composition of *Swietenia macrophylla* from Guanacaste, Costa Rica. American Journal of Essential Oils and Natural Products. 2019; 7(1):14-16.
10. Adams RP. Identification of Essential Oil Components by Gas Chromatography/Mass Spectrometry, 4th ed. Allured Publishing, Carol Stream, Illinois, USA, 2007.
11. Konovalov DA. Polyacetylene compounds of plants of the Asteraceae family (review). Pharmaceutical Chemistry Journal. 2014; 48(9):613-631.

12. Tzakou O, Vagias C, Gani A, Yannitsaros A. Volatile constituents of essential oils isolated at different growth stages from three *Conyza* species growing in Greece. Flavour and Fragrance Journal. 2005; 20(4):425-428.
13. Nazaruk J, Kalemba D. Chemical composition of the essential oils from the roots of *Erigeron acris* L. and *Erigeron annuus* (L.) Pers. Molecules, 2009; 14(7):2458-2465.
14. Raal A, Kaur H, Orav A, Arak E, Kailas T, Müürisepp M. Content and composition of essential oils in some Asteraceae species. Proceedings of the Estonian Academy of Sciences. 2011; 60(1):55-63.
15. Washington VD, Palazzo MC, Haber WA, Setzer WN. The chemical composition and antibacterial activity of the leaf essential oil of *Neomirandea angularis* (Asteraceae) from Monteverde, Costa Rica. Journal of Essential Oil-Bearing Plants. 2010; 13(1):108-111.
16. Cardenas J, Rojas J, Rojas-Fermin L, Lucena M, Buitrago A. Essential oil composition and antibacterial activity of *Monticalia greenmaniana* (Asteraceae). Natural Product Communications. 2012; 7(2):243-244.
17. Rooks LE, Tuten JA, Haber WA, Lawton RO, Setzer WN. The antimicrobial activity and composition of *Fleischmannia pratensis* leaf essential oil from Monteverde, Costa Rica. Journal of Essential Oil-Bearing Plants. 2010; 13(2):219-223.
18. Satyal P, Shrestha S, Setzer WN. Composition and bioactivities of an (*E*)-β-farnesene chemotype of chamomile (*Matricaria chamomilla*) essential oil from Nepal. Natural Product Communications. 2015; 10(8):1453-1457.
19. Kim C, Bu HJ, Lee SJ, Hyun CG, Lee NH. Chemical compositions and anti-inflammatory activities of essential oils from *Aster spathulifolius* and *Vitex rotundifolia* maxim. Journal of Applied Pharmaceutical Science. 2014; 4(10):12-15.
20. Rajčević N, Marin PD, Vujisić L, Krivošej Z, Vajs V, Janaćković P. Chemical composition of *Aster albanicus* Deg. (Asteraceae) essential oil: Taxonomical implications. Archives of Biological Sciences, Belgrade. 2015; 67(3):1055-1061.