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Original Article

Anticholinesterase and antityrosinase activities of endemic *Prangos heyniae* H. Duman & M. F. Watson and its metabolites

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ABSTRACT

Background and Aims: *Prangos* Lindl. (Apiaceae) are abundant in coumarins. Previously, along with *n*-hexane(HEX), chloroform($CHCl_3$), and methanol(MeOH) extracts, 8 molecules named osthol(**1**), isoimperatorin(**2**), oxypeucedanin(**3**), 7-methoxy-isoarnottinin-4'-O-β-D-glucopyranoside(**4**), 7-methoxy-isoarnottinin-4'-O-rutinoside(**5**), oxypeucedanin hydrate-3'-O-β-D-glucopyranoside(**6**), 1-methylethyl-6-O-D-apio-β-D-furanosyl-β-D-glucopyranoside(**7**), and cnidioside A(**8**) were obtained from the roots of endemic *Prangos heyniae* H. Duman & M. F. Watson. **4** and **5** were reported as novel compounds. Coumarins are known for their neuroprotective properties. Tyrosinase and cholinesterase enzymes play a key role in the course of neurodegenerative diseases such as Parkinson's and Alzheimer's disease(AD), respectively. Therefore, we aimed to evaluate the antityrosinase and anticholinesterase effects of the extracts and compounds **1-8** from *Prangos heyniae* roots.

Methods: Tyrosinase and acetylcholinesterase-butyrylcholinesterase(AChE-BChE) inhibitory activities of the samples were evaluated spectrophotometrically. The screening of the samples was carried on at 1000 µg/mL. Results of triplicate analyses of the samples were given as IC_{50} values obtained through linear regression analysis. Kojic acid and galantamine were used as positive controls for antityrosinase and anticholinesterase experiments, respectively.

Results: Only MeOH extract showed antityrosinase activity with an IC_{50} value of 543.37±7.45 µg/mL. $CHCl_3$ extract exhibited both AChE and BChE inhibitory activities with IC_{50} values of 273.92 ± 32.07 and 38.68±2.56 µg/mL, respectively. Among tested compounds, **6** showed a weak BChE-specific inhibitory activity (IC_{50}= 91.93±3.86µg/mL) and managed to possess 40 times inferior activity than galantamine(IC_{50}= 2.25 ± 0.05µg/mL).

Conclusion: The $CHCl_3$ extract displayed a good BChE inhibitory activity. These findings suggested that *Prangos heyniae* could be a valuable natural source to develop novel BChE inhibitors with further studies against AD.

Keywords: *Prangos heyniae*, coumarin, anticholinesterase activity, antityrosinase activity, oxypeucedanin hydrate-3'-O-β-D-glucopyranoside

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INTRODUCTION

Prangos Lindl. (Apiaceae) genus is an Iran-Turan element and is represented by 45 species worldwide (Lyskov, Degtjareva, Samigullin, & Pimenov, 2017). The genus is spread out from Europe to Tibet, mostly growing in Turkey and Iran (Lyskov et al., 2017; Menemen, 2012; Mottaghipisheh, Kiss, Tóth, & Csupor, 2020). Species of the genus grow on calcareous rocks, basalt rocky soils, salty soils, and mountain slopes (Aytaç & Duman, 2016; B. Başer & Pehlivan, 2015; Lyskov et al., 2017; Menemen, 2012; Mottaghipisheh et al., 2020). There are 19 taxa of which 11 are endemic to Turkey (Aytaç & Duman, 2016; Behçet, Yapar, & Olgun, 2019; Menemen, 2012). Several traditional usages of the plants of the genus have been reported. In Anatolian folk medicine, the roots of the plant are beneficial as an antihemorrhoidal, wound-healing agent, and aphrodisiac whereas the aerial parts are used as a stimulant and carminative (Bulut, Tuzlacı, Doğan, & Şenkardes, 2014). In literature, bioactivity studies were found to be generally associated with the antibacterial, cytotoxic and antioxidant effects of *Prangos* species (Farooq et al., 2014; Kogure et al., 2004; Massumi, Fazeli, Alavi, & Ajani, 2007; Özek et al., 2007; Ulubelen et al., 1995; Zahri, Razavi, Niri, & Mohammadi, 2009). Besides, anti-inflammatory, wound healing, antiviral, hepatoprotective, antidiabetic, and vascular reactivity studies were also reported by previous studies (Doković et al., 2004; Farkhad, Farokhi, & Tukmacki, 2012; Farokhi, Farkhad, & Togmechi, 2012; Sevin et al., 2022; Shokoohinia, Sajjadi, Gholamzadeh, Fattahi, & Behbahani, 2014; Tada et al., 2002; Zahri et al., 2009). In addition to various bioactivity studies of the genus, anticholinesterase activities of the different *Prangos* species have also been investigated (Albayrak, Demir, Koyu, & Baykan, 2022; Dall'Acqua et al., 2022; Mottaghipisheh et al., 2020; Zengin et al., 2022). *Prangos heyniae* H. Duman & M. F. Watson, known as "Boz çakşır" in Anatolia, is a perennial herb and an endemic species distributed in Konya province, Turkey (Duman & Watson, 1999; Menemen, 2012). There are few studies reported on this endemic plant. Antioxidant, mosquitocidal, and anticandidal activities are the bioactivity studies conducted with *P. heyniae* (Ahmed, Güvenç, Küçükboyacı, Baldemir, & Coşkun, 2011; Öke-Altuntaş, Aslım, Duman, Gülpınar, & Kartal, 2015; Özek et al., 2018). The essential oil composition of fruits and roots of the plant have been investigated and elemol, α-pinene, , kessane and germacrene D were found as major compounds (K. H. C. Başer, Özek, Demirci, & Duman, 2000; Karahisar, Köse, İşcan, Kürkçüoğlu, & Tugay, 2022; Özek et al., 2018; Zengin et al., 2022). In addition, a sesquiterpene ketone; 3,7(11)-eudesmadien-2-one was obtained from the essential oils of *P. heyniae* fruits using preparative gas chromatography (Özek et al., 2018). The essential oils and extracts obtained from the aerial parts of *P. heyniae* have been evaluated for their antityrosinase and anticholinesterase activities in different studies (Dall'Acqua et al., 2022; Zengin et al., 2022). However, to the best of our knowledge, the plant roots have not been investigated for anticholinesterase and antityrosinase properties before. Coumarins and furanocoumarins represent the major group among the metabolites occurring in the genus *Prangos* and they are known for acetylcholinesterase (AChE) and butyrylcholinesterase (BChE) inhibitory activity studies related to neurodegenerative diseases (De Souza, Renn O B, & Figueroa-Villar, 2016; Mottaghipisheh et al., 2020). Tyrosinase plays an important role in melanin biosynthesis and the overproduction of melanin results in hyperpigmentation. Melanin pigment is also found in the brain, as neuromelanin, and high levels of neuromelanin have been associated with dopamine neurotoxicity, which leads to Parkinson's disease. Tyrosinase enzyme is an important target to decrease the melanocyte function, and there are several studies evaluating the tyrosinase inhibitory activity of these metabolites (Chang, 2009; Fais et al., 2009; Shu et al., 2020; Zolghadri et al., 2019). Among these compounds, osthole, oxypeucedanin, oxypeucedanin hydrate, psoralen, xanthotoxin, marmesin, heraclenin, heraclenol, imperatorin, and isoimperatorin draw attention as the main coumarins and furanocoumarins isolated from *Prangos* species (Abbas-Mohammadi et al., 2018; Bruno et al., 2021; Mottaghipisheh et al., 2020; Zengin et al., 2020). Recent studies have shown that coumarins and furanocoumarins are prominent in the search for the treatment of neurodegenerative disease. The neuroprotective activity along with mechanism studies of coumarin and furanocoumarin derivatives are increasingly supported by not only cholinergic pathway studies (Karakaya et al., 2020; Orhan et al., 2021) but also anti-amyloidogenic activity studies (Palmioli et al., 2019). Considering this information, the aim of this study was to evaluate the *in vitro* anticholinesterase and antityrosinase potential of HEX, $CHCl_3$, and MeOH extracts of the plant roots along with the compounds [**Figure 1**; osthol (**1**), isoimperatorin (**2**), oxypeucedanin (**3**), 7-methoxy isoarnottinin 4'-O-β-D-glucopyranoside (**4**), 7-methoxy isoarnottinin 4'-O-rutinoside (**5**), oxypeucedanin hydrate-3'-O-β-D-glucopyranoside (**6**), 1-methylethyl 6-O-D-apio-β-D-furanosyl-β-D-glucopyranoside (**7**), and cnidioside A (**8**)] obtained from our previous study (Albayrak, Demir, Kose, & Baykan, 2021). In summary, hoping to reveal the pharmacological value of this endemic plant of Turkey, our purpose is to discover the neuroprotective and anti-hyperpigmentation potential of this plant and its chemical components that could lead to the development of novel candidate metabolites for the prevention and treatment of neurodegenerative and hyperpigmentation disorders.

MATERIALS AND METHODS

Plant extracts and isolated compounds

Prangos heyniae H. Duman & M. F. Watson was collected from Konya province in 2016, identified by Prof. Dr. Serdar Gokhan Senol, Department of Biology, Faculty of Science, Ege University. A voucher specimen (IZEF-6051) was stored in the Herbarium of Ege University, Faculty of Pharmacy, Izmir, Turkey. In our previous study, air-dried roots of the plant were extracted with HEX, $CHCl_3$, and MeOH, sequentially. Moreover, 8 compounds [6 coumarin derivatives (**1**-**6**), one isopropyl glycoside (**7**), and one benzofuran derivative (**8**)] were obtained from the extracts by using chromatographic methods and were identified using spectroscopic techniques (Albayrak et al., 2021). The HEX, $CHCl_3$, and MeOH extracts and isolated molecules named osthol (**1**), isoimperatorin (**2**), oxypeucedanin (**3**), 7-methoxy isoarnottinin 4'-O-β-D-glucopyranoside (**4**), 7-methoxy isoarnottinin 4'-O-rutinoside (**5**), oxypeucedanin hydrate-3'-O-β-D-glucopyranoside (**6**), 1-methylethyl 6-O-D-apio-β-D-furanosyl-β-D-glucopyranoside (**7**), and cnidioside A (**8**) used in this study were isolated from the roots of *Prangos heyniae* in the above-mentioned work (Albayrak et al., 2021).

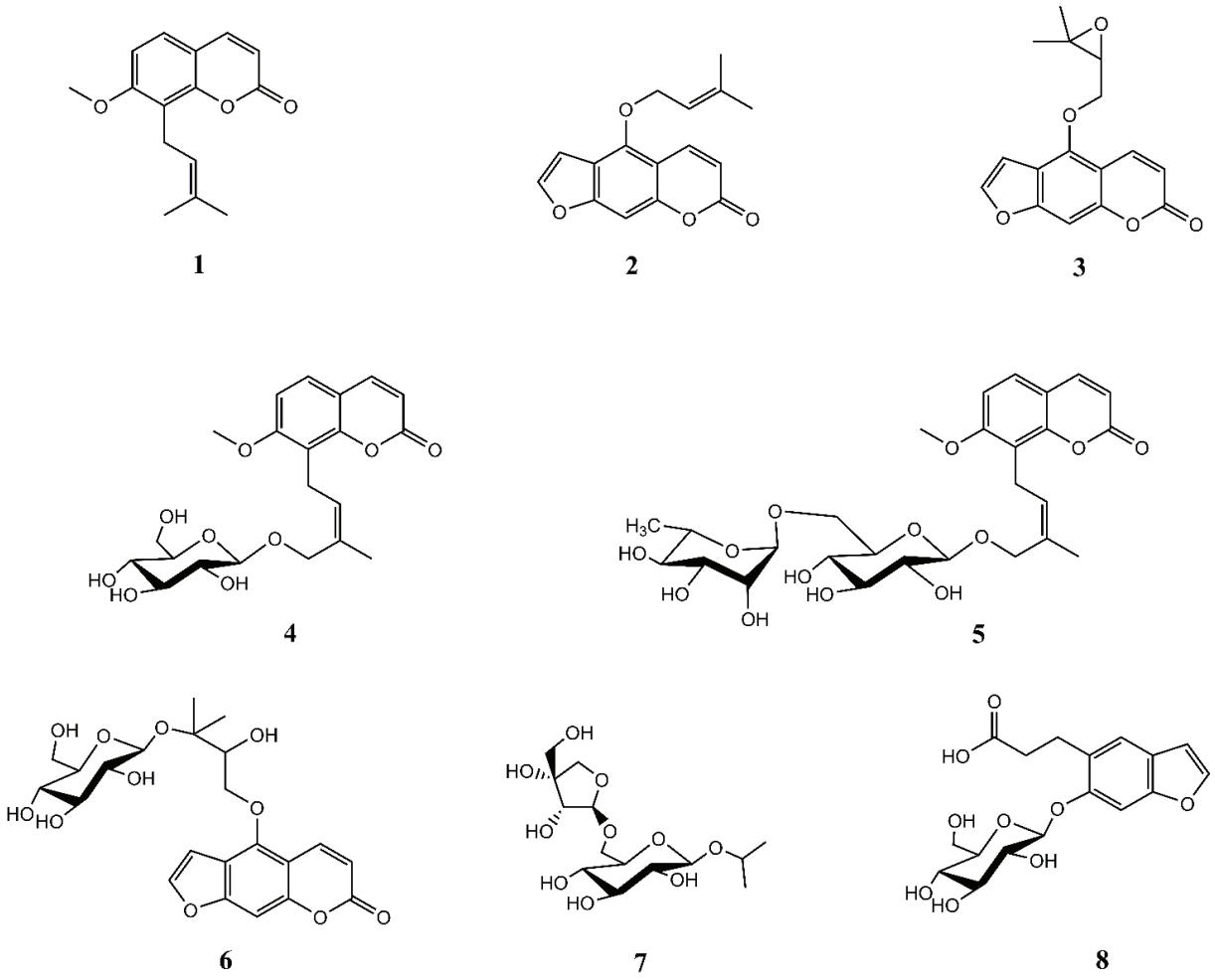

Figure 1. The tested compounds **1-8** from *Prangos heyniae*.

Anticholinesterase activity

AChE and BChE inhibitory activities of the extracts and isolated compounds were evaluated using a modified Ellman's method (Ellman, Courtney, Andres, & Featherstone, 1961). Electric eel AChE and horse serum BChE were used as the enzymes. Acetylthiocholine iodide and butyrylthiocholine iodide (3 mM) were selected as substrates for the enzymatic reaction, respectively. 5, 5'-Dithio-bis 2-nitrobenzoic acid (DTNB) was used for the measurement of the anticholinesterase activity. Briefly, 150 µL 0.1 M sodium phosphate buffer, DTNB (0.01 M), sample solution (prepared with DMSO: H_2O, 1:9), and acetylcholinesterase/butyrylcholinesterase (0.1 Unit/mL) enzymes were added in a 96-well microplate. Samples were pre-incubated at room temperature for 5 min at 300 rpm on an orbital shaker. The reaction was then initiated by adding 3 mM substrate (in buffer). Kinetic absorbance was measured at room temperature per 30-sec intervals through an incubation period of 10 min at 412 nm with a microplate reader. Enzyme activity was calculated with the linear change of absorbance during the incubation period compared to that of the assay using a buffer without any inhibitor. The activity results for cholinesterase inhibition were calculated by the following formula;

$$\% \text{ inhibition} = [(A_{blank} - A_{sample}) / A_{blank}] \times 100$$

where A_{blank} is the absorbance with sodium phosphate buffer (instead of the tested sample) and A_{sample} is the absorbance with the extract/isolated compound/positive control at 412 nm. The positive control was galantamine as the reference drug. In order to evaluate the validity of our study protocol, Sigma Plot 12.0 Enzyme Kinetics Module 1.3 was used to establish the inhibition kinetics of galantamine with Lineweaver-Burk, Michaelis-Menten, and Eadie-Hofstee methods (Albayrak et al., 2022). The results of triplicate experiments were depicted with IC_{50} values (concentration that inhibits 50% of enzyme activity) obtained by linear regression analysis where 1000 µg/mL was the initial test concentration for the tested samples. The selected test samples were evaluated at concentrations of 1000 µg/mL and 15.625 µg/mL to determine their IC_{50} values. Development and optimization of the activity study protocol were done through an inhibition kinetic study with galantamine as a reference drug for ChE inhibition, for the accurate determination of enzyme inhibition assay parameters and activity results. Inhibition kinetics were analyzed with acetylthiocholine iodide as a single substrate within the concentration range of 31.25–125 µM and galantamine as a single inhibitor within the range of 0.0875–0.35 µM with a blank (0 µM). The determined competitive type inhibition correlated with the literature for galantamine

thus approving the validity of our developed study protocol (Albayrak et al., 2022; Ellman et al., 1961).

Antityrosinase activity

An adapted 96-well microplate assay was conducted for the determination of tyrosinase inhibitory activity. Kojic acid was used as the reference drug. Twenty-five µl of samples (in pH 6.8 phosphate buffer) were mixed with 150 µl 2 mM L-dopa (in pH 6.8 phosphate buffer). Then, this mixture was pre-incubated at 25 °C in the dark for 2 min. Finally, 25 µl of tyrosinase enzyme (50 Unit/mL in phosphate buffer) was added and the whole mixture was incubated for 10 min at 25 °C. Kinetic readings at 30-sec intervals were recorded with a microplate reader (Clariostar, BMG Labtech) at 475 nm to determine the linear change of the absorbance during dopachrome formation within the 10 min reaction period. Tyrosinase inhibitory activity results were calculated with the following formula;

$$\% \text{ inhibition} = [(A_{blank} - A_{sample}) / A_{blank}] \times 100$$

where A_{blank} is the absorbance with the sample solvent (DMSO: water 2:3) and A_{sample} is the absorbance with the extract/isolated compound at 475 nm. The positive control was kojic acid. The results of the triplicate analysis were depicted as IC_{50} values obtained through linear regression analysis where 1000 µg/mL was the initial test concentration for the tested samples. The selected test samples were evaluated at concentrations of 1000 µg/mL and 15.625 µg/mL to determine their IC_{50} values. (Koyu, Kazan, Demir, Haznedaroglu, & Yesil-Celiktas, 2018).

Statistical analysis

The data were analyzed using GraphPad Prism version 5.03 program (GraphPad Software, San Diego California, USA). The data were given as '± standard deviation of the mean'. The results were given as IC_{50} values of tested samples from triplicate analysis. The level of significance was set as $p < 0.05$.

RESULTS AND DISCUSSION

Anticholinesterase activity

HEX, $CHCl_3$, and MeOH extracts of *P. heyniae* roots, and 8 pure compounds (Figure 1) were evaluated for their AChE and BChE inhibitory activities. IC_{50} values of the tested extracts are given in Table 1. Linearity was determined with R^2 values as above 0.9500 and relative standard deviation values (RSD%) were determined as below 11.71% for the extracts and 4.2% for the compounds. The HEX and MeOH extracts did not show AChE inhibitory activity at the concentration of 1000 µg/mL. However, $CHCl_3$ extract inhibited both AChE and BChE enzymes with IC_{50} values of 273.92 ± 32.07 µg/mL and 38.68 ± 2.56 µg/mL, respectively. It exhibited weak AChE inhibitory activity but showed good BChE inhibitory activity (17-fold inferior activity than galantamine). Extracts and essential oils obtained from different parts of *Prangos* species have previously been evaluated for their anticholinesterase activities to discover potential sources of neuroprotective agents (Abbas-Mohammadi et al., 2018; Bruno et al., 2021; Dall'Acqua et al., 2022; Zengin et al., 2022, 2020). In a previous study, essential oils, HEX, dichloromethane (DCM) and MeOH extracts from the aerial parts of *P. gaube* were tested for their anticholinesterase activities and among the tested materials, DCM extract (3.51±0.24 mg GEs/g, galantamine equivalents) was reported as the most potent BChE inhibitor (Bahadori, Zengin, Bahadori, Maggi, & Dinparast, 2017). In another study, HEX, ethyl acetate (EtOAc) and MeOH extracts from the aerial parts of *P. ferulacea* were investigated for AChE inhibitory activity where HEX (200 µg/mL) and EtOAc extracts (200 µg/mL) were the most effective extracts and showed inhibition of 75.6±2.8% and 63.8±1.3%, respectively (Abbas-Mohammadi et al., 2018). Coumarins were indicated as the main group responsible for high activity in both studies (Abbas-Mohammadi et al., 2018; Bahadori et al., 2017). Recently, Zengin et al. investigated the essential oils from the aerial parts of *P. uechtritzii*, *P. meliocarpoides* var. *meliocarpoides,* and *P. heyniae* for their cholinesterase inhibitory properties and among the tested samples, only the essential oil of *P. heyniae* (9.85±0.20 mg GALAE/g, galantamine equivalents) showed BChE specific inhibitory activity (Zengin et al., 2022). Dall'Acqua et al. investigated the HEX, EtOAc, MeOH, and water extracts from the aerial parts of *P. uechtritzii*, *P. meliocarpoides* var. *meliocarpoides,* and *P. heyniae* for their cholinesterase inhibitory properties. HEX (AChE=2.39±00.6 mg GALAE/g, BChE=7.83±0.18 mg GALAE/g, galantamine equivalents) and

Table 1. Anticholinesterase and antityrosinase activities of *P. heyniae* extracts and compounds 1-8.

	IC_{50} ± S.D. [µg/mL] [a]		
Extracts/ Compounds	**AChE**	**BChE**	**Tyr**
HEX	-	-	-
$CHCl_3$	273.92 ± 32.07 (R^2=0.9724)	38.68 ± 2.56 (R^2=0.9717)	-
MeOH	-	-	543.37 ± 7.45 (R^2=0.9654)
1	-	-	-
2	-	-	-
3	-	-	-
4	-	-	-
5	-	-	-
6	-	91.93 ± 3.86 (R^2=0.9959)	-
7	-	-	-
8	-	-	-
Galantamine [b]	0.22 ± 0.02 (R^2=0.9571)	2.25 ± 0.05 (R^2=0.9518)	
Kojic acid [c]			3.38 ± 0.17 (R^2=0.9502)

[a] Values are means of three independent samples with triplicate determination. The IC_{50} is represented as mean±standard deviation obtained from dose-response curves by linear regression. Units of concentrations are expressed as [µg/mL]
[b] Standard for cholinesterase inhibitory activities.
[c] Standard for tyrosinase inhibitory activities.
Dash means no activity at 1000 µg/mL.

EtOAc (AChE=1.58±0.38 mg GALAE/g, BChE=7.64±0.15 mg GALAE/g, galantamine equivalents) extracts of *P. heyniae* displayed BChE-specific inhibitory activities. Coumarins and hydrolyzable tannins were reported as responsible compounds for the activity (Dall'Acqua et al., 2022). Considering the studies with *Prangos* species on cholinesterase inhibition along with our results, *P. heyniae* can be considered as a candidate source for neurotherapeutic agents, especially as a potential BChE inhibitor drug source. Among the tested isolated compounds, **6** showed BChE inhibitory activity with an IC_{50} value of 91.93 ± 3.86 µg/mL. It demonstrated 40 times inferior activity than galantamine (IC_{50}= 2.25 ± 0.05 µg/mL). However, it did not inhibit AChE at 1000 µg/mL. In previous studies, oxypeucedanin hydrate, the aglycone moiety of **6,** was inactive against AChE and BChE enzymes *in vitro* (Albayrak et al., 2022; Orhan et al., 2021; Youkwan, Sutthivaiyakit, & Sutthivaiyakit, 2010). The enhanced effect of **6** on BChE comparing its aglycone could be relevant to the presence and position of the glucose moiety at C-3'. In studies against AD, AChE seems to have a more active role than BChE in regulating acetylcholine levels in the healthy brain or early stages of AD. However, AChE activity decreases with acetylcholine in the mid to late stages of the disease, while BChE activity continues to increase (Greig, Lahiri, & Sambamurti, 2002; Greig et al., 2001). Hence, BChE could also be a significant contributor to the decrease of acetylcholine levels in AD (Walsh, Rockwood, Martin, & Darvesh, 2011). Therefore, the inhibition of the BChE is as important as the inhibition of AChE. In many studies, coumarins and furanocoumarins have been found to exhibit selectivity for BChE (De Souza et al., 2016). Especially, the presence of the prenyl moiety at the C-8 position (Granica et al., 2013; Wszelaki, Paradowska, Jamróz, Granica, & Kiss, 2011), and the presence of the furan ring at the C-6 position (Özbek et al., 2018; So & Young, 2007) were related with the increase of BChE inhibitory activity of coumarins and furanocoumarins and these studies correlate with our findings for the BChE inhibitory effect of oxypeucedanin hydrate-3'-O-β-D-glucopyranoside (**6**). The other compounds did not show AChE and BChE inhibitory activity at 1000 µg/mL. The AChE and BChE inhibitory activities of CHCl3 extract are more potent than the inhibitory activities of the isolated compounds **1**-**8**. In the BChE inhibition experiment, the extract exhibited 2.4 times (IC_{50}=38.68±2.56 µg/mL) inferior activity than galantamine (IC_{50}=2.25±0.05µg/mL), while compound **6** (IC_{50}=91.93±3.86µg/mL) showed 40 times inferior activity than the reference. The reason for the extract's superior activity could be due to the synergistic effect of all the molecules or due to other active non-isolated compounds in the extract. However, further studies are needed to reveal the activity mechanism of the extract and the compounds.

Antityrosinase activity

All three extracts along with the pure compounds (Figure 1) were tested for their antityrosinase activity. IC_{50} values of the tested extracts are given in Table 1. Linearity was determined with R^2 values above 0.9500 and relative standard deviation values (RSD%) were determined as below 1.37% for all analyzed samples. Only MeOH extract inhibited tyrosinase with an IC_{50} value of 543.37 ± 7.45 µg/mL. The extract exhibited 160-fold inferior activity than the reference drug, kojic acid (IC_{50}= 3.38 ± 0.17 µg/mL). Compounds **1**-**8** did not show any effect against the enzyme at 1000 µg/mL. There are few tyrosinase inhibitory studies with *Prangos* species (Bahadori et al., 2017; Dall'Acqua et al., 2022; Orhan et al., 2021; Zengin et al., 2022, 2020). Recently, Zengin et al. investigated the essential oils from the aerial parts of *P. uechtritzii*, *P. meliocarpoides* var. *meliocarpoides,* and *P. heyniae* for their tyrosinase inhibitory properties and among the tested samples, the essential oils of *P. meliocarpoides* var. *meliocarpoides* (69.56±4.80 mg KAE/g, kojic acid equivalents) were reported to display the strongest tyrosinase inhibitory activity. In that study, *P. heyniae* (53.91±2.11 mg KAE/g, kojic acid equivalents) was indicated to possess moderate antityrosinase activity (Zengin et al., 2022). Dall'Acqua et al. investigated the HEX, EtOAc, MeOH and water extracts from the aerial parts of *P. uechtritzii*, *P. meliocarpoides* var. *meliocarpoides,* and *P. heyniae* for their tyrosinase inhibitory properties and among the tested samples, the HEX extract of *P. meliocarpoides* var. *meliocarpoides* (81.15±0.19 mg KAE/g, kojic acid equivalents) was reported to display the strongest tyrosinase inhibitory activity. In the same study, *P. heyniae* displayed the lowest activity among the three species. The MeOH extract of *P. heyniae* (65.20±0.89 mg KAE/g, kojic acid equivalents) was indicated to possess the strongest antityrosinase activity among the other extracts and conformed with our study (Dall'Acqua et al., 2022). This can be attributed to the polar compounds such as glycosylated coumarins and tannins in the plant. In another study, 17 coumarin derivatives including osthol, isoimperatorin, oxypeucedanin and oxypeucedanin hydrate (the aglycone unit of compound **6**) were evaluated, and none of the tested compounds showed anti-tyrosinase activity at 100 µg/mL (Orhan et al., 2021). *Prangos* species and coumarins seem to show weak to moderate antityrosinase activity in previous studies, and our results were consistent with the literature (Dall'Acqua et al., 2022; Erdogan Orhan, Orhan, & Gurkas, 2011; Shu et al., 2020; Zengin et al., 2022).

CONCLUSION

In conclusion, HEX, $CHCl_3$, and MeOH extracts of the roots of endemic *P. heyniae* and the isolated metabolites; 7-methoxy isoarnottinin 4'-O-β-D-glucopyranoside (**4**), 7-methoxy isoarnottinin 4'-O-rutinoside (**5**), oxypeucedanin hydrate-3'-O-β-D-glucopyranoside (**6**), 1-methylethyl 6-O-D-apio-β-D-furanosyl-β-D-glucopyranoside (**7**), and cnidioside A (**8**) were evaluated for antityrosinase and anticholinesterase activities for the first time in this study. The chloroform extract demonstrated selective inhibitory activity against BChE. It could be a natural source for helping the development of novel BChE inhibitor drugs with further research for the treatment of AD. Coumarins and furanocoumarins draw attention as active principles for the activity results of the extracts.

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