THE CONTENTS OF 20-HYDROXYECDYSONE (20E), QUERCETIN AND ESSENTIAL OILS IN ASTERACEAE SPECIES GROWING IN TAM DAO DISTRICT, VINH PHUC PROVINCE, VIETNAM

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SUMMARY

In this study, 36 species belonging to 23 genera of family Asteraceae were discovered in Dai Dinh commune, Tam Dao district, Vinh Phuc province, of which *Vernonia* is the most diverse genus with four species accounting for 11.42% out of 36 species. The contents of 20-hydroxyecdysone (20E), quercetin and essential oils were evaluated for Asteraceae species with different plant parts. The results showed that among 36 species, the compound 20E was detected in 11 species, quercetin was found in seven species and essential oils were evaluated in 23 species. The 20E content in the species varied from 0.005 % to 0.245% of dry weight with the highest concentration was presented in *Eupatorium fortunei*. *Artemisia vulgaris* contained maximum amount of quercetin with 0.349% of dry weight while *Adenostemma viscosum* obtained the higher essential oils in the branch and leaf extracts than other speices. From the obtained information, this study could conclude that *Eupatorium fortunei*, *Artemisia vulgaris*, and *Adenostemma viscosum* have high value of 20E, quercetin and essential oils respectively will become potential sources of bioactive ingredients for foods, pharmaceuticals and medicinal products.

Keywords: 20-hydroxyecdysone, Asteraceae, Dai Dinh, essential oils, quercetin, Tam Dao.

1. INTRODUCTION

The Asteraceae family is one of the largest families in the plant kingdom with approximately 1,700 genera and 24,000 species worldwide (Sun et al., 2017). In Vietnam, 126 genera with 374 species, of Asteraceae were identified (Bien, 2007). According to Plant List of Tam Dao National Park (2010), 44 species, 33 genera of Asteraceae species were recorded. Asteraceae species has high potential uses in medicine and in pharmaceutical, cosmetic and food secondary metabolite industries (Bessada et al., 2015). They indicated that chamomile (*Matricaria recutita*), yarrow (*Achillea millefolium*), or wormwood (*Artemisia absinthium*) with their highly aromatic compounds were applied in medical stuff (Bessada et al., 2015). Many Asteraceae species have been consumed as traditional medicines and teas daily (Bich et al., 2003; Loi, 2006).

20-hydroxyecdysone (20E) is a natural bioactive compound of ecdysteroid which has been identified in about 6% of plant species (Mallek et al., 2018). Ecdysteroids are synthesized in plants as phytoecdysteroid. Several studies have showed that 20E was used in medicine and pharmaceuticals or applied in the biochemical and physiological processes of plants (Golovatskaya, 2004; Tarkowska and Stamad, 2016). In addition, some food companies are showing interest in adding ecdysteroid-containing plant materials or extracts into food products as a way of enhancing health claims and profit margins (Naggar et al., 2017). In family Asteraceae, *Serratula coronate* was revealed as a promissing source of 20E (Odinokov et al., 2002) while *Rhaponticum carthamoides, Rhaponticum integrifolium, Rhaponticum nanum, Serratula coronata, Serratula inermis,*and *Serratula algida* have high ecdysteroid contents (Volodin et al., 2002). Volodin et al. (2016) have analysed phytoecdysteroid for 51 plant species collected in Cuc Phuong National Park and Dac et al. (2019) have evaluated 20E for 47 species sampled in Tam Dao National Park.

Besides 20E, flavonoids are natural compounds widely distributed in plants. They have many crucial biological activities such as antioxidant, antibacterial, antitumor capacities

(Berardini et al., 2005). Quercetin (3,3′,4′,5,7-pentahydroxyflavone) is one of the most important flavonoids in the human diet belonging to the subclass of flavonols (Sharma et al., 2018). This compound exists in plants with higher content than other compounds. Quercetin was reported to have great therapeutic potential in the prevention and treatment of different chronic diseases, including cardiovascular and neurodegenerative diseases, as well as cancer (Lesjak et al., 2018). Recently, quercetin is being used as a dietary supplement or supplement for human health (Edwards et al., 2007). In the Western diet the daily intake of quercetin is about 15 mg (Lesjak et al., 2018).

Essential oils are mixture of volatile compounds extracted from many plants. Essential oils are fragrant, insoluble in water, but soluble in organic solvents, evaporated in normal temperature and isolated by hydro-distillation method (Zhai et al., 2018). Essential oils have been applied in pharmaceutical and cosmetic industries. There were 3,000 compounds of essential oils identified and more than 300 compounds were used as scent and perfumes (Vietnam Pharmacopoeia 1971).

There are many researches focusing on extraction, isolation of bioactive compounds from medicinal plants to improve effectiveness in treating diseases in Vietnam (Thuong et al., 2006; Quang and Jong, 2011; Trang et al., 2018). However, the information of 20E, quercetin, and essential oils contents in Asteraceae species are limited. This study was conducted to provide informaiton of 20E, quercetin and essential oils contents in Asteraceae species growing in Dai Dinh commune, Tam Dao district, Vinh Phuc province of Vietnam.

2. RESEARCH METHODOLOGY

Determination of Asteraceae species distribution

Three transects were conducted for determination of Asteraceae species in Dai Dinh commune, Tam Dao district, Vinh Phuc province including (1) From bottom of the cable car to the top of Tay Thien temple with 6km in long and mixed forest of broadleaf trees habitat; (2) From Den Thong village to stupa Tay Thien with 2 km in long and vacant yard mix with grass habitat; (3) From Long Sau village to Truc Lam monastery with 2km in long and plantation habitat. All Asteraceae species were sampled three specimens and those species were identified (Bien, 2007).

Determination of species abundance

High frequency observation (+++) is a species that appear on all three surveyed transects, medium frequency observation (++) is species that appear on two survey transects, less frequence observation (+) is a species that only exist in one survey transect.

Determination of 20E and quercetin contents in plant samples by HPLC

Chemicals

Chemicals used were 20-hydroxyecdysone (20E) and quercetin with > 99,9% purity provided by the Institute of Biology, Komi Science Center, Russian Academy of Science. Solvents were obtained from local suppliers.

Plant materials and preparation of the extracts

Whole plant including of branches, leaves, flowers and roots were collected in Dai Dinh commune, Tam Dao district and then washed with tap water. After that, samples were oven dried at 65°C to constant weight and then ground into powder. An amount of 100 mg plant powder was soaked in 3 ml of methanol 60% at 25°C for 16 hours. The extract was filtered and then centrifuged at 12.000 rpm for 25 min. The extract 1 ml was diluted with 2 ml of distilled water and then passed through a Diapak C16 concentrating cartridge (BioChemMac Co., Russia). Samples were eluated from the cartridge by using 70% methanol for HPLC analysis (Khramova et al., 2008).

Quantification of 20E and quercetin by HPLC

Contents of 20E and quercetin were measured at 242 nm using HPLC Agilent

1200 (America), column Zorbax Eclipse XDB-C18 (5 µm, 4,6 x 150 mm), the mobile phase: water/acetonitrile (80/20), the flow rate was 1 ml/min at 30°C. Identification of 20E or quercetin were carried out by comparing their retention times to the standards (Figure 1 and 2). The 20E and quercetin contents were expressed in % of dry weight and calculated by formula of Volodin et al. (2018):

% 20E or quercetin content = [(dfxC)/m]x100

C is the peak area; m is the dry weight (g); df is the sample extract dilution factor.

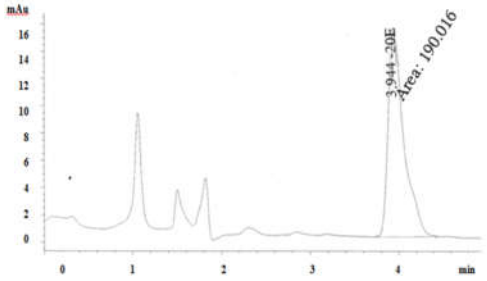

Figure 1. HPLC chromatogram of standard 20E

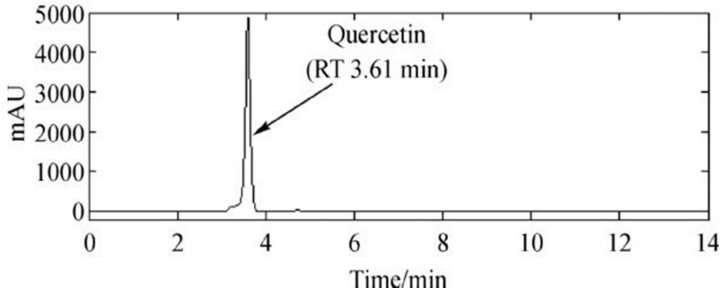

Figure 2. HPLC chromatogram of standard quercetin

Evaluation of essential oils

Essential oils were extracted according to the method of Hammouda et al. (2013). An amount of 100g of plant powder and 500 ml distilled water were placed in a 2000 ml round-bottom flask and connected to a Clevenger-type apparatus to extract the essential oils with hydro-distillation method for 3 hours. The essential oils were obtained and calculated using the following formula:

$X\% = \frac{a.100}{b}$ (Vietnam Pharmacopoeia, 1971)

where X is the content of essential oils (ml/g)

a is the volume of essential oils after extract from 100 g dry weight (ml)

b is the amount of dry weight (g)

Statistical analysis: Data were analyzed using SPSS 17 (SPSS Inc, Chicago, IL, USA). The means of 20E and quercetin were compared using student's t-test. Statistical significance was defined as $p < 0.05$.

3. RESULTS AND DISSCUSION

Distribution of Asteraceae species in Dai Dinh commune, Tam Dao district, Vinh Phuc province

Twenty-three genera with 36 species of Asteraceae were identified in Dai Dinh commune, Tam Dao district, Vinh Phuc province (Table 1). In detail, 13 genera included only one species, 8 genera consisted of 2 species, and 2 genera had more than 3 species. It was found that the number of Asteraceae species in the study site is quite diverse and abundant. However, the number of species in each genus was not equal. The genus had the highest number of species was *Vernonia* with 4 species.

Total of 36 species in Asteraceae were divided into four groups including medicinal plants (MP), edible plants (EP), ornamental plants (OP) and unknown use value plants (UP). MP included the highest species numbers with 23 species accounted for 64%, other groups had 9–17 species (11–25%).

Regarding frequency observation of Asteraceae species, 17 species were medium frequence observation (47%), 14 species were high frequence observation (39%) and 5 species were very low frequence observation.

Amount of 20E, quercetin and essential oils

Twenty-three species of Asteraceae were evalutated essential oils, 11 species were detected 20E, and 7 species were observed quercetin (Table 2). The content of 20E varied from 0.005% to 0.245%. Leaf extract of *Eupatorium fortunei* obtained the highest amount of 20E and this content was significantly higher than that of other species (p<0.05). Among 36 species, two species including *Artemisia vulgaris* and *Elephantopus scaber* were detected three

compounds (20E, quercetin and essential oils) and those species such as *Adenostemma vicosum, Conyza leucantha, Eupatorium odoratum, Spilanthes oleracea, Eclipta prostrata, Elephantopus tomentosus, Blumea hieracifolia, and Vernonia cinereal* were determined with the compounds.

Table 1. Asteraceae species in Dai Dinh commune, Tam Dao district, Vinh Phuc province

No.	Scientific names	Local names	Use values	Frequency observation
	Genus 1. *Achillea*			
1	*Achillea millefolium* L.	"Dương kỳ thảo"	MP	(++)
	Genus 2. *Adenostemma*			
2	*Adenostemma viscosum* J.R.Forst. & G.Forst.	"Cỏ hôi hoa trắng"	MP, EP	(+++)
3	*Adenostemma lavenia* (L.) Kuntze	"Cúc dính"	MP	(++)
	Genus 3. *Ageratum*			
4	*Ageratum conyzoides* (L.) L.	"Cứt lợn"	MP	(+++)
5	*Ageratum houstonianum* Mill.	"Tam duyên"	MP	(++)
	Genus 4. *Artemisia*			
6	*Artemisia vulgaris* L.	"Ngải cứu"	MP, EP	(+++)
	Genus 5. *Bidens*			
7	*Bidens pilosa* L.	"Xuyến chi"	MP	(+++)
	Genus 6. *Blumea*			
8	*Blumea hieracifolia* Hayata	"Bát tầy"	MP	(++)
9	*Blumea lanceolaria* (Roxb.) Druce	"Xương sông"	MP, EP	(+++)
10	*Blumea balsamifera* (L.) DC.	"Đại bi"	MP	(+)
	Genus 7. *Conyza*			
11	*Conyza canadensis* (L.) Cronquist	"Thượng lão"	MP	(++)
12	*Conyza leucantha* (D.Don) Ludlow & P.H.Raven	"Cỏ lông heo"	MP	(+)
	Genus 8. *Cosmos*			
13	*Cosmos sulphureus* Cav.	"Cúc chuồn"	OP	(++)
	Genus 9. *Crassocephalum*			
14	*Crassocephalum crepidioides* (Benth.) S.Moore	"Rau tàu bay"	EP	(+++)
	Genus 10. *Eclipta*			
15	*Eclipta prostrata* (L.) L.	"Nhọ nồi"	MP	(+++)
	Genus 11. *Elephantopus*			
16	*Elephantopus scaber* L.	"Cúc chỉ thiên"	MP	(+)
17	*Elephantopus tomentosus* L.	"Cúc chân voi"	MP	(++)
	Genus 12. *Emilia*			
18	*Emilia scabra* DC.	"Chua lè nhám"	EP	(+++)
19	*Emilia sonchifolia* (L.) DC. Ex DC	"Rau má tía"	MP, EP	(+++)
	Genus 13. *Eupatorium*			
20	*Eupatorium fortunei* Turcz.	"Mần tưới"	MP, EP	(++)
21	*Eupatorium odoratum* L.	"Cỏ lào"	MP	(+++)
	Genus 14. *Laggera*			
22	*Laggera aurita* (DC.) Sch.Bip. ex Schweinf.	"Cúc dính"	UP	(++)
	Genus 15. *Lactuca*			
23	*Lactuca sativa* L.	"Xà lách"	EP	(+++)
24	*Lactuca serriola* L.	"Nhũ diệp đầu mũi tên"	UP	(++)
	Genus 16. *Siegesbeckia*			
25	*Siegesbeckia orientalis* L.	"Hy thiêm"		
	Genus 17. *Spilanthes*		MP, OP	(++)
26	*Spilanthes oleracea* L.	"Nụ áo gân tím"	UP	(++)

No.	Scientific names	Local names	Use values	Frequency observation
	Genus 18. *Synedrella*			
27	*Synedrella nodiflora* (L.) Gaertn.	"Cỏ thỏ"	UP	(++)
	Genus 19. *Tagetes*			
28	*Tagetes paluta* L.	"Cúc cà cuống"	OP	(+++)
	Genus 20. Taraxacum			
29	*Taraxacum indicum* Hand.-Mazz.	"Bồ công anh ấn"	EP	(++)
	Genus 21. *Vernonia*			
30	*Vernonia andersoni* Clarke	"Rau ráu"	MP	(+)
31	*Vernonia cinerea* (L.) Less	"Dạ hương ngưu"	UP	(+++)
32	*Vernonia divergens* (DC.) Edgew	"Bạch đầu rẽ"	UP	(+)
33	*Vernonia paluta* (Aiton) Merrill	"Nút áo tím"	OP	(++)
	Genus 22. *Wedelia*			
34	*Wedelia biflora* (L.) DC.	"Hải cúc"	MP	(++)
35	*Wedelia chinensis* (Osbeck) Merr.	"Sài đất"	MP	(+++)
	Genus 23. *Xanthium*			
36	*Xanthium strumarium* L.	"Ké đầu ngựa"	MP	(++)

Use values were defined according to Ly (1993) and Chi (2009)
EP: edible plant; MP: medicinal plant; OP: ornamental plant; UP: unknown use value plant
(+++): high frequency observation
(++): medium frequency observation
(+): less frequence observation

Table 2. Contents of 20E, quercetin and essential oils in Asteraceae species

No.	Scientific names	Part used	20E (%)	Quercetin (%)	Essential oils (%)
	Genus 1. Achillea				
1	*Achillea millefolium* L.	Leaf	0.020 ± 0.00g	-	-
	Genus 2. Adenostemma				
2	*Adenostemma viscosum* J.R.Forst. & G.Forst.	Branch and leaf	-	0.067 ± 0.002c	1.239
3	*Adenostemma lavenia* (L.) Kuntze	Branch and leaf	-	-	0.029
	Genus 3. Ageratum				
4	*Ageratum conyzoides* (L.) L.	Branch and leaf	-	-	-
5	*Ageratum houstonianum* Mill.	Branch and leaf	-	-	0.120
		Flower	-	-	0.020
	Genus 4. Artemisia				
6	*Artemisia vulgaris* L.	Branch and leaf	0.082 ± 0.002d	0.349 ± 0.001a	0.347
	Genus 5. Bidens				
7	*Bidens pilosa* L.	Branch and leaf,	-	-	-
		Flower	-	-	-
	Genus 6. Blumea				
8	*Blumea hieracifolia* Hayata	Branch and leaf	0.113 ± 0.002c	-	0.029
		Flower	0.125 ± 0.002c	-	0.120
		Root	0.115 ± 0.002c	-	0.080
9	*Blumea lanceolaria* (Roxb.) Druce	Branch and leaf	-	-	0.776
		Root	-	-	0.609
10	*Blumea balsamifera* (L.) DC.	Branch and leaf	0.010 ± 0.001h	-	-

No.	Scientific names	Part used	20E (%)	Quercetin (%)	Essential oils (%)
	Genus 7. Conyza				
11	*Conyza canadense* (L.) Cronquist	Branch and leaf	-	-	0.404
		Flowers	-	-	0.119
12	*Conyza leucantha* (D.Don) Ludlow & P.H.Raven	Branch and leaf	-	0.008 ± 0.001f	0.210
		Flower	-	-	0.240
		Root	-	-	0.070
	Genus 8. Cosmos				
13	*Cosmos sulphureus* Cav.	Branch and leaf	0.033 ± 0.002e	-	0.120
		Flower	0.052 ± 0.002e	-	0.330
		Root	0.050 ± 0.001e	-	0.209
	Genus 9. Crassocephalum				
14	*Crassocephalum crepidioides* (Benth.) S.Moore	Branch and leaf	-	-	0.129
		Flower	-	-	0.809
		Root	-	-	0.110
	Genus 10. Eclipta				
15	*Eclipta prostrata* (L.) L.	Branch and leaf	-	0.031 ± 0.001d	0.020
	Genus 11. Elephantopus				
16	*Elephantopus scaber* L.	Branch and leaf	0.011 ± 0.001h	0.013 ± 0.002e	0.100
17	*Elephantopus tomentosus* L.	Branch and leaf	-	0.102 ± 0.002b	0.001
	Genus 12. Emilia				
18	*Emilia scabra* DC.	Branch and leaf	-	-	-
19	*Emilia sonchifolia* (L.) DC. Ex DC	Branch and leaf	-	-	-
		Flower	-	-	-
		Root	-	-	-
	Genus 13. Eupatorium				
20	*Eupatorium fortunei* Turcz.	Leaf	0.245 ± 0.01a	-	0.659
21	*Eupatorium odoratum* L.	Branch and leaf	-	0.009 ± 0.001f	0.308
		Flower	-	-	0.215
	Genus 14. Laggera				
22	*Laggera aurita* (DC.) Sch.Bip. ex Schweinf.	Branch and leaf	-	-	0.249
		Flower	-	-	-
	Genus 15. Lactuca				
23	*Latuca sativa* L.	Branch and leaf	-	-	-
24	*Latuca serriola* L.	Branch and leaf	-	-	-
	Genus 16. Siegesbeckia				
25	*Siegesbeckia orientalis* L.	Branch and leaf	0.005 ± 0.001i	-	-
	Genus 17. Spilanthes				
26	*Spilanthes oleracea* L.	Flower	0.184 ± 0.001b	-	0.109
	Genus 18. Synedrella				
27	*Synedrella nodiflora* (L.) Gaertn.	Branch and leaf	-	-	0.087
	Genus 19. Tagetes				
28	*Tagetes paluta* L.	Branch and leaf	-	-	0.169
		Flower	-	-	-

No.	Scientific names	Part used	20E (%)	Quercetin (%)	Essential oils (%)
	Genus 20. Taraxacum				
29	*Taraxacum indicum* Hand.-Mazz.	Leaf	0.021 ± 0.001g	-	-
	Genus 21. Vernonia				
30	*Vernonia andersoni* Clarke	Branch and leaf	-	-	-
31	*Vernonia cinerea* (L.) Less	Branch and leaf	0.017 ± 0.001g	-	-
		Flower	0.067 ± 0.003f	-	-
		Root	0.023 ± 0.001g	-	0.050
32	*Vernonia divergens* (DC.) Edgew		-	-	0.170
33	*Vernonia paluta* (Aiton) Merrill	Branch and leaf	-	-	0.010
		Flower	-	-	-
		Root	-	-	0.250
	Genus 22. Wedelia				
34	*Wedelia biflora* (L.) DC.	Branch and leaf	-	-	0.080
		Flower	-	-	0.371
35	*Wedelia chinensis* (Osbeck) Merr.	Leaf	-	-	-
	Genus 23. Xanthium				
36	*Xanthium strumarium* L.	Leaf	-	-	-

Values of 20E and quercetin contents were represented the Mean ± SD (standard deviation) with three replications. Means with the same letter are not significantly different at $p < 0.05$.

4. DISCUSSION

Phytoecdysteroids are triterpenoids which have been identified in 100 terrestrial plant family (Kayani, 2016). Dinan (2001) reported that less than 2% of the world flora has been investigated, among them 6% produce phytoecdysteroids. Since phytoecdysteroids was discovered for the first time in plants until year 2000, scientists have only recorded 176 species of plants containing phytoecdysteroids belonging to 28 families, but by 2017, 1.339 plant species containing PEs belonging to 132 different families were identified (Dac et al., 2019). The most common and biologically active phytoecdysteroid found in plants is 20-hydroxyecdysone (20E) (Kayani, 2016). 20E is an ecdysteroid that is ecdysone substituted by a hydroxy group at position 20 (Figure 2). 20E is one of the triteroenoids and recognized steroidal hormone (Dinan, 2001; Kayani, 2016).

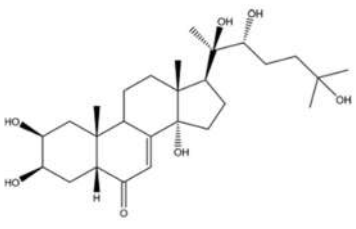

Figure 3. The chemical structure of 20E (Mamadalieva et al., 2019)

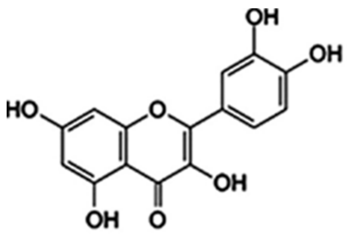

Figure 4. The chemical structure of quercetin (David et al., 2016)

This study found that there were differences in 20E contents of different parts in Asteraceae species (Table 2). Dinan (2001) stated that 20E was synthesized in reproductive organs was much higher than that in roots, leaves and stems. Therefore, in comparison of various plant parts of Asteraceae in this research, flowers also

contained high levels of 20E than leaves, branches and roots. This finding agrees with Dian (2001).

Quercetin is a flavonoid with another name of 3,5,7,4-pentahydroxyflavon pentahydroxyflavone (Figure 4). This compound is yellow and poorly soluble in hot water, well soluble in alcohol and lipids and insoluble in cold water (Lakhanpal et al., 2007) and commonly found in apples, grapes, oranges, tangerines, vegetables, nuts, olive oil, onions, and green teas. Quercetin is revealed to have antioxidant activity, health-beneficial effect (David et al., 2016). One previous study was conducted to exploit quercetin for 115 samples of 90 tropical species, it was found that more than 50% of the samples containing quercetin, of which leaves of Indian mulberry, Ashitaba, Chinese cedar, Vietnamese coriander, Moringa were high in quercetin and luteolin (Yang et al., 2008). In Vietnam, Lien (2011) initially isolated four flavonoids AC1 ($C_{16}H_{12}O_7$), AC2 ($C_{16}H_{12}O_6$), AC7 ($C_{18}H_{16}O_5$) and AC8 ($C_{19}H_{18}O_6$) in the *Ageratum conyzoides* (one of Asteraceae species). Loi et al. (2017) has determined the structure of two flavonoids in Mulberry tree (*Morus alba*) is kaempferol 3-O-D-glucopyranoside and quercetin 3-O-α-L-rhamnopyranoside; Viet et al. (2011) reported average content of quercetin in 100 mg of *Crinum latifolium* leaf powder (22.14 ± 0.23 mg). In general, studies on quercetin in plants and especieally in Asteraceae species in Vietnam are quite limited. Therefore, results in this study was the first identification of quercetin in Asteraceae species in Vietnam.

The results in table 2 indicate that, the essential oils contents are presented in all the aerial parts but their amounts are not equal. In some species, the content of essential oils distributed in flowers accounts for more than 60% of the total amount of essential oils such as *Tagetes paluta*, *Blumea hieracifolia*, *Cosmos sulphureus*, *Laggera aurita*, *Crassocephalum crepidioides*, *Vernonia paluta* (Table 2). Species with essential oil contents are accumulated mainly in the leaves including *Conyza canadense*, *Eupatorium odoratum*, *Ageratum houstonianum*, *Wedelia biflora*. The concentration of essential oils ranged in different parts of the plant, probably due to the growth time of each species. Thao et al. (2011) concluded that in the period of flowering, the concentration of essential oils in the leaves is the lowest, whereas when the flower starts to fade, the essential oils in the leaves increases.

5. CONCLUSIONS

There were 36 species belonging to 23 genera of the family Asteraceae identified in Dai Dinh commune, Tam Dao district, Vinh Phuc province. *Vernonia* is the most diverse and abundant genus with 4 species accounting for 11.42%, followed by genus *Blumea* with three species (accounting for 8.57%), the remaining genera have only 1–2 species. The analysis by HPLC showed that 11 species of Asteraceae species contained detectable of 20E, seven species included quercetin and 21 species consisted of essential oils. Flowers were indicated the highest content of 20E in comparison to leaves, branches and roots. Identification of quercetin in Asteraceae species was the first report in Vietnam and it was a reference for other research in the future. This study suggests that those Asteraceae have high value of 20E, quercetin and essential oils such as *Eupatorium fortune, Artemisia vulgaris, Adenostemma viscosum* will be as potential sources to discover bioactive ingredients for foods, pharmaceutical products or medicines.

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HÀM LƯỢNG 20-HYDROXYECDYSONE (20E), QUERCETIN VÀ TINH DẦU CỦA CÁC LOÀI CÂY HỌ CÚC PHÂN BỐ TẠI HUYỆN TAM ĐẢO, TỈNH VĨNH PHÚC

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TÓM TẮT

Nghiên cứu đã xác định được 36 loài thuộc 23 chi trong họ Cúc phân bố tại xã Đại Định, huyện Tam Đảo, tỉnh Vĩnh Phúc, trong đó chi *Vernonia* có nhiều loài nhất 4 loài chiếm 11,42% tổng số loài. Hàm lượng 20-hydroxyecdysone (20E), quercetin và tinh dầu được xác định cho 36 loài cây họ Cúc từ các bộ phận lá, cành, hoa và rễ của cây. Kết quả cho thấy, hợp chất 20E được phát hiện ở 11 loài, quercetin đã được tìm thấy trong 7 loài và tinh dầu được xác định trong 23 loài. Hàm lượng 20E dao động từ 0,005% đến 0,245% trọng lượng khô với Mần tưới (*Eupatorium fortunei*) có hàm lượng 20E cao nhất. Loài Ngải cứu (*Artemisia vulgaris*) có hàm lượng quercetin lớn nhất là 0,35% trọng lượng khô và loài Cỏ hôi hoa trắng (*Adenostemma viscosum*) có hàm lượng tinh dầu cao hơn so với các loài khác. Căn cứ vào kết quả thu được, các loài Asteraceae có hàm lượng 20E, quercetin và tinh dầu cao bao gồm Mần tưới, Ngải cứu, và Cỏ hôi hoa trắng sẽ là các loài có tiềm năng trong việc ứng dụng trong công nghiệp thực phẩm, dược liệu và y học.

Từ khóa: 20E, Asteraceae, Đại Đình, quercetin, Tam Đảo, tinh dầu.

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