Bull. Pharm. Sci., Assiut University, Vol. 46, Issue 1, 2023, pp. 217-223.

Bulletin of Pharmaceutical Sciences
Assiut University
Website: http://bpsa.journals.ekb.eg/
e-mail: bullpharm@aun.edu.eg

SECONDARY METABOLITES FROM THE STEM BARK OF *POLYALTHIA STENOPETALA* (HOOK. F. & THOMSON) RIDL. AND THEIR ACETYLCHOLINESTERASE ACTIVITY

Wan Mohd Nuzul Hakimi Wan Salleh[1*], Natasa Mohd Shakri[1], Mohd Azlan Nafiah[1], Nurunajah Ab Ghani[2,3], Salam Ahmed Abed[4] and Abu-Baker M. Abdel-Aal[1,5]

[1]*Department of Chemistry, Faculty of Science and Mathematics, Universiti Pendidikan Sultan Idris, 35900 Tanjong Malim, Perak, Malaysia*
[2]*Atta-ur-Rahman Institute for Natural Product Discovery (AuRIns), Universiti Teknologi MARA, Puncak Alam Campus, 42300 Bandar Puncak Alam, Selangor, Malaysia*
[3]*Faculty of Applied Sciences, Universiti Teknologi MARA, 40450 Shah Alam, Selangor, Malaysia*
[4]*Department of Pharmacognosy, College of Pharmacy, University of Kerbala, Iraq*
[5]*Department of Pharmaceutical Organic Chemistry, Faculty of Pharmacy, Assiut University, Assiut 71526, Egypt*

*Plants have always been a common source of medicaments, either in the form of traditional preparations or as pure active principles. Polyalthia belong to the Annonaceae family and are a type of evergreen trees distributed across many tropical and subtropical regions. Polyalthia stenopetala is locally used to treat rheumatic fever and diarrhea. Herein, we report the phytochemical composition and acetylcholinesterase (AChE) inhibitory activity of Polyalthia stenopetala. Fractionation and purification of the stem bark extract of P. stenopetala led to isolation and identification of laurotetanine (**1**), N-methyllaurotetanine (**2**), reticuline (**3**), liriodenine (**4**), yangambin (**5**), syringaresinol (**6**), vanillic acid (**7**), 4-hydroxybenzoic acid (**8**), cinnamic acid (**9**), and syringic acid (**10**). Structures of these ten compounds were elucidated using different spectral analyses and their comparison with previously reported data. All isolated compounds were found to inhibit AChE (inhibition of 40.2 to 80.6%). Our study highlights the potential of Polyalthia species as phytomedicinal sources.*

Keywords: *Annonaceae, Polyalthia stenopetala, alkaloid, lignan, acetylcholinesterase*.

INTRODUCTION

Alzheimer's disease (AD), a neurodegenerative disease associated with memory loss and various psycho-behavioral issues, is due to a reduction in cholinergic transmission which ultimately leads to dementia with age progression. Acetyl cholinesterase (AChE) inhibitors are used to treat AD by increasing acetylcholine in cholinergic neurons synapses[1]. Tacrine, donezepil, rivastigmine, huperzine A, and galanthamine are the common medications currently used to treat AD. Unfortunately, all these drugs have adverse effects and only moderate efficacy[2]. Most of these drugs are linked to natural products which encourage the search for naturally occurring compounds from plants as potential sources of either new or more effective AChE inhibitors for treatment of AD[3].

Polyalthia, one of the largest genera in the plant family of Annonaceae, has more than three hundred species of shrubs and trees[4]. It is mainly located in the palaeotropical area extending from Southeast Asia and southern

Received in 26/8/2022 & Accepted in 21/10/2022

*Corresponding author: Wan Mohd Nuzul Hakimi Wan Salleh, E-mail: wmnhakimi@fsmt.upsi.edu.my

India to Northern Australia, and East Africa[5]. Several clerodane diterpenoids and alkaloids were isolated from *Polyalthia* plants which highlights their potential medicinal use[6&7].

Polyalthia stenopetala (Hook.f. & Thomson) Ridl. (Annonaceae) is known in Malaysia, as *jambul cicit* where it is locally used to treat rheumatic fever and diarrhea[8]. It grows as a shrub or a small to ten-meter tree with brownish inner bark and ginger-like smell[4] . These trees are suitable for urban site planting as it has green foliage with red leaves flushing, salmon pink flowers, and single-seeded, flattened squarish red fruits turning black upon maturity[5]. Our recently published study indicates that the essential oil obtained from *P. stenopetala* leaves contains thirty components representing about seventy percent of the oil with sesquiterpene hydrocarbons representing slightly above fifty percent of the oil[8]. The major constituents include α-cadinol, δ-cadinene, γ-elemene and germacrene D, respectively as 13.0%, 10.2%, 5.4%, 5.4%. Herein, we have investigated the phytochemistry and biological activity of the secondary metabolites isolated from the stem bark of *P. stenopetala* collected from Malaysia.

MATERIALS AND METHODS

Plant material

The *P. stenopetala* stem bark (SK31/19, UKMB herbarium) was collected from Gambang, Pahang in Sep-2019 and identified by Dr Shamsul Khamis (UKM, Malaysia).

General experimental procedures

Dried sample were subjected to cold extraction using different polarity solvents. Merck silica gel 60 was used as stationary phase of vacuum liquid chromatography (VLC: 230-400 mesh) and column chromatography (CC, 70-230 mesh). Merck pre-coated silica (SiO_2) gel F_{254} plates were used for TLC and spots were visualized under UV light (254 and 366 nm) and stained with Dragendorff's reagent for detection of alkaloids. Melting points were measured using Leica Gallen III as uncorrected. Bruker Avance 400 Spectrometer was used for ^{1}H-NMR (400 MHz) and ^{13}C-NMR (100 MHz) spectra using $CDCl_3$ as the NMR solvent. Perkin Elmer ATR and 1600 IR (USA) were used for IR spectra (KBr disc). The mass spectra were obtained using Shimadzu LCMS-IT-TOF (Japan). The optical rotations were recorded on a Perkin Elmer 341 Polarimeter equipped with a sodium lamp, obtained from New England Discovery Partners (NEDP) Analytical Services, USA.

Extraction and isolation

Air-dried stem bark of *P. stenopetala* (300 g) was exhaustively extracted with hexane (5L, 12h) and the residue was dried, moistened with 10% ammonium hydroxide (4 hrs), then macerated in dichloromethane (DCM, 5 L, 4 days) and filtered. The DCM supernatant was evaporated to 500 mL at rt and alkaloids were extracted with 5% HCl until a negative Mayer's test. The aqueous fraction was rendered alkaline (pH 11) with NH_4OH and alkaloids were re-extracted with DCM. The re-extracted DCM fraction was washed with distilled H_2O, dried over anhydrous sodium sulphate, and evaporated to give crude alkaloid residue (10 g) which was subjected to exhaustive CC using DCM-MeOH. This led to the separation of 10 fractions which were combined based on their TLC behavior. Fractions 2-5 (2.0 g), afforded two alkaloids identified as compound **1** (5 mg, PTLC-DCM:MeOH 92:8) and compound **2** (7 mg, PTLC-DCM:MeOH 95:5). Fraction 7-8 (2 g) yielded compound **3** (5 mg, PTLC-DCM:MeOH 95:5) and compound **4** (5 mg, PTLC-DCM:MeOH 94:6). On the other hand, the non-alkaloid organic fraction (2 g) was also subjected to exhaustive CC using hexane:DCM to yield two compounds: **5** (8 mg) and **6** (10 mg). Meanwhile, silica gel column chromatographic separation of the first hexane extract was carried out using hexane:$CHCl_3$:EtOAc and successfully yielded four compounds **7**-**10**.

Acetylcholinesterase activity

AChE inhibitory activities were measured using a spectrophotometric method [9] with electric eel AChE, acetylthiocholine iodides and 5,5'-Dithio-bis(2-nitrobenzoic) acid (DTNB) were employed. Briefly, sodium phosphate buffer (140 µL, pH 8.0), DTNB (20 µL), tested compound (20 µL, 1 mg/mL) and of AChE solution (20 µL) were incubated in a 96-well microplate (15 min, 25°C). The enzyme catalyzes hydrolysis of acetylthiocholine iodide

(10 µL) forming yellow 5-thio-2-nitrobenzoate anion which is measured at 412 nm using microplate reader (Epoch Micro-Volume Spectrophotometer, USA). AChE percentage inhibition (I%) was determined in triplicates (mean ± SD) with galantamine as a positive control and reaction rates of samples were compared with blank sample (ethanol in phosphate buffer pH = 8):

$$I\% = [\, E - S / E] \times 100;$$

where activity of enzyme without test sample is (E) and with the test sample is (S). Statistical analyses were carried out by employing one-way ANOVA (p>0.05). The experiment has been conducted at the Laboratory of Natural Products, UPSI.

RESULT AND DISCUSSION

Numerous secondary metabolites have been isolated and identified as a consequence of phytochemical research on *Polyalthia* species. Studies on the stem bark of *P. stenopetala* species were conducted in light of the reported medicinal benefits leading to isolation and structure elucidation of ten metabolites including alkaloids, lignans, and phenolics. Isolated compounds were identified as laurotetanine (**1**), *N*-methyllaurotetanine (**2**), reticuline (**3**), liriodenine (**4**), yangambin (**5**), syringaresinol (**6**), vanillic acid (**7**), 4-hydroxybenzoic acid (**8**), cinnamic acid (**9**), and syringic acid (**10**), as shown in Figure 1. To the best of our knowledge, the current study is the first to isolate and identify the above-mentioned metabolites from *P. stenopetala*. Alkaloids have been reported from other *Polyalthia* species such as *P. sumatrana*[9], *P. cauliflora*[10], *P. laterifolia*[11], and *P. insignis*[12]. Meanwhile, lignans were also reported from *P. rumphii*[13], and compound (**5**) was firstly reported from the genus *Polyalthia.* These beneficial alkaloids and lignans are found in a variety of species, which increases their chemical diversity and supports chemotaxonomic research on the *Polyalthia* species and its family of Annonaceae.

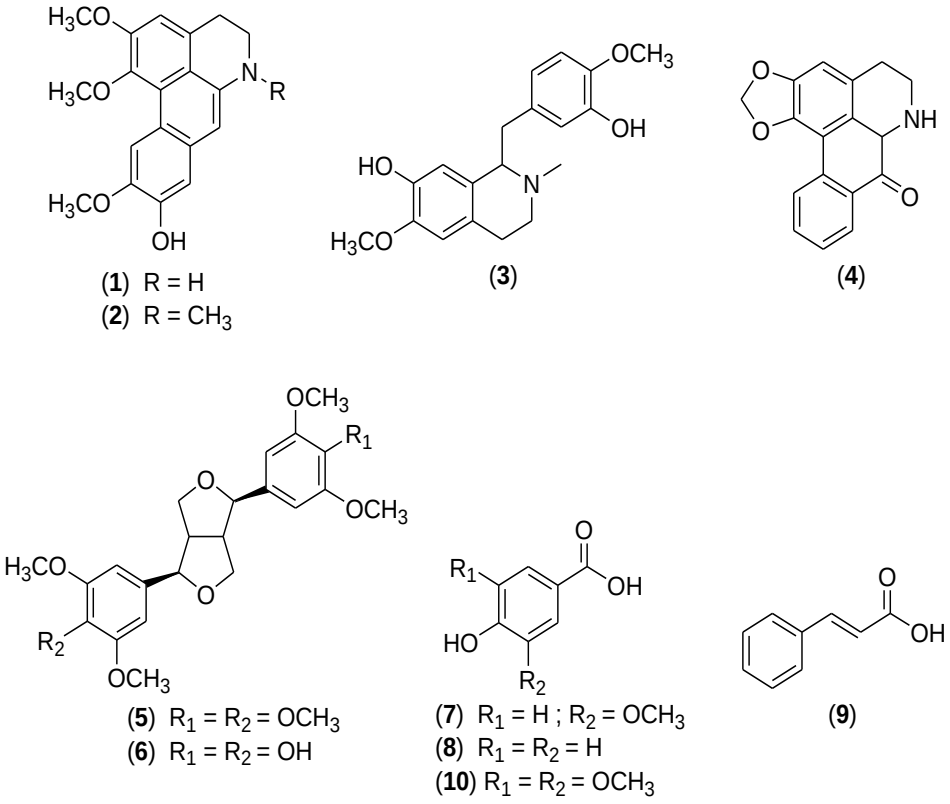

Fig.1: Chemical structures of isolated compounds.

.

(+)-Laurotetanine (**1**). Brown amorphous solid, mp 126-127°C. $[\alpha]^D$ +95° (c 0.5, EtOH). MS *m/z* 328 $[M+H]^+$, $C_{19}H_{21}NO_4$. ^{1}H NMR (400 MHz, $CDCl_3$, δ, ppm, J/Hz): 2.72 (2H, m, H7), 3.05 (2H, m, H4), 3.35 (2H, m, H5), 3.64 (3H, s, 1-OCH_3), 3.82 (1H, m, H6a), 3.86 (3H, s, 2-OCH_3), 3.90 (3H, s, 10-OCH_3), 6.58 (1H, s, H3), 6.80 (1H, s, H8), 8.05 (1H, s, H11). ^{13}C NMR (100 MHz, $CDCl_3$, δ, ppm): 29.0 (C4), 36.0 (C7), 43.2 (C5), 53.5 (C6a), 55.5 (10-OCH_3), 56.0 (2-OCH_3), 60.5 (1-OCH_3), 110.2 (C3), 111.8 (C11), 113.6 (C8), 124.0 (C11a), 126.2 (C1a), 127.5 (C1b), 128.2 (C3a), 129.2 (C9), 129.5 (C7a), 144.2 (C1), 145.8 (C10), 152.0 (C2).

(+)-*N*-Methyllaurotetanine (**2**). Brownish amorphous solid, mp 139-140°C. $[\alpha]^D$ +80° (c 0.5, $CHCl_3$). MS *m/z* 342 $[M+H]^+$, $C_{20}H_{23}NO_4$. ^{1}H NMR (400 MHz, $CDCl_3$, δ, ppm, J/Hz): 2.45 (2H, d, J = 3.6, H5), 2.55 (2H, d, J = 3.6, H7), 2.56 (3H, s, *N*-CH_3), 2.66 (2H, dd, J = 16.0, 4.4, H4), 2.97 (1H, m, H6a), 3.65 (3H, s, 1-OCH_3), 3.88 (3H, s, 2-OCH_3), 3.90 (3H, s, 10-OCH_3), 6.58 (1H, s, H3), 6.85 (1H, s, H8), 8.02 (1H, s, H11). ^{13}C NMR (100 MHz, $CDCl_3$, δ, ppm): 29.0 (C4), 34.2 (C7), 53.0 (C5), 55.6 (10-OCH_3), 56.0 (2-OCH_3), 60.4 (1-OCH_3), 62.5 (C6a), 110.0 (C3), 111.2 (C11), 113.5 (C8), 124.2 (C11a), 127.0 (C1a), 127.5 (C3a), 128.5 (C1b), 130.2 (C7a), 144.0 (C1), 144.5 (C9), 145.5 (C10), 151.1 (C2).

(+)-Reticuline (**3**). Brown amorphous solid. mp 203-200°C. $[\alpha]^D$ +85° (c 0.5, $CHCl_3$). MS, *m/z* 330 $[M+H]^+$, $C_{19}H_{23}NO_4$. ^{1}H NMR (400 MHz, $CDCl_3$, δ, ppm, J/Hz): 2.42 (3H, s, *N*-CH_3), 2.57 (1H, m, H4β), 2.65 (2H, m, H4), 2.74 (1H, d, J = 14.0, Hβ), 2.78 (1H, m, H3β), 2.82 (1H, m, H4α), 2.92 (2H, m, H3), 3.04 (1H, dd, J = 14.0, 6.0, Hα), 3.18 (1H, m, H3α), 3.62 (1H, dd, J = 6.0, 14.0, H1), 3.82 (6H, s, 4′,6-OCH_3), 6.35 (1H, s, H8), 6.50 (1H, s, H5), 6.57 (1H, dd, J = 2.0, 8.0, H6′), 6.70 (1H, d, J = 8.3, H5′), 6.75 (1H, d, J = 2.0, H2′). ^{13}C NMR (100 MHz, $CDCl_3$, δ, ppm): 25.0 (C4), 40.0 (Cα), 42.5 (*N*-CH_3), 46.2 (C3), 55.8 (4′, 6-OCH_3), 64.5 (C1), 110.5 (C5), 110.5 (C5′), 113.6 (C8), 115.6 (C2′), 120.8 (C6′), 125.0 (C8a), 130.2 (C4a), 133.2 (C1′), 143.5 (C7), 145.0 (C6), 145.2 (C3′), 145.5 (C4′).

(+)-Liriodenine (**4**). Yellow needles. mp 280-282ºC. $[\alpha]^D$ +75° (c 0.8, EtOH). MS *m/z* 275 $[M^+]$ $C_{17}H_9NO_3$. ^{1}H NMR (400 MHz, $CDCl_3$, δ, ppm, J/Hz): 6.42 (2H, s, OCH_2O), 7.15 (1H, s, H3), 7.60 (1H, td, J = 7.8, 1.5, H9), 7.75 (1H, td, J = 7.2, 1.2, H10), 7.82 (1H, d, J = 5.1, H4), 8.60 (1H, dd, J = 7.8, 1.2, H8), 8.64 (1H, d, J = 7.2, H11), 8.90 (1H, d, J = 5.1, H5). ^{13}C NMR (100 MHz, $CDCl_3$, δ, ppm): 102.5 (OCH_2O), 103.6 (C3), 108.5 (C1a), 123.6 (C3b), 124.5 (C4), 127.8 (C11a), 128.7 (C9), 129.0 (C8), 131.5 (C7a), 133.0 (C11a), 134.5 (C10), 136.2 (C3a), 145.2(C5), 145.7 (C6a), 148.5 (C2), 152.2 (C2), 182.6 (C7).

(+)-Yangambin (**5**). White solid. mp 125-128ºC. $[\alpha]^D$ +85 (c 0.02, $CHCl_3$). MS *m/z* 446 $[M^+]$ $C_{24}H_{30}O_8$. ^{1}H NMR (400 MHz, $CDCl_3$, δ, ppm, J/Hz): 3.12 (2H, m, H8, H8'), 3.86 (6H, s, 2×OCH_3), 3.88 (12H, s, 4×OCH_3), 3.95 (2H, dd, J = 9.2, 3.5, H9β, H9β'), 4.35 (2H, dd, J = 9.2, 3.5, H9α, H9α'), 4.76 (2H, d, J = 4.4, H7, H7'), 6.62 (4H, s H2, H6, H2', H6'); ^{13}C NMR (100 MHz, $CDCl_3$, δ, ppm): 54.2 (C8, C8'), 56.0 (4×OCH_3), 60.4 (2×OCH_3), 71.6 (C9, C9'), 85.8 (C7, C7'), 102.6 (C2, C2', C6, C6'), 136.5 (C1, C1'), 137.5 (C4, C4'), 153.4 (C3, C3', C5, C5').

(+)-Syringaresinol (**6**). Colorless needle. mp 183-184ºC. $[\alpha]^D$ +145° (c 0.02, $CHCl_3$). MS *m/z* 418 $[M^+]$ $C_{22}H_{26}O_8$. ^{1}H NMR (400 MHz, $CDCl_3$, δ, ppm, J/Hz): 3.10 (1H, m, H8, 8'), 3.90 (12H, s, 4×OCH_3), 3.94 (2H, m, H9β, H9β'), 4.30 (2H, m, H9α, H9α'), 4.75 (1H, d, J = 4.5, H7, H7'), 5.96 (2H, s, 2×OH), 6.60 (4H, s, H2, H2', H6, H6'). ^{13}C NMR (100 MHz, $CDCl_3$, δ, ppm): 54.5 (C8, C8'), 56.6 (4×OCH3), 71.5 (C9, C9'), 86.0 (C7, C7'), 102.7 (C2, C6, C2', C6'), 132.0 (C1, C1'), 134.3 (C4, C4'), 147.2 (C3, C5, C3', C5').

NMR spectral data of vanillic acid (7), 4-hydroxybenzoic acid (8), cinnamic acid (9), and syringic acid (10) were... in accordance with previously published data[14-16].

Inhibition of AChE is the current strategy for treatment of AD and the search for novel anticholinesterase alkaloids is attracting interest since the approval of galantamine for the treatment of AD patients. Alkaloids have received great attention due to their well-known anticholinergic activity, which generally has in common the presence of nitrogen atoms in a cyclic ring. This fact has motivated the screening of isolated alkaloids as possible AChE inhibitors. Galantamine is used as a standard in this study. It was the first alkaloid isolated from different species of

Amaryllidaceae and the most recently AChE inhibitor approved in Europe and the United States for the symptomatic treatment of AD. Aside from alkaloids, some plant terpenoids and shikimate-derived compounds may inhibit AChE to a lesser degree.

In this regard, compounds **1-6** of *P. stenopetala* were subjected to AChE inhibitory activity and the results are shown in Table 1. Among the tested alkaloids, compound **4** showed the highest inhibitory activity, 80.6%. The difference in the activity towards the cholinesterase could be attributes to the bulkiness and skeleton structure of the alkaloids especially the high degree of methoxylation at ring A and the presence of tertiary amine[17&18]. In addition, the aporphine type alkaloid is an important class of natural AChE inhibitors and there are several sub-type aporphine alkaloids that have been obtained as AChE inhibitors[19&20].

Table 1: Acetylcholinesterase inhibitory activity of isolated compounds from *P. stenopetala.*

Compounds	**AChE inhibition (I%)**
(+)-Laurotetanine (**1**)	45.0%
(+)-*N*-Methyllaurotetanine (**2**)	40.2%
(+)-Reticuline (**3**)	58.2%
(+)-Liriodenine (**4**)	**80.6%**
(+)-Yangambin (**5**)	60.5%
(+)-Syringaresinol (**6**)	69.5%
Galantamine	85.5%

Conclusion

Plant secondary metabolites provide a promising source for the discovery of new acetylcholinesterase inhibitors which are important for the treatment of various neurodegenerative diseases. The current study highlighted the effect of *P. stenopetala* alkaloids/lignans as AChE inhibitors. Further studies are needed to reveal the mode of action of these alkaloids to understand their possible roles in human physiology.

Acknowledgments

The authors would like to thank the Fundamental University Research Grant (GPUF2022) for financial support under vote 2022-0130-102-01 and the Department of Chemistry, Faculty of Science and Mathematics, Universiti Pendidikan Sultan Idris for research facilities.

REFERENCES

1. M.W. Bondi, E.C. Edmonds and D.P. Salmon, "Alzheimer's disease: past, present, and future", ***J Int Neuropsychol Soc,*** 23(9-10), 818-831 (2017).
2. R. Briggs, S.P. Kennelly and D. O'Neill, "Drug treatments in Alzheimer's disease", ***Clin Med,*** 16(3), 247-253 (2016).
3. A. Nordberg and A.L. Svensson, "Cholinesterase inhibitors in the treatment of Alzheimer's disease", ***Drug-Safety,*** 19(6), 465-480 (1998).
4. I. Nielsen, "Flowers of Annonaceae: morphology, classification andevolution", ***Nord J Bot,*** 13, 500 (1993).
5. I.H. Burkill, "A Dictionary of Economic Products of the Malay Peninsula. Ministry of Agriculture and Co-operative: Kuala Lumpur", ***Malaysia,*** (2^{nd}), 2444 (1966).
6. Y.C. Wu, C.Y. Duh, S.K. Wang, K.S. Chen and T.H. Yang, "Two new naturalazafluorene alkaloids and a cytotoxic aporphine alkaloid from *Polyalthia longifolia*", ***J Nat Prod,*** 53(5), 1327-1331 (1990).
7. Y.C. Wu, "Azafluorene and aporphine alkaloids from *Polyalthia longifolia*", ***Heterocycles,*** 29, 463 (1989).
8. N.M. Shakri, W.M.N.H.W. Salleh, S. Khamis, N.A.M. Ali and S.M. Shaharudin, "Chemical composition of the essential oils of four *Polyalthia* species from Malaysia", ***Z Naturforsch C J Biosci,*** 75(11-12), 473-478 (2020).
9. W.M.N.H.W. Salleh, N.M. Shakri, M.A. Nafiah and S. Khamis, "Chemical constituents and acetylcholinesterase activity from *Polyalthia sumatrana* (Miq.) Kurz", ***Latin Amer Appl Res,*** 52(1), 73-76 (2022).
10. A. Jossang, M. Leboeuf, A. Cave, T. Sevenet and K. Padmawinata, "Alkaloids

from Annonaceae: alkaloids from *Polyalthia cauliflora*", ***J Nat Prod,*** 47(3), 504-513 (1984).
11. S.S.S.A. Azziz, A.K.O. Aldulaimi, S.A. Aowda, Y.M. Bakri, A.A. Majhool, R.M. Ibraheem, T.K.O. Aldulaimi, H. Idris, C.F. Wong, K. Awang, M. Litaudon and F. Abdullah, "Secondary metabolites from leaves of *Polyalthia lateriflora* and their anti-microbial activity", ***Int J Res Pharm Sci,*** 11(3), 4353-4358 (2020).
12. K.H. Lee, C.H. Chuah and S.H. Goh, "seco-Benzyltetrahydroisoquinolines from *Polyalthia insignis* (Annonaceae)", ***Tetrahedron Lett,*** 38(7), 1253-1256 (1997).
13. W. Tian-Shan, L. You-Ping, W. Jing, H. Meng-Xion, Z. Ming-Guo, L. Ying and S. Xiao-Ping, "(+)-Rumphiin and polyalthurea, new compounds from the stems of *Polyalthia rumphii*", ***Nat Prod Commun,*** 8(10), 1427-1429 (2013).
14. W.M.N.H.W. Salleh, F. Ahmad, H.Y. Khong, R.M. Zulkifli and S.D. Sarker, "Madangones A and B: Two new neolignans from the stem bark of *Beilschmiedia madang* and their bioactivities", ***Phytochem Lett,*** 15, 168-173 (2016).
15. A.J. Sun, S.Q. Pang and G.Q. Wang, "Chemical constituents from *Bletilla striata* and their anti-tumor activities", ***Chinese Pharm J,*** 51(2), 101-104 (2016).
16. X.J. Li, W.C. Huang, Z. Li and X.Q. Liu, "Chemical constituents from leaves of *Acanthopanax evodiaefolius*", ***Chin Tradit Herb Drugs,*** 45(19), 2748 (2014).
17. K.Y. Khaw, S.B. Choi, S.C. Tan, H.A. Wahab, K.L. Chan and V. Murugaiyah, "Prenylated xanthones from mangosteen as promising cholinesterase inhibitors and their molecular docking studies", ***Phytomedicine,*** 21(11), 1303-1309 (2014).
18. B. Wang, Y.C. Mai, Y. Li, J.Q. Hou, S.L. Huang, T.M. Ou, J.H. Tan, L.K. An, D. Li, L.Q. Gu and Z.S. Huang, "Synthesis and evaluation of novel rutaecarpine derivatives and related alkaloids derivatives as selective acetylcholinesterase inhibitors", ***Eur J Med Chem,*** 45(4), 1415-1423 (2010).
19. M.R. Loizzo, R. Tundis, F. Menichini and F. Menichini, "Natural products and their derivatives as cholinesterase inhibitors in the treatment of neurodegenerative disorders: An update", ***Curr Med Chem,*** 15(12), 1209-1228 (2008).
20. W.M.N.H.W. Salleh, M.A. Nafiah, M.H. Jauri and S. Khamis, "Chemical constituents and acetylcholinesterase inhibitory activity of *Beilschmiedia insignis* Gamble", ***Bull Chem Soc Ethiopia,*** 35(3), 685-691 (2021).

Bull. Pharm. Sci., Assiut University, Vol. 46, Issue 1, 2023, pp. 217-223.

نشرة العلوم الصيدلية
جامعة أسيوط

BULL. PHARM. SCI. Assiut Univ.

الأيضات الثانوية من اللحاء الجذعي لـــنبات بولي الثيا ستينوبيتالا (هوك. و. وطومسون ريدل) و نشاط أسيتيل كولين استيراز خاصتهم

وان محمد نزل حكيمي وان صالح[١] – ناتاسا محمد شاكري[١] – محمد أزلان نافع[١] – نورونجاه أب غاني[٢،٣] – سلام أحمد عابد[٤] – أبوبكر م. عبد العال[١،٥]

[١] قسم الكيمياء ، كلية العلوم والرياضيات ، جامعة بنديكان سلطان إدريس ، ٣٥٩٠٠ تانجونج ماليم ، بيراك ، ماليزيا

[٢] معهد عطاء الرحمن لاكتشاف المنتجات الطبيعية (AuRIns) ، جامعة مارا للتكنولوجيا ، حرم بونشاك علم ، ٤٢٣٠٠ بندر بونشاك علم ، سيلانجور ، ماليزيا

[٣] كلية العلوم التطبيقية ، جامعة مارا للتكنولوجيا ، ٤٠٤٥٠ شاه علم ، سيلانجور ، ماليزيا

[٤] قسم العقاقير ، كلية الصيدلة ، جامعة كربلاء ، العراق

[٥] قسم الكيمياء العضوية الصيدلية، كلية الصيدلة، جامعة اسيوط، أسيوط ٧١٥٢٦، مصر

تعتبر النباتات مصادر مهمة جدًا للعديد من المركبات الحيوية النشطة ذات القيمـــة التـــي تفيـــد صحة الإنسان والحيوان. هنا ، نقوم بنشر التركيب الكيميائي النباتي والنشاط المثـــبط لانـــزيم أســـيتيل كولينستراز لـــنبات بولي الثيا ستينوبيتالا. أدى تجزئة وتنقية مستخلص لحاء ساق هـــذا النبـــات إلـــى الفصل والتعرف علي لوروتيتانين (١)، ن–ميثيل لوروتيتانين (٢)، ريتيكـــولن (٣)، ليريـــودينين (٤)، يانجامبين(٥)، سرنجاريزينول (٦)، حمض فانيليك (٧) ، وحمـــض ٤–هيدروكســـي بنزويـــك (٨) ، وحمض سيناميك (٩) ، وحمض السرنجك (١٠). تم التعرف علي التركيب الكيميائي لهذه المركبـــات باستخدام تحليلات طيفية مختلفة ومقارنتها مع البيانات التي تم نشرها مسبقًا. قامت جميـــع المركبـــات بتثبيط انزيم أسيتيل كولينستراز بنسب تتراوح بين ٤٠.٢ و ٨٠.٦٪. تسلط دراستنا الضوء على أنواع البولي الثيا كمصادر طبية نباتية.