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PLANTS IN THE ASTERACEAE FAMILY CONTAINING ESSENTIAL OILS AT MUONG LA NATURE RESERVE, SON LA PROVINCE

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Abstract. This study aimed to evaluate the compositional diversity of essential oil-producing species within the Asteraceae family at Muong La Nature Reserve, Son La province. A comprehensive identification revealed a total of 56 species distributed across 39 genera. In addition to the value for essential oils, species of the Asteraceae family also demonstrate multiple application aspects, including medicinal (Th) with 54 species; and food (Tp) with 19 species. Additionally, 7 species as ornamental plants (Ca) while others are used for ornamental, and enological purposes. Fifteen Asteraceae species have a use value (UV) index ≥ 0.80, and 1 species (accounting for 1.72%) is identified as potentially threatened, listed in the Red Data Book of Vietnam 2007. Life forms of Asteraceae species studied are constructed as follows: the Spectrum of Biology (SB) = 50.00 % Ph + 21.43 % Th +16.07% Hm + 12.50% Ch. In the study area, the Asteraceae family is categorized into 6 main geographical factors: tropical Asia accounts (accounting for 78.57% of the total number), followed by Crop factor with 5 species (accounting for 8,93% of the total number) and Northern temperate elements with 3 species (accounting for 5.36%); Paleo-tropical with 2 species (accounting for 3.57%); The lowest factors include; Tropical Asia-Australia-America and sub-endemic with the same 1 specie (accounting for 1.79%).

Keywords: survey, Asteraceae, oil, Muong La Nature, Son La.

1. Introduction

Muong La Nature Reservation (Son La) is located in geographical coordinates: from 21^0 51'99"- 21^0 67'94" North latitude; from 103^0 93'26" - 104^0 33'84" East longitude, with a total area of 18,733.25 hectares, belonging to the administrative

boundaries of 3 communes: Ngoc Chien (7,783.72 hectares), Hua Trai (6,130.92 hectares), Nam Pam (4,818.61ha). The climatic conditions here possessed the general characteristics of a tropical monsoon, illustrating distinguished seasonal characteristics. The dry season begins from December of the previous year to April of the following year. The rainy season starts in May and lasts until November [1]. Up to now, there have been a number of works on plant diversity in the research area by Dao TMH, Tran Q K [2], and Vu TL. et al [3]. Vu TL et al [4] (2021), Vu TL, et al [5]. However, in-depth research on taxa is still relatively scarce, especially the Asteraceae family with essential oils has not been mentioned. This article provides data on the Asteraceae family with essential oils in Muong La Nature Reservation as a basis for the necessary work to orient the conservation and exploitation of plant resources here.

2. Content

2.1. Research methods

Subjects, time, location: Asteraceae species containing essential oils include 8 villages: Dong Khit, It, Bau, Peng, Ke, Dong Xuong, Luoi, and Phay in Muong La Nature Reserve, Son La province.

Sample collection and sample processing: Proceed according to the current common method of Nguyen NT [6]. Specifically: there are 8 investigation lines (total length of 63.1 km), carried out from July 2022 to May 2023.

Identify scientific name: Identify species name using comparative morphological method and following classification key: Wu ZY, Raven PH & Hong DY, eds. [7], Le KB [8], Nguyen TB [9]; Pham HH [10]; Vo VC [11], Do TL [12]. Establishing life forms (Biological spectrum) based on the division scale of Raunkiær [13] and geographical factors according to Le TC [14]. The plant specimen is kept at the Museum, Northwestern University.

- *Evaluating usage index*: Applying the method of Martin GJ [15] with a total of 240 informants between the ages of 25 and 76 years (n = 240). Use value compiled from assessment results based on practical experiences of local people and monographs by Vo VC [11], Do TL [12], Tran DL [16], and Trieu VH [17]. Identify species of the Asteraceae family that contain essential oils based on documents by Pham HH [10], Do HB [18], La DM [20]. Vegetation index (UV) calculated according to the formula by Phillips and Gentry [18], de Albuquerque, Monteiro, Ramos, de Amorim, ELC [21] and Hoang, Baas, Keβler PJA (2008b) [22]. Assessment of the level of danger: Based on the classification of Vietnam Red Book part II - Plants [23]. Synthesize, compile statistics, and calculate data and interview forms using Excel software.

2.2. Results and discussion

2.2.1. Component type

The first-step survey identifies 56 species belonging to 40 genera (Table 1).

Table 1. List of Asteraceae family containing essential oils in Muong La Nature Reserve, Son La province

No.	Science name	Life form	Geographical factor	Uses	Use value (240)	Voucher codes
1	*Adenostemma lavenia* (L.) Kuntze.	Hp	4	Thu	0.28	MLA 157
2	*Ageratina adenophora* (Spreng.) King & H. Rob. (*Eupatorium glandulosum* Kunth non Michx.)	Hp	4	Thu	0.7	MLA 108
3	*Ageratum conyzoides* L	Hp	4	Thu	0.65	MLA 36
4	*Artemisia annua* L.	Th	5.3	Thu	0.23	MLA 99
5	*Artemisia lactiflora* Wall. ex. DC	Hp	4	Thu, Tp	0,62	MLA 174
6	*Artemisia indica* Willd.	Hp	4	Thu	0.69	MLA 107
7	*Artemisia vulgaris* L.	Hp	4	Thu, Tp	1,00	MLA 177
8	*Aster amellus* L.	Hp	7	Ca	0.08	MLA 228
9	*Bidens bipinnata* L	Hp	4	Thu, Tp	0.18	MLA 236
10	*Bidens pillosa* L	Hp	4	Thu, Tp, Tavn	0.98	MLA 19
11	*Blumea balsamifera* (L.) DC	Na	4	Thu	0.41	MLA 47
12	*Blumea lacera (*Bunm.f.) DC	Ch	4.4	Thu	0,21	MLA 18
13	*Blumea lanceo-laria (*Roxb.) Druce	Na	4	Thu, Tp	0,73	MLA 145
14	*Blumea megacephala (*Rand.) Chang & Tseng	Th	4.1	Thu	0.16	MLA 64
15	*Calendula officinalis* L.	Hp	7	Thu, Ca	0.29	MLA 155
16	*Centipeda minima* (L.) A. Br. & Aschers.	Th	4	Thu	0.47	MLA 216
17	*Chrysanthemum indicum* L.	Hp	5.4	Ca, Thu	0.49	MLA 155
18	*Chrysanthemum coronarium* L	Th	7	Thu, Tp, Tavn	1.00	MLA 182
19	*Chromolaena odorata* (L.) R.King et H.Rob.	Hp	4.2	Thu	0.65	MLA 8
20	*Cirsium japonicum* Fish.ex DC.	Th	4	Thu, Ca	0.78	MLA 26
21	*Conyza canadensis* (L.) Cronq**.**	Hp	4.4	Thu	0.18	MLA 3
22	*Crassocephalum crepidioides (*Benth.) S. Moore *(Gynura creppidioides* Benth.)	Hm	4	Thu, Tavn	0.42	MLA 202
23	*Crassocephalum rubens* (Jussieu ex Jacquin) S. Moore	Hp	3.2	Thu, Tavn	0.84	MLA 66

24	*Crossostephium chinense* (L.) Makino	Hp	7	Thu	0.32	MLA 52
25	*Cyathocline purpurea* (Buch.-Ham. ex D. Don) Kuntze	Hp	4	Thu	0.50	MLA 48
26	*Eclipta prostrata* L.	Hm	4	Thu	0.97	MLA 269
27	*Elephantopus scaber* L	Hp	3.1	Thu	0.32	MLA 227
28	*Enhydra fluctuans* Lour.	Hp	4	Thu, Tp	0,63	MLA 164
29	*Erigeron crispus* Pourr	Th	4.4	Thu	0.10	MLA 36
30	*Eupatorium fortunei* Turcz.	Hp	4.4	Thu, Tp	0.18	MLA 25
31	*Eupatorium triplinerve* Vahl.	Hp	2.1	Thu	0.24	MLA 126
32	*Gnaphalium affine* D. Don	Ch	4.2	Thu, Tp	0,98	MLA 176
33	*Gnaphalium hypoleucum* DC. Ex Wight	Ch	4	Thu, Tp	0.92	MLA 182
34	*Gnaphalium polycaulon* Pers.	Th	4.1	Thu, Tp	0.91	MLA 183
35	*Gynura procumbens* (Lour.) Merr.	Hm	4	Thu	0,76	MLA 192
36	*Laggera pterodonta* (DC.) Benth .& Hook. f.	Ch	4.1	Thu	0.26	MLA 180
37	*Lactuca indica* L.	Hm	4	Thu, Tp	0.83	MLA 121
38	*Matricaria chamomilla* L	Hp	4	Ca, Thu	0.48	MLA 249
39	*Microglossa pyrifolia* (Lamk.) Kuntze	Ch	4	Thu	0.11	MLA 53
40	*Parthenium hysterophorus* L.	Hm	4.2	Thu	0.23	MLA 50
41	*Pluchea indica* (L.) Less.	Na	4.2	Tp, Thu, Tavn	0.98	MLA 238
42	*Pseudo-elephantopus spicatus* (Juss. ex Aubl.) Gleason	Th	6.1	Thu	0.08	MLA 255
43	*Siegesbeckia orientalis* L	Hm	4	Thu	0.84	MLA 208
44	*Spilanthes iabadacensis* A. Moore	Hm	4	Tp, Thu	0.81	MLA 122
45	*Spilanthes oleracea* L.	Ch	4	Tp, Thu	0.36	MLA 106
46	*Spilanthes paniculata* Wall. ex DC.	Hm	4	Tp, Thu	0.46	MLA 16
47	*Synedrella nodiflora* (L.) Gaertn.	Hm	4	Thu, Tavn, Mr	0.83	MLA 7
48	*Tagetes erecta* L.	Th	7	Thu, Ca	0.84	MLA 88
49	*Taraxacum indicum* Hand.-Mazz.	Hp	4.2	Tp	0.74	MLA 39
50	*Tithonia diversifolia* (Hemsl.) A.	Na	4	Ca, Thu	0.78	MLA

	Gray					264
51	*Vernonia amygdalina* Delile	Na	4	Thu	0,45	MLA 6
52	*Vernonia cumingiana* Benth.	Hp	4	Thu	0.43	MLA 176
53	*Vernonia patula* (Ait.) Merr. *(Vernonia patula (*Dryand.) Merr.)	Th	4	Thu	0.41	MLA 21
54	*Wedelia chinensis* Less	Ch	4	Thu	0.65	MLA 232
55	*Youngia heterophylla* (Hemsl.) Babc. & Stebbins	Th	4.2	Tp, Thu	0.80	MLA 43
56	*Youngia japonica* (L.) DC.	Th	5.4	Tp, Thu	0.36	MLA 209

(Real investigation in 2022, and 2023 in Muong La Nature Reserve, Son La province.)

Note: *DS (Life form*)**:** *Nano- phanérophytes* (*Na*)**;** *Herb phanerophytes* (*Hp*)*; Chamaephytes* (*Ch.*)*; Hemicrypto phytes* (*Hm*)*; Therophytes* (*Th*). Uses: *Medicine* (*Thu*); *Ornamental plants (Ca); Food (Tp*); *Pet food* (*Tavn*); *Wine yeast* **(**Mr**)** *Geographical factor***:** 2-1. *Tropical Asia-Australia-America*; 3. *Paleo-tropical*; 3.1. *Tropical Asia - Australia; 3.2. Tropical Asia and Africa; 4. tropical Asia; 4.1. Indochina - Malaysia elements, 4.2. Tropical Asian continent; 4.4. Indochina - South China elements;5. Northern temperate elements, 5.3. East Asian factors; 6.1. Sub-endemic element. 7. Crop factor, Voucher codes: MLA (Muong La)*

Distribution of species within genera

Table 1 shows that among the 39 genera, the number of species distributed in each genus is different, the *Artemisia* and *Blumea* genera contain the most species: 4 species, accounting for 7.14% of the total number of species, followed by the *Gnaphalium* and *Vernonia* have 3 species (accounting for 5.36%); Ranked third include: *Bidens, Calendula, Chrysanthemum, Crassocephalum, Eupatorium, Spilanthes, Vernonia, Youngia* together with 2 other species (accounting for 3.57%); The remaining genera have less than 2 species (1.79%), including the following genera: *Adenostemma, Ageratina, Ageratum, Aster, Chromolaena, Cirsium, Crossostephium, Conyza, Cyathocline, Eclipta, Elephantopus, Enhydra, Erigeron,, Gynura, Laggera, Lactuca, Matricaria, Microglossa, Parthenium, Pluchea, Pseudo-elephantopus, Siegesbeckia, Spilanthes, Synedrella, Tagetes, Taraxacum, Tithonia, Wedelia.*

2.2.2. Life form

The life forms of species in the Asteraceae family containing essential oils (Tables 1 and 3), based on the classification of Raunkiaer (1934), are presented into 4 main groups: upper buds (Ph), ground buds (Ch), Semi-hidden buds (Hm) and annual plants (Th).

Table 2. Life form groups of* Asteraceae *Oil plants

Life form	Phanerophytes (Ph)	Therophytes (Th)	Chamerophytes (Ch)	Hemicrypto phytes (Hm)
Species number	28	12	7	9
Proportion (%)	50.00	21.43	12.50	16.07

Table 2 shows that, among the life form groups, the upper shoot group (Ph) dominates with 28 species (accounting for 50.00%) of the total number of species compared to the remaining groups, which mainly include two main tree types: perennial herbs (Hp) and small upper shoots (Na), belonging to genera such as *Adenostemma, Ageratina, Ageratum, Artemisia, Aster, Bidens, Centipeda, Chrysanthemum, Crassocephalum, Cyathocline, Eclipta, Erigeron, Enhydra, Gymnanthemum, Lactuca, Spilanthes, Taraxacum, Vernoni*. Ranked second is the annual shoot group (Th) with 12 species (21.43%), followed by the ground-close shoot group (Ch) with 7 species (12.50%) and the semi-hidden shoot group (Hm) with 9 species (16.07%). The life form of essential oil species in the Asteraceae family is SB = 50.00 % Ph + 21.43 % Th +16.07% Hm +12.50% Ch.

2.2.3. Usage value

In addition, studies have shown that essential oils have other uses (Figure 1): medicine (Thu) has the largest number of species with 54 (accounting for 96.43%); Next is food (Tp) with 19 species (accounting for 33.93%); ornamental plants (Ca) have 7 species (accounting for 12.50%); pet food (Tavn) with 6 species (accounting for 10.71%); and the lowest for wine yeast includes 1 species (accounting for 1.79%).

From the actual survey (Table 1), the project recorded one species called *Cirsium japonicum* Fish.ex DC. (accounted for 1.79% of total species) of the Asteraceae family having essential oils. Its endangered level is ranked at VU. (vulnerable to extinction).

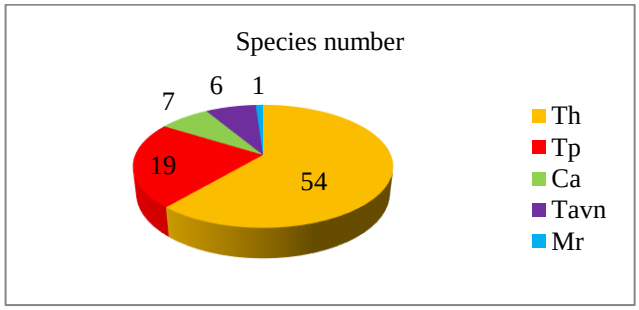

Figure 1. Use the value of essential oil species in the Asteraceae family in the study location

Note: One species can have one or more different use values

The research data in Table 1 shows that the UV scale is from 0.05 to 1.0. Fourteen (14) species of Asteraceae are identified to possess essential oils with UV level ≥ 0.80, of which there are 2 species with UV level = 1.00 (accounting for 52% of total UV) including *Artemisia vulgaris* L. and *Chrysanthemum coronarium* L.), 5 species have UV ranging from 0.91 to 0.98 (accounting for 36%), followed by 7 species with UV level from 0.80 to 0.84 (accounting for 12%). These are common species and are suitable for the traditional culture, customs, and natural conditions of local people.

2.2.4. Geographical factors

The list of Asteraceae species with essential oils has compiled the geographical factors of the species according to Le TC (1999), and Nguyen NT (2008) (Table 1) showing that: tropical Asia accounts for a large proportion with 44 species (accounting for 78.57% of the total number), followed by Crop factor with 5 species (accounting for 8,93% of the total number) and Northern temperate elements with 3 species (accounting

for 5.36%); Paleo-tropical with 2 species (accounting for 3.57%); the lowest factors include; tropical Asia-Australia-America and sub-endemic with the same 1 species (accounting for 1.79%).

3. Conclusions

Resources of the Asteraceae family with essential oils in Muong La Nature Reservation have identified 56 species and 39 genera. Among them, 1 species (accounting for 1.79%) is rare and needs conservation priority. In addition to essential oils, species in the Asteraceae family also have other uses including medicine (Th) with 54 species; food (Tp) with 19 species; ornamental plants (Ca) with 7 species; pet food (Tavn) with 6 species; and the lowest for wine yeast includes 1 species (accounting for 1.79%); 14 plant species have UV ≥ 0.80. The life form of species in the Asteraceae family is built as SB = 50.00 % Ph + 21.43 % Th +16.07% Hm + 12.50% Ch. There are 6 main geographical factors: tropical Asia accounts (accounting for 78.57% of the total number), followed by Crop factor with 5 species (accounting for 8,93% of the total number) and Northern temperate elements with 3 species (accounting for 5.36%); Paleo-tropical with 2 species (accounting for 3.57%); The lowest factors include; Tropical Asia-Australia-America and sub-endemic with the same 1 specie (accounting for 1.79%).

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