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In Review:

Chemical Compound Content of Uncaria Plant and Its Pharmacological Effects

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Abstract— Species in the Uncaria have significant therapeutic potential for a variety of health problems, including neurodegenerative disorders, depression and conditions associated with osmotic stress. Their active compounds, such as alkaloids, flavonoids, phenolics, and terpenoids, have been extensively studied for their anti-inflammatory, antioxidant and immunomodulatory effects. In particular, Uncaria rhynchophylla has been shown to have potent anti-inflammatory, antimicrobial and immunomodulatory effects. This article aims to review research related to the chemical compounds and pharmacological effects of Uncaria plants. The method used in writing this review article involved a systematic search in various digital databases, including ScienceDirect. The search results show that the use of Uncaria as a medicinal ingredient continues to be developed, focusing on new extracts and drug formulas. Uncaria plants contain various chemical compounds, such as triterpenes, glycosides, polyphenols, flavonoids and alkaloids, each with pharmacological potential. Studies have shown that compounds in Uncaria have neuroprotective, antioxidant, immunomodulatory and anti-inflammatory effects. With the identification and characterization of critical compounds in Uncaria, there are great opportunities for developing effective herbal therapies. This article concludes that further research and development of Uncaria based formulations are needed to maximize their therapeutic potential and provide more natural and effective treatment alternatives.

Keywords – Antioxidant, Chemical Compounds; Herbal Therapy; Immunomodulatory; Pharmacological Effects

I. INTRODUCTION

Uncaria plants, especially Uncaria rhynchophylla and Uncaria tomentosa, are important in traditional medicine due to their phytochemical composition with medicinal properties [1]; [2]; [3]. The plant is commonly known as cat's claw or "Gouteng" and has been used for centuries in various traditional medicine practices, in China and South America [1]; [4]. Various health problems, ranging from inflammatory conditions to digestive diseases [5] can be treated using these plants. Another potential of species in the Uncaria genus is that they have therapeutic potential for various diseases, including neurodegenerative diseases, bone diseases, depression and conditions related to oxidative stress [1]; [4]; [2]; [6].

The chemical contents found such as alkaloids, flavonoids, phenolic compounds and terpenoids, have attracted the attention of scientists for their pharmacological effects, including anti-inflammatory, antioxidant, neuroprotective and immunomodulatory effects [7]; [8]; [9]. This is evident from the content of alkaloid compounds such as rhyncophylline and isorynchophylline have which have anti-inflammatory and neuroprotective effects [5]. In addition, polyphenolic compounds found in *Uncaria*, such as tannins and flavonoids, have antioxidant effects and may play a role in improving general health [10].

In understanding the chemical complexity and potential of medicinal compounds found in *Uncaria* plants, it is necessary to search for scientific information from various sources as scientific references in the development of natural product-based medicines. The writing of this article aims to review research related to the content of chemical compounds of *Uncaria* plants and their pharmacological effects.

II. METHODS

The method used for this literature review involved a systematic search in various digital databases to identify relevant studies regarding the chemical content and therapeutic potential of *Uncaria* plants. The search was conducted in the ScienceDirect database using keywords such as "*Uncaria*", "chemical compounds", "therapeutic potential", "anti-inflammatory" and "antioxidant".

III. RESULTS AND DISCUSSION

3.1 Chemical Compound Content in *Uncaria* and its Utilization in Medicine

Several studies have contributed to a comprehensive understanding of the chemical compound content of various *Uncaria* plants, which have been studied in various scientific reference sources and are shown in table 1. The identification and characterization of key compounds in *Uncaria* has been the subject of significant research, which sheds light on their potential medicinal efficiencies and therapeutic applications.

Table 1. Chemical Compound Content in *Uncaria* and its Utilization in Medicine

No	Species	Chemical Compounds	Chemical Formula	Chemical Compound Group	Potential for Medicine	Author and Year
1.	*Uncaria rhynchophylla*	Rhynchophyllin and Isorhynchophyllin	$C_{22}H_{28}N_2O_4$ and $C_{22}H_{28}N_2O_4$	Alkaloid	Has Neuroprotective and Anti-Inflammatory Effects	[11]
2.	*Uncaria tomentosa*	Mitrapillin and Pteropodine	-	Alkaloid	Has Antioxidant and Immunomodulatory Properties	[12]
3.	*Uncaria tamentosa*	Asam oleanolat and Asam ursolat	$C_{30}H_{48}O_3$ and $C_{30}H_{48}O_3$	Triterpen	Anti-Inflammatory and Anticancer	[12]; [13]
4.	*Uncaria*	Rutin and Kuersetin	$C_{27}H_{30}O_{16}$ and $C_{15}H_{10}O_7$	Glikosida	Has Antioxidant and Cardioprotective Effects	[14]
5.	*Uncaria tomentosa*	Katekin, Epikatekin and Procyanidin	$C_{15}H_{14}O_6$, $C_{15}H_{14}O_6$ and $C_{30}H_{26}O_{12}$	Polifenol And Flavonoid	Anti-Inflammatory and Anti-Cancer	[13]
6.	*Uncaria rhynchophylla*	Quercetin and Kaempferol	$C_{15}H_{10}O_7$ and $C_{15}H_{10}O_6$	Flavonoid	Has Neuroprotective and Vasodilating Effects	[11]
7.	*Uncaria*	Tanin	$C_{76}H_{52}O_{46}$	Polifenol	Has Antioxidant Capabilities	[10]

1. Alkaloids

Uncaria has a high alkaloid content. For example, *Uncaria rhynchophylla* contains several alkaloids, including

rhynchophyllin and isorynchophyllin, which have been shown to have neuroprotective and anti-inflammatory effects [11]. Similarly, *Uncaria tomentosa* also contains alkaloids such as mitrapillin and pteropodine, which have antioxidant and immunomodulatory properties [12].

2. Triterpenes and glycosides

Triterpenes and glycosides are important contents of *Uncaria*. Studies have reported the presence of pentacyclic triterpenes, including oleanolic acid and ursolic acid in *Uncaria tomentosa,* which contribute to anti-inflammatory and anticancer effects [12]; [13]. In addition, glycosides such as rutin and quercetin have been isolated from *Uncaria* that have antioxidant and cardioprotective effects [14].

3. Polyphenols and flavonoids

Polyphenol and flavonoid compounds are chemical compounds that are also found in *Uncaria*. Research has identified catechins, epicatechins, and procyanidins in *Uncaria tomentosa* that function as anti-inflammatory and anti-cancer [13]. In addition, in *Uncaria rhynchophylla,* flavonoids such as quercetin and kaempferol have been reported to have neuroprotective and vasodilatory effects [11]. Other polyphenols contained in *Uncaria* are tannins, which also have antioxidant abilities [10].

4. Other compounds

In addition to the above compounds, Uncaria also contains a wide variety of other bioactive molecules. carotenoids, phenolic acids, and volatile oils, which have medicinal functions [14]. The identification and characterization of these key compounds in Uncaria will provide valuable information on its pharmacological effects and therapeutic benefits, supporting its use in herbal medicine.

3.2 Pharmacological Effects of *Uncaria*

The pharmacological effects and therapeutic applications of the compounds present in *Uncaria* have been extensively studied *Uncaria rhynchophylla*, commonly known as Gouteng, has been found to possess various biological properties that contribute to its potential therapeutic value. The pharmacological effects of *Uncaria* are presented in table 2.

Table 2: Pharmacological effects of *Uncaria*

No	Species	Pharmacological Effects	Author dan Tahun
1.	*Uncaria rhynchophylla*	Has a neuroprotective effect	[1]; [6]
2.	*Uncaria rhynchophylla*	Improves Cognition, Learning Memory and Antidepressant Effects	[1]; [6]
3.	*Uncaria*	Anti-Inflammatory and Antioxidant	[2]
4.	*Uncaria tomentosa*	Reduces Osteoclastic Bone Loss	[2]
5.	*Uncaria hirsuta*	Binds Intracellular Reactive Oxygen and Inhibits Caspase Activity	[4]
6.	*Uncaria Gambir*	Antimicrobial	[8]; [3]

Firstly, *Uncaria rhynchophylla* extract has been shown to have neuroprotective effects, which may be beneficial for neurodegenerative diseases such as Alzheimer's and Parkinson's disease. According to [1] and [6] highlighted *Uncaria rhynchophylla*'s ability to improve cognition, memory, and learning in middle-aged rats and its antidepressant effects by activating 5-HT1A receptors. These findings suggest the possibility that compounds found in *Uncaria* may be able to repair neuronal damage and improve cognitive function.

Secondly, compounds in *Uncaria* have shown anti-inflammatory and antioxidant properties, indicating their potential in controlling inflammation. Ref [2] reported that *Uncaria tomentosa* extract was able to reduce osteoclastic bone loss in-vivo,

indicating its efficacy in the treatment of bone-related diseases. In addition, [4] demonstrated the ability of *Uncaria hirsuta* compounds to bind intracellular reactive oxygen and inhibit caspase activity, under oxidative stress conditions.

In addition, *Uncaria* compounds have antimicrobial and immunomodulatory effects that can be beneficial in fighting infections and regulating immune responses. Ref [8] and [3] observed antimicrobial properties of *Uncaria gambir* leaf extract. These findings suggest a possible role for *Uncaria* compounds in supporting immune function and fighting microbial infections. With the development of technology, it has paved the way for the development of standardized extracts and new drug formulations especially from various *Uncaria* species [7]; [15].

IV. Conclusion

Species in the *Uncaria* genus contain various active compounds such as alkaloids, triterpenes, glycosides, polyphenols, flavonoids and other bioactive compounds. These compounds have pharmacological effects as anti-inflammatory, antioxidant, neuroprotective and immunomodulatory agents. Studies conducted show that *Uncaria rhynchophylla* has neuroprotective effects, improves cognition, memory and learning, as well as anti-inflammatory and antioxidant effects. In addition, *Uncaria tomentosa* extract has also been shown to reduce osteoclastic bone loss. The development of new extracts and drug formulations from *Uncaria* plants is in the process of development. With its therapeutic potential, *Uncaria* has potential as a drug candidate for herbal therapy.

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