PROFIL FITOKIMIA DAN GC-MS RESIN *DRYOBALANOPS KEITHII*
Phytochemical And Gc-Ms Profile Of Dryobalanops Keithii Resin

Oleh:
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ABSTRAK

Dryobalanops keithii sebagai salah satu jenis dipterokarpa yang ditemukan di Kalimantan Timur, secara tradisional berfungsi sebagai obat luka dalam. Namun resin *Dryobalanops keithii* hingga saat ini belum diketahui kandungan kimianya. Penelitian bertujuan untuk mengetahui kandungan resin *Dryobalanops keithii* menggunakan analisa fitokimia dan GC-MS. Uji fitokimia yang dilakukan antara lain uji alkaloid, flavonoid, saponin, tannin, terpenoid dan steroid. Uji GC-MS menggunakan Shimadzu QP 2010, tipe kolom RTx-5MS. Hasil uji fitokimia dari resin kapur *D.keithii* yang larut dalam etanol 96% mengandung alkaloid dan terpenoid. Hasil uji GC-MS mendeteksi 29 senyawa kimia Senyawa 2-[4-Cyclohexylbutanoylamino]-3-chloro-1,4-naphthoquinone ($C_{20}H_{22}ClNO_3$) sebanyak 0,99% tergolong alkaloid. α-Pinene, β-pinene, humulene dan γ-gurjunene merupakan contoh senyawa terpenoid.
Kata kunci: Dryobalanops keithii, resin, fitokimia, GC-MS

ABSTRACT

Dryobalanops keithii, one of the dipterocarp species found in East Kalimantan, has traditionally functioned as internal wounds medicine. Unfortunately, the chemical content of Dryobalanops keithii resin is unknown. The study aimed to determine the resin content of Dryobalanops keithii using phytochemical and GC-MS tests. Phytochemical tests carried out alkaloids, flavonoids, saponins, tannins, terpenoids, and steroids. GC-MS test using Shimadzu QP 2010, column type RTx-5MS. Phytochemical test results of D. keithii lime resin, which is soluble in 96% ethanol, contain alkaloids and terpenoids. The results of the GC-MS test detected 29 chemical compounds. Compounds 2-[4-Cyclohexylbutanoylamino]-3-chloro-1,4-naphthoquinone (C20H22ClNO3) as much as 0,99% were classified as alkaloids. α-Pinene, β-pinene, humulene, and γ-gurjunene are terpenoid compounds.
Keywords: Dryobalanops keithii, resin, phytochemical, GC-MS

I. PENDAHULUAN

Pulau Kalimantan memiliki hutan hujan tropis yang didominasi oleh family Dipterocarpaceae (Eni et al., 2018). Jenis Dipterokarpa dapat dimanfaatkan baik kayunya maupun non kayu, seperti resin (Purwaningsih, 2004). Resin pada jenis dipterokarpa dapat dibedakan menjadi *solid* resin dan oleoresin (Evans et al., 2003). *Solid* resin berbentuk padatan yang rapuh dengan warna yang spesifik. Oleoresin berwujud cair dan memiliki aroma yang khas. Resin/oleoresin didapatkan apabila kulit batang atau kayunya dilukai (Evans et al., 2003; Purwaningsih, 2004).

Senyawa kimia yang dimiliki dari tiap jenis Dipterokarpa berbeda-beda dan khas. Contohnya adalah dari jenis *Shorea javanica* yang salah satu produk unggulannya adalah damar mata kucing dengan senyawa kimia *germacrene, vulgarol B* dan lai-lain (Gusti, 2014; Yunanta et al., 2014). Sedangkan produk dari *Dryobalanops aromatica* adalah kamfer dan parfum, serta diketahui memiliki senya seperti *borneol, caryophyllene,* dan lain-lain (Aswandi & Kholibrina, 2020; Pasaribu et al., 2014).

Genus Dryobalanops (Kapur) merupakan salah satu bagian dari family Dipterocarpaceae (Dayanandan et al., 1999) juga memiliki resin. Dryobalanops keithii adalah salah satu jenis

jenis kapur yang ditemukan di Kalimantan Timur. Berdasarkan keterangan pengobat tradisional di desa Merabu, kecamatan Kelay, kabupaten Berau, ±5 gram resin kapur ditumbuk hingga halus, diminum dengan air, berfungsi untuk mengobati luka dalam. Resin dari jenis *Dryobalanops keithii* hingga saat ini belum diketahui kandungan kimia dan potensi kegunaannya pada skala yang lebih luas.

Sebagai langkah awal untuk mengetahui kegunaan resin D. keithii perlu dilakukan uji fitikimia dan uji GC-MS. Uji fitikimia berfungsi untuk mengetahui jenis metabolit sekunder, yaitu alkaloid, flavonoid, saponin, tannin, terpenoid dan steroid (Rachmawan & Dalimunthe, 2017). Sedangkan untuk menentukan senyawa kimia dalam suatu bahan dapat digunakan uji GC-MS (Darmapatni et al., 2016). Penelitian bertujuan untuk mengetahui kandungan resin dari jenis *Dryobalanops keithii* menggunakan analisa fitokimia dan GC-MS sehingga dapat diketahui potensi kegunaannya pada skala yang lebih luas.

II. METODOLOGI PENELITIAN

1.1.Preparasi contoh uji

Resin D keithii diperoleh dari pohon yang terluka di hutan sekitar desa Merabu, Kecamatan Kelay, Kabupaten Berau. Berdasarkan identifikasi botani Dryobalanops keithii sesuai dengan specimen pada http://specimens.kew.org/herbarium/K000671041. Resin diperoleh dari 2 pohon, dengan berat 4,05 gram dan 6,21 gram.

10 gram resin yang telah dihaluskan selanjutnya dicampur dengan 20 ml etanol 96% dalam erlenmeyer dan ditutup. Setelah didiamkan selama 48 jam, filtrate disaring dan dipekatkan hingga 10 ml. Setelah

1.2.Pengujian Fitokimia

Pipet 1 ml filtrat pekat ke dalam tabung reaksi, lalu larutkan dalam 14 ml etanol untuk digunakan sebagai bahan uji fitokimia. Uji fitokimia yang dilakukan antara lain uji alkaloid, flavonoid, saponin, tannin, terpenoid dan steroid.

a. Pengujian Alkaloid (Amta & Jyoti, 2012)

Tambahkan sebanyak 5 ml ekstrak ke dalam 2 ml HCl, lalu tambahkan 1 ml larutan Dragendorff. Warna larutan akan berubah menjadi jingga atau merah yang menandakan ekstrak tersebut mengandung alkaloid.

b. Pengujian Flavonoid (Oeung et al., 2017)

Tambahkan beberapa tetes natrium hidroksida encer (NaOH 1%) ke dalam total 1 ml ekstrak. Ekstrak tampak berwarna kuning bening dan tidak berwarna setelah ditambahkan asam encer (1% HCl), menunjukkan adanya flavonoid.

c. Pengujian Saponin (Surya and Hari, 2017)

Kocok ekstrak ± 10 menit saponin akan terdeteksi bila kocokan ekstrak menghasilkan buih yang stabil, dan saponin tidak akan hilang ketika ditambahkan 1 tetes HCl 2N.

d. Pengujian Tanin (Auwal et al., 2014)

Ketika larutan timbal asetat 1% ditambahkan ke ekstrak dan endapan kuning terbentuk, tanin terdeteksi.

e. Pengujian Terpenoid dan Steroid (Keo et al., 2017)

Tambahkan 10 tetes anhidrida asetat dan 2 tetes asam sulfat pekat ke dalam 1 ml sampel yang dilarutkan dalam aseton. Selain itu, reagen Liebermann-Burchard ditambahkan ke sampel uji, dikocok dan didiamkan selama beberapa menit. Jika terjadi perubahan warna menjadi merah dan ungu, uji terpenoid positif. Jika warna berubah menjadi hijau dan biru, hasil tes menunjukkan adanya steroid.

1.3.Pengujian GC-MS

Untuk memperkirakan kandungan senyawa dalam ekstrak, dilakukan uji GC-MS. GC-MS (Shimadzu QP 2010: Tipe kolom RTx-5MS (Restek Corp.), panjang 30 m, temperatur masuk dan detektor) 250˚C, temperatur kerja 50-300˚C. Atur kenaikan suhu 50-120˚C, pertahankan pada laju pemanasan 4˚C/menit selama 1 menit, lalu suhu 120-300˚C, laju pemanasan 6˚C/menit, lalu pertahankan itu pada suhu ini selama 5 menit, waktu retensi total (Rt) bisa sampai 60 menit.Gas pembawa: helium, kisaran berat molekul 50-500. Kuantifikasi senyawa yang diprediksi diperoleh dengan membaca area pada grafik GC-MS. Gunakan perpustakaan perangkat lunak Wiley/NIST untuk memperkirakan senyawa yang dihasilkan oleh uji GC-MS.

III. HASIL DAN PEMBAHASAN

Untuk mengetahui kelompok metabolit sekunder dalam resin D. keithii larut etanol 96% dilakukan uji fitokimia.

Tabel 1. Hasil uji fitokimia
Table 1. Phytochemical test results

Komponen fitokimia	Hasil uji	Keterangan
alkaloid	+	sedikit
flavonoid	-	Tidak terdeteksi
saponin	-	Tidak terdeteksi
tanin	-	Tidak terdeteksi
terpenoid	+++	banyak
steroid	-	Tidak terdeteksi

Sumber: data primer

Berdasarkan hasil uji fitokimia, resin D. *keithii* larut etanol 96% mengandung sedikit alkaloid dan banyak terpenoid. Sebagai perbandingan, jenis *Dryobalanops oblongifolia* mengandung komponen steroid (Indriani et al., 2020) dan *Dryobalanops aromatica* mengandung terpenoid (Aswandi & Kholibrina, 2020; Pasaribu et al., 2014).

Alkaloid adalah sekelompok bahan kimia alami yang mengandung sebagian besar atom nitrogen basa. Alkaloid diproduksi oleh berbagai macam organisme, termasukbakteri, jamur, hewan dan tumbuhan. Senyawa ini memiliki berbagai manfaat seperti anti kanker, anti depresan, anti nosiseptif, anti-inflamasi, anti piretik, anti-platelet, danti-oksidan dan anti-bakteri (Ain et al., 2016; Hartrampf et al., 2018; Khan et al., 2018). Ciri khas alkaloid yaitu memiliki atom N yang berasal dari asam amino dan merupakan bagian dari heterosiklik (Lichman, 2021).

Terpenoid merupakan kelompok metabolit sekunder terbesar, dilihat dari jumlah senyawa dan variasi struktur struktur dasarnya. Terpenoid banyak ditemukan pada tumbuhan tingkat tinggi, namun dari penelitian diketahui bahwa jamur, organisme laut dan serangga juga menghasilkan terpenoid.

Senyawa terpenoid memiliki sifat yang tersusun atas karbon-karbon dalam kelipatan lima. Kebanyakan teepenoid juga diketahui memiliki kerangka karbon yang terdiri dari dua atau lebih unit C_5 yang disebut unit isopren. Disebut satuan isopren karena kerangka karbon C_5 sama dengan senyawa isoprena. Dari beberapa struktur senyawa terpenoid yang telah diidentifikasi, terlihat bahwa unit-unit isoprena ini saling berhubungan secara teratur dimana “kepala” suatu unit bergabung dengan “ekor” unit lainnya dan pengaturan ini dikenal sebagai aturan isopren (Kristanti, Alfinda Novi, et al. 2019).

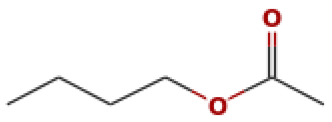
Untuk mengetahui kandungan senyawa kimia dalam resin D. keithii larut etanol 96% dilakukan uji GC-MS. Dugaan senyawa kimia hasil uji GC-MS dapat dilihat pada tabel 1 berikut ini :

Tabel 2. Hasil uji GC-MS
Tabel 2. GC-MS test results

No.	**Waktu retensi (menit)** *Retention time (minutes)*	**Konsentrasi (%)** *Concentration (%)*	**Senyawa kimia** *Chemical compound*
1	4.543	1.38	1,6-Heptadien-3-yne

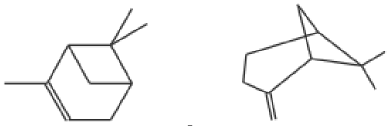
2	5.263	0.06	Acetic acid, butyl ester
3	6.004	0.36	Tyranton -
4	8.253	0.17	α-Pinene
5	8.355	0.01	Rhodium, [1,2-bis(.eta.2-ethenyl)-4-ethenylcyclohexane]di-.mu.-chlorodi-
6	8.509	0.44	α-Pinene
7	9.860	0.04	β-Pinene
8	16.601	2.85	Patchoulane
9	18.306	0.35	1b,5,5,6a-Tetramethyl-octahydro-1-oxa-cyclopropa[a]inden-6-one
10	19.044	0.30	12-Oxabicyclo[9.1.0]dodeca-3,7-diene, 1,5,5,8-tetramethyl-, [1R-(1R*,3E,7E,11R*)]-
11	21.115	0.15	Tetracyclo[6.3.2.0(2,5).0(1,8)]tridecan-9-ol, 4,4-dimethyl-
12	21.526	0.10	Patchoulane
13	22.434	0.27	Patchoulane
14	22.710	0.85	Isocaryophyllene
15	23.231	0.73	Patchoulane
16	23.549	0.10	Humulene
17	24.699	0.04	α-Bulnesene
18	26.718	0.04	Spiro[2.2]pentane-1-carboxylic acid, 2-cyclopropyl-2-methyl-
19	28.612	0.11	Bicyclo[3.3.0]octan-2-one, 7-isopropylidene-
20	32.975	0.07	Palmitic acid
21	44.865	1.04	Phthalic acid
22	45.754	0.08	Bicyclo[2.2.1]heptane-2,5-diol, 1,7,7-trimethyl-, (2-endo,5-exo)-
23	53.000	3.22	Lupeol
24	53.059	14.62	γ-Gurjunene
25	53.385	0.28	Bicyclo[3.3.1]nonan-2-one, 1-methyl-9-(1-methylethylidene)-
26	53.405	0.99	2-[4-Cyclohexylbutanoylamino]-3-chloro-1,4-naphthoquinone
27	54.209	68.90	9,19-Cycloergost-24(28)-en-3-ol, 4,14-dimethyl-, acetate, (3 β.,4. α.,5 α)-
28	54.545	0.67	Phenylacetic acid, 2-(1-adamantyl)ethyl ester
29	54.573	1.77	Betulin

Sumber : Data primer



Gambar (*Figure*) 1. Acetic acid, butyl ester

Dari hasil uji GC-MS diduga senyawa acetic acid, butyl ester ($C_6H_{12}O_2$) terkandung dalam resin kapur *D.keithii* yang larut dalam etanol 96% sebanyak 0,06% dengan waktu retensi 5,263 menit. Acetic acid, butyl ester merupakan kelompok ester dari tumbuhan yang berfungsi sebagai antibiotik (Mukhtarovna, 2021), antioksidan (K. Li et al., 2007) dan penyedap rasa (FAO, 2015; Pubchem, 2020). Ester dari tumbuhan aman untuk digunakan sebagai bahan makanan pada manusia.



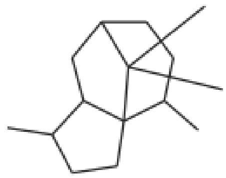
a b.

Gambar 2 a. Alpha-pinene, b. Betha-pinene

Berdasarkan tabel hasil uji GC-MS resin kapur *D.keithii* yang larut dalam etanol 96%, diduga mengandung senyawa Alpha-Pinene dan Betha-pinene merupakan senyawa organik dari kelas terpene (Jaoui & Kamens, 2003) dengan rumus molekul $C_{10}H_{16}$ (Gambar 2). Kedua senyawa ini terdapat sebanyak 0,17% dan 0,04% dengan waktu retensi masing-masing senyawa 8,253 menit dan 9,860 menit. Senyawa ini berfungsi sebagai anti-inflamasi dan *inhibitor acetylcholinesterase*, (membantu daya ingat) (Nissen et al., 2010), antimikroba (Silva, Ana Cristina Rivas da et al., 2012; Van Zyl et al., 2006; Wibowo & Komarayati, 2015), anti jamur, pewangi (Salehi et al., 2019).

Senyawa α-pinene dan ß-pinene juga memiliki sifat antiseptik yang kuat serta berfungsi sebagai agen antibiotik (Kovač et al., 2015), anti-koagulan (N. Y. Yang et al., 2011), anti-inflammatory (Cho et al., 2017; Kim et al., 2015; X. J. Li et al., 2016; Rufino et al., 2014) serta antitumor (Catanzaro et al., 2012; W. Chen et al., 2015; W. Q. Chen et al., 2014; Kusuhara et al., 2012; Matsuo et al., 2011; Susilo et al., 2020; Y. Wang et al., 2019; Q. Xu et al., 2018; Zhang et al., 2015; Zhao et al., 2018).

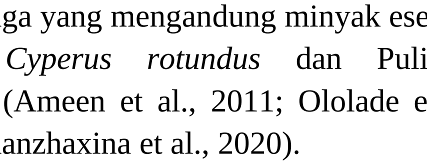
Alpha-pinene dan Betha-pinene juga merupakan salah satu dari komponen obat hati dan ginjal (Sybilska et al., 1994). Serta digunakan sebagai anti-bakteri karena efek toksiknya pada membran (Alma et al., 2004). Pada penelitian lain ditemukan memiliki efek penghambat untuk kanker payudara dan leukimia (Zhou et al., 2004) serta alpha-pinene digunakan sebagai antioksidan (Austin et al., 1988; Bouzenna et al., 2017; Karthikeyan et al., 2018, 2019; Türkez & Aydın, 2016) begitu pula dengan betha-pinene (Sharopov et al., 2015). Pemberian senyawa pinenes juga terbukti sangat fleksibel dalam sintesis polimer (Kamigaito & Satoh, 2017; Winnacker & Rieger, 2015). Senyawa ini juga ditemukan dalam minyak esensial rosemari (Rosmarinus officinalis) dan pinus (Chahboun et al., 2014; Derwich et al., 2011; Salehi et al., 2019; Wibowo & Komarayati, 2015)



Gambar (*Figure*) 3. Patchoulane

Patchoulane ($C_{15}H_{26}$) dengan struktur kimia seperti pada gambar 3 juga ditemukan dalam resin kapur *D.keithii* yang larut dalam etanol 96% berdasarkan dari hasil uji GC-MS pada tabel 1. sebanyak 0,10% dengan waktu retensi sebesar 21,526 menit yang di dapat dari hasil GC-MS. Senyawa ini banyak terdapat pada bunga yang mengandung minyak esensial seperti *Cyperus rotundus* dan Pulicaria vulgaris (Ameen et al., 2011; Ololade et al., 2014; Zhanzhaxina et al., 2020).

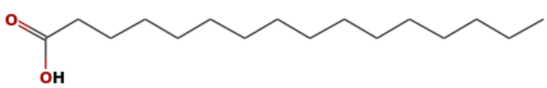
Senyawa Patchoulane yang masih tergolong ke dalam senyawa sesquiterpene ini memiliki sifat sitotoksik dikarenakan kemampuannya dalam menghambat sel kanker ovarium dan sel kanker endometrium (Ahn et al., 2015). Senyawa ini juga dilaporkan sebagai senyawa analgesik dan anti-inflamasi (Chavan et al., 2012). Beberapa penelitian menyebutkan bahwasanya senyawa ini dapat berpotensi menjadi anti-HBV dengan gugus karboksil pada posisi C-4 yang menunjukkan aktivitas melawan sekresi HbsAg dengan cara yang bergantung pada pemberian dosis (H. B. Xu et al., 2015).



Gambar (*Figure*) 4. A. Isocaryophyllene, b. Humulene

Dalam studi ini, diduga resin kapur *D. keithii* yang larut dalam etanol 96% mengandung senyawa Isocaryophyllene dan Humulene ($C_{15}H_{24}$) sebanyak 22,710% dan 23,549% dengan waktu retensi masing-masing 0,85 menit dan 0,10 menit. Senyawa ini memiliki struktur kimia seperti gambar 4 ini masih termasuk ke dalam golongan terpena. Kedua senyawa ini biasanya terdapat dalam minyak esensial dari tanaman rempah-rempah seperti oregano (*Origanum vulgare* L.), cinnamon (*Cinnamomum* sp.) dan *black pepper* (*Piper nigrum* L.) dan minyak atsiri seperti pada *Salvia officinalis*. Senyawa ini dikenal karena penggunaannya penyedap rasa dan kosmetik karena memiliki rasa aromatik yang lemah (Jayaprakasha et al., 2003; Mockute et al., 2001; Orav et al., 2004; Rzepa et al., 2009; Sköld et al., 2006).

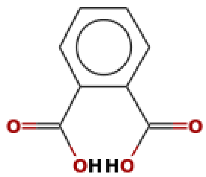
Senyawa Isocaryophyllene dan Humulene dapat digunakan sebagai anti-kanker, antibiotik, anti-inflamasi, antioksidan dan digunakan untuk anestesi lokal (Legault & Pichette, 2010). Senyawa humulene dan isocaryophyllene ini juga dapat menghambat pertumbuhan cel MCF-7 masing-masing sebesar 50% dan 69%, dan apabila kedua senyawa ini dikombinasikan maka dapat meningkatkan sitotiksisitas terhadap sel tumor secara in vitro sebesar 75% dan 90% (Legault et al., 2003; Legault & Pichette, 2010; Passos et al., 2007).



Gambar (*Figure*) 5. Palmitic-acid

Pada hasil uji GC-MS resin kapur *D. keithii* yang larut dalam etanol 96% terdapat beberapa senyawa dari golongan ester, yaitu Palmitic-acid (PA) ($C_{16}H_{32}O_2$) yang merupakan asam lemak rantai panjang dengan tulang punggung 16-karbon (gambar 5) sebanyak 32,975% dengan waktu retensi 0,07 menit, *Phthalic acid* (gambar 6) sebanyak 44,865% dengan waktu retensi 1,04 menit, dan Phenylacetic acid, 2-(1-adamantyl) ethyl ester 54,545% dengan waktu retensi 0,67 menit.

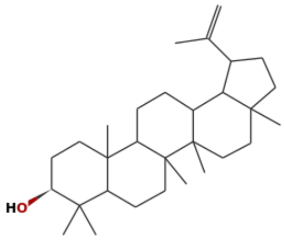
PA termasuk dalam golongan senyawa ester. Senyawa ini biasanya terdapat pada biji kelapa sawit (Denke & Grundy, 1992) dan memiliki fungsi sebagai antiproliferasi pada sel kanker kolon. PA menunjukkan aktivitas antitumor pada beberapa ekstrak tanaman serta antioksidan (Valente et al., 2012). Palmitic-acid dapat menjadi kandidat obat untuk dematitis atopik dikarenakan senyawa ini mengikat filaggrin pada asam amino LEU D75 (Earlia et al., 2019). PA juga memainkan peran dalam pelemahan ROS (Reactive Oxygen Species), ER stress, apoptosis dan inflamasi yang menyebabkan terjadinya berbagai penyakit, khususnya penyakit degeneratif seperti kanker, diabetes, dll (Nemecz et al., 2019).



Gambar (*Figure*) 6. Phthalic acid

Phthalic acid (PTA) dengan gugus kimia seperti gambar 6 ($C_8H_6O_4$) merupakan oro-isomer kristal yang tidak berwarna, .dan diduga senyawa ini terdapat dalam resin kapur *D.keithii* yang larut dalam etanol 96%. Senyawa ini digunakan dalam produksi parfum, pewarna dan sintesis beberapa senyawa organik. Senyawa ini terdapat di beberapa tanaman, seperti kemangi (*Ociumum basilicum* L.) (Fattahi et al., 2019), *Capparis decidua* (Pradeep Singh et al., 2011), *Nigella sativa* L. (Aftab et al., 2020) dan *Melastomastrum capitatum* (Ukwubile et al., 2020).

Senyawa PTA ini dapat dijadikan sebagai pendeteksi salah satu antioksidan seperti Glutathione (GSH) dalam suplemen makanan (Detsri & Seeharaj, 2017). Diketahui pula bahwa senyawa ini dapat berfungsi sebagai obat anti kanker (Ukwubile et al., 2020), antibiotik (Felton, 2019) dan digunakan pula untuk memproduksi produk plastik seperti mainan, botol dan lain-lain (Tan et al., 2017; Yilmaz, 2019).

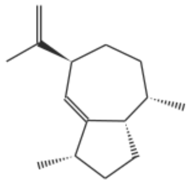


Gambar (*Figure*) 7. Lupeol

Berdasarkan hasil uji GC-MS resin kapur *D.keithii* yang larut dalam etanol 96% diduga terdapat senyawa Lupeol ($C_{30}H_{50}O$). Senyawa ini merupakan salah satu senyawa dari golongan terpenoid yang memiliki aktivitas biologis seperti anti-virus (Silva et al., 2017), obat ansiolitik (Wal et al., 2019), anti-inflamasi (Fernández et al., 2010; Geetha & Varalakshmi, 2001; Lee et al., 2016; Oliveira-Junior et al., 2019), anti-kanker (Bhattacharyya et al., 2019; He et al., 2018; Jiang et al., 2020; Min et al., 2019; Pitchai et al., 2014; Prasad et al., 2018; Rauth et al., 2016), anti-diabetes (Malik et al., 2019; Pushpanjali et al., 2019; Shreenithi et al., 2019; Soni et al., 2018; Taylor et al., 2012).

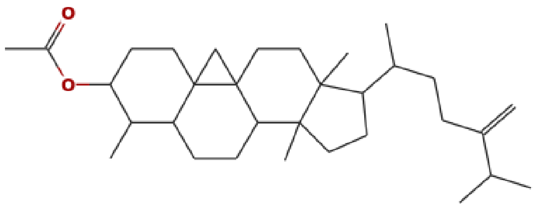
Penelitian lain juga menyebutkan beberap fungsi dari lupoel ini, diantaranya sebagai kardioprotektif (Thilakarathna & Vasantha Rupasinghe, 2012; M. Xu et al., 2020), pelindung kulit (Ciurlea et al., 2010; Payal Singh et al., 2017; Srivastava et al., 2016), anti-protozoa (Das et al., 2017; Goyal et al., 2011; Isah et al., 2018; Shai et al., 2009; Siddique & Saleem, 2011; A. Singh et al., 2020), anti-mikroba (Amoussa et al., 2016; Mutai, 2012; Okusa et al., 2014; Silva et al., 2017; Tolo, F.M., *et al.*, 2010), anti-proliferasi (Siddique & Saleem, 2011), dan sebagai agen nefroprotektif (Devkar et al., 2016; Sinha et al., 2019).

Lupeol ditemukan pada beberapa tanaman buah seperti mangga (Soujanya, 2017), strawberry, anggur, *Hieracium pilosella* (Gawrońska-Grzywacz & Krzaczek, 2007), *Tamarindus indica* (Imam et al., 2007), *Calendula officinalis* (Kadhim et al., 2019), *Crataeva nurvala* (Sudhahar et al., 2006) dan lain-lain.



Gambar (*Figure*) 8. gamma-Gurjunene

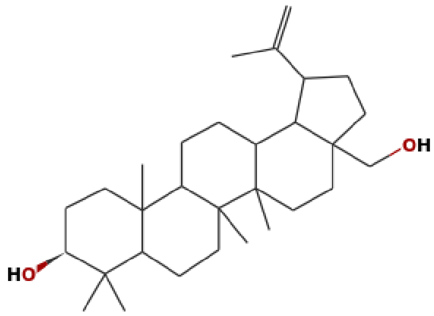
Hasil uji GC-MS diketahui bahwa dari resin kapur *D.keithii* yang larut dalam etanol 96% diduga terdapat senyawa Gamma-Gurjunene ($C_{15}H_{24}$) sebanyak 53,059% dengan waktu retensi 14,62 menit. Senyawa ini termasuk dalam kelas senyawa organik yang dikenal sebagai seskuiterpenoid. Terdapat dalam *Thymus Kotschyanus* (Karami et al., 2013), rumput teki (*Cyperus rotundus* Linn) (Busman & Kanedi, 2018) serta tanaman lainnya. Seskuiterpenoid digunakan sebagai anti-proliferasi (Ambrož et al., 2017) dan anti-kanker (H. Li et al., 2016; J. Wang et al., 2016; B. Yang et al., 2016).



Gambar (*Figure*) 9. 19-Cycloergost-24(28)-en-3-ol, 4,14-dimethyl-, acetate, (3β,4α,5α)

Hasil uji GC-MS dari resin kapur *D.keithii* yang larut dalam etanol 96% diduga pada waktu rentensi 54,209 menit terdapat senyawa 19-Cycloergost-24(28)-en-3-ol, 4,14-dimethyl-, acetate, (3β,4α,5α) ($C_{32}H_{52}O_2$) dengan konsentrasi 68,90%. 19-Cycloergost-24(28)-en-3-ol, 4,14-dimethyl-, acetate, (3β,4α,5α) termasuk dalam golongan steroid. Senyawa ini memiliki fungsi sebagai anti-mikroba, anti–inflamasi, anti kanker, anti asma, *Hepatoprotective* dan aktivitas diuretik (Chouni et al., 2021; Rajalakshmi & Mohan, 2016). 19-Cycloergost-24(28)-en-3-ol, 4,14-dimethyl-, acetate, (3β,4α,5α) dikenal juga dengan nama Cycloeucalenyl acetate atau Cycloeucalenol acetate. Selain tergolong steroid, Cycloeucalenol acetate juga memiliki sifat triterpenoid (Zubair et al., 2017). Cycloeucalenol acetate berfungsi sebagai cardiotonic dengan efek toksisitas yang rendah sehingga dapat digunakan sebagai bahan baku obat di masa datang (Adewusi et al., 2013).

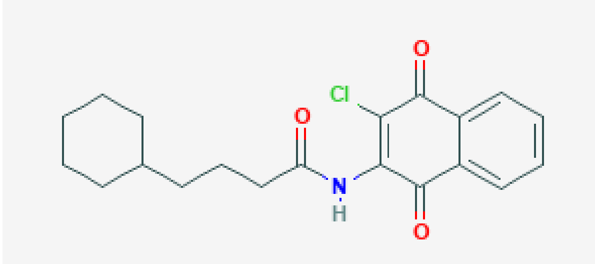
Berdasarkan tabel hasil uji GC-MS diatas diduga dalam resin kapur *D.keithii* yang larut dalam etanol 96% terdapat Phenylacetic acid, 2-(1-adamantyl) ethyl ester yang memiliki gugus ester. Ethyl ester berfungsi sebagai anti-oksidan, hemolitik, Hipokolesterolemia, perasa, nematisida dan aktivitas anti-androgenik (Tyagi & Agarwal, 2017).



Gambar (*Figure*) 10. Betulin

Senyawa hasil uji GC-MS resin kapur *D.keithii* yang larut dalam etanol 96%, diduga salah satunya adalah senyawa Betulin ($C_{30}H_{50}O_2$) tergolong dalam terpenoid (gambar 10) yang terdapat pada banyak tanaman.

Senyawa betulin berpotensi sebagai anti-HIV dan anti-inflamasi (Chaniad et al., 2019). Senyawa ini bersifat sitotoksik (Pfarr et al., 2015), berfungsi sebagai anti kanker (Bębenek et al., 2015; Y. Li et al., 2016; Yim et al., 2015; Zehra et al., 2019), anti-leishmanial (Alakurtti et al., 2010), anti oksidan, anti-inflamasi, antivirus, anti-bakteri, anti-neoplastik (Amiri et al., 2020; Rastogi et al., 2015) dan antineurodegeneratif (Tsai et al., 2017).



Hasil uji GC-MS dari resin kapur *D.keithii* yang larut dalam etanol 96% diduga terdapat senyawa 2-[4-Cyclohexylbutanoylamino]-3-chloro-1,4-naphthoquinone ($C_{20}H_{22}ClNO_3$) sebanyak 0,99% pada waktu retensi 53,405 menit. Senyawa ini termasuk dalam alkaloid karena memiliki gugus N. Senyawa ini juga memiliki gugus fungsional naphthoquinone yang secara umum berfungsi sebagai anti-inflamasi, obat analgesik, anti-bakteri, anti-parasit, antioksidan, leishmanicidal dan anti-tumor (Han et al., 2019; Jentzsch et al., 2020; Rauf et al., 2020; H. Zhao et al., 2020).

IV. KESIMPULAN

Hasil uji fitokimia dari resin kapur *D.keithii* yang larut dalam etanol 96% mengandung alkaloid dan terpenoid. Hasil uji GC-MS mendeteksi 29 senyawa kimia pada waktu retensi 4,543-54,573 menit. Senyawa 2-[4-Cyclohexylbutanoylamino]-3-chloro-1,4-naphthoquinone ($C_{20}H_{22}ClNO_3$) sebanyak 0,99% pada waktu retensi 53,405 menit tergolong alkaloid. Sedangkan contoh senyawa terpenoid adalah α-Pinene, β-pinene, humulene dan γ-gurjunene. Berbagai senyawa yang terkandung dalam resin Dryobalanops keithii berpotensi sebagai antioksidan, anti-inflamasi, antibiotic dan beberapa fungsi biologis lainnya.

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