

## Contemporary Pharmacological Studies and Therapeutic Uses of the Medicinal Insect *Coridius chinensis*

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### ABSTRACT

*Coridius chinensis*, a traditional medicinal insect in China, consists of the dried whole insect from the Pentatomidae family (*Coridius chinensis* Dallas). Recent pharmacological research has isolated and characterized over 100 bioactive small molecules from this species. Experimental studies have revealed multiple pharmacological effects, including pain relief, antioxidant activity, anticancer potential, anticoagulation, and antibacterial properties. Traditionally, it has been used in Chinese medicine formulations to manage conditions such as impotence, hemangioma, and various types of pain. Despite these findings, comprehensive understanding of its pharmacological mechanisms remains limited. This review compiles current domestic and international research on *Coridius chinensis*, highlighting its key chemical constituents, biological activities, and therapeutic applications, offering a foundation for future development and utilization of this insect in traditional medicine.

**Keywords:** Clinical, Pharmacological activity, Main components, *Coridius chinensis*

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### Introduction

*Coridius chinensis*, a medicinal insect from the Pentatomidae family, is traditionally characterized as warm and salty and is valued for both its therapeutic and nutritional properties [1]. In southwestern China, it has long been incorporated into local diets [2]. Classical Chinese medicine references, including the Compendium of Materia Medica and the Pharmacopoeia of the People's Republic of China, highlight its ability to harmonize qi, ease pain, and strengthen Yang by warming the middle burner, making it useful for conditions such as kidney insufficiency, impotence, and lumbar or knee discomfort [3–5]. Modern studies have confirmed its rich nutrient profile and demonstrated multiple biological activities, including antibacterial effects, anticancer potential, reproductive system protection, and promotion of angiogenesis [6–10]. As scientific exploration of insect-based traditional medicine grows, *Coridius chinensis* has become recognized as a promising therapeutic agent for a variety of diseases [11]. This review compiles recent findings on its chemical constituents, pharmacological effects, and clinical applications, aiming to provide an evidence-based framework for its use, quality evaluation, and potential drug development in line with traditional Chinese medicine.

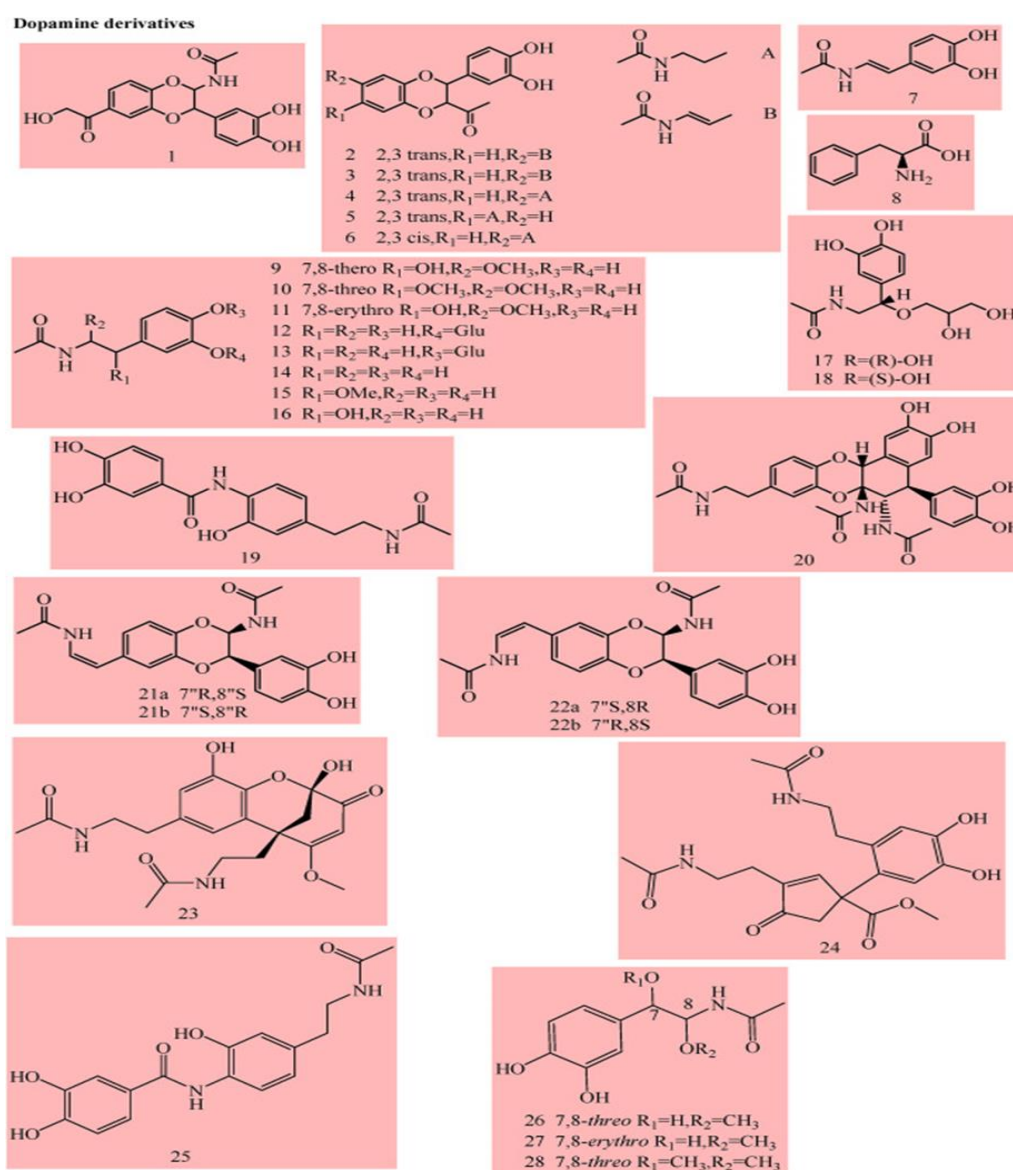
#### *Main components*

Understanding the chemical composition of traditional Chinese medicines is fundamental for studying their biological effects. Early research on *Coridius chinensis* focused mainly on its nutritional makeup [7]. With improvements in extraction and purification methods, researchers have begun isolating and characterizing its small-molecule compounds, though the biological activity of many remains underexplored [12, 13]. Analyses reveal that water and alcohol extracts of *Coridius chinensis* contain 124 distinct compounds, including fatty acids, nucleosides, amino acids, and peptides, with 74 compounds reported for the first time [14].

As a functional food, *Coridius chinensis* is highly nutritious. Modern detection techniques indicate that its main constituents are proteins, unsaturated fatty acids, amino acids, nucleosides, and dopamine-related compounds. It is rich in essential proteins, unsaturated fats, vitamins, and trace minerals, with a well-balanced amino acid composition. These molecules contribute to its medicinal properties, supporting vitality and modulating key physiological functions.

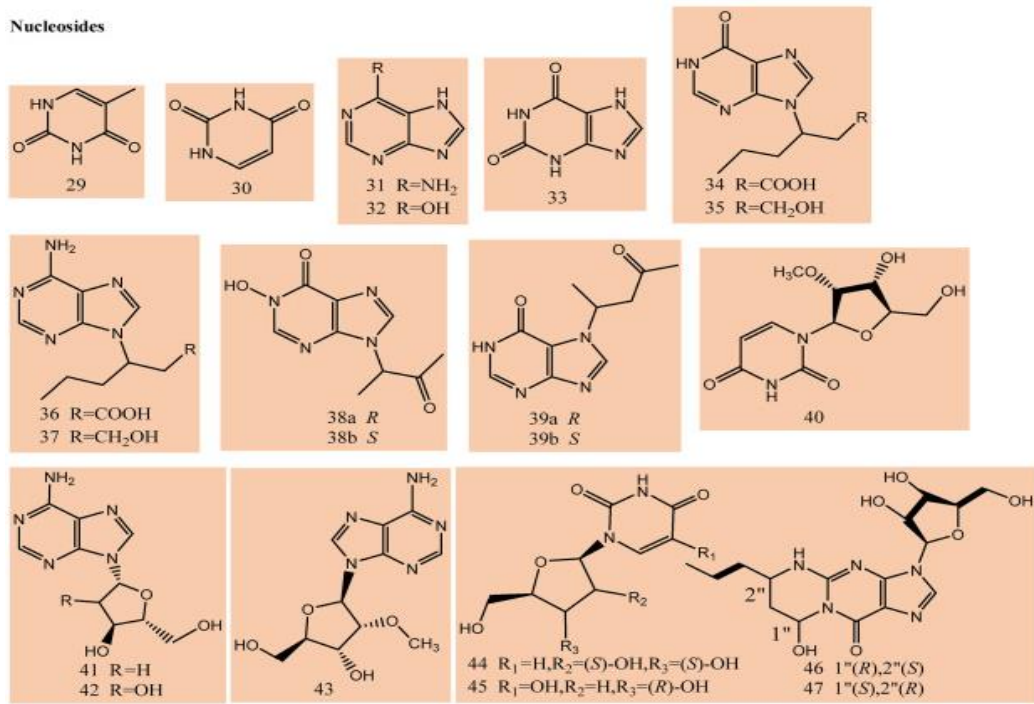
### Non-peptide compounds

Earlier investigations primarily examined macromolecules such as proteins and sugars, leaving small non-peptide molecules largely unexplored. To date, over 100 small-molecule compounds have been isolated from *Coridius chinensis*, many of which are racemic and include nucleosides, benzene derivatives, dopamine and its analogues, base heteropolymers, and sesquiterpenes [12, 14]. Yongming Yan *et al.* identified 59 compounds, including 23 previously unknown molecules, such as ( $\pm$ )-Aspongamide A, a novel dopamine trimer. Additional discoveries included a dopamine dimer, pyridine salts, nucleoside or base derivatives, and newly identified sesquiterpenes [12]. Tiantian Xu *et al.* isolated Cotidione A, a new dopamine derivative, alongside three known analogues [15]. The chemical structures and molecular formulas of these compounds are summarized in **Table 1** and illustrated in **Figure 1**.



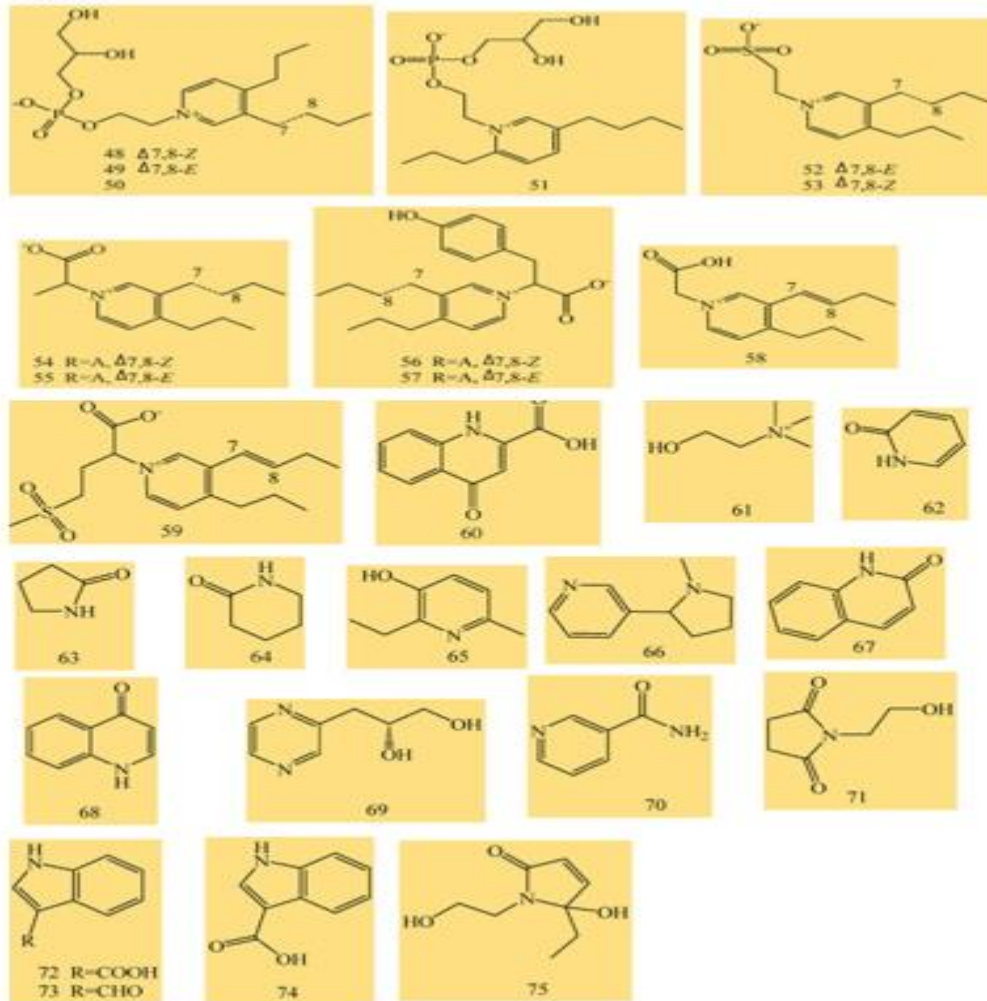
a)

**Nucleosides**



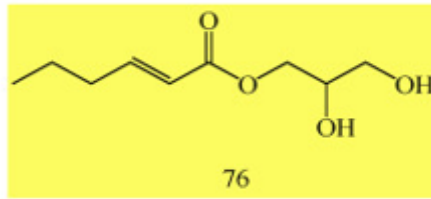
b)

**Alkaloids**



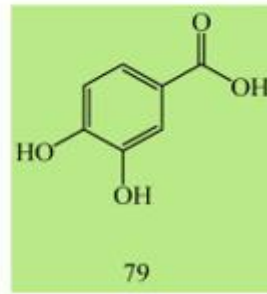
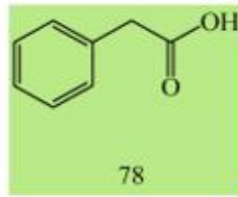
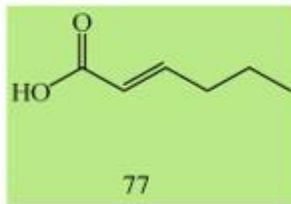
c)

**Glycerides**



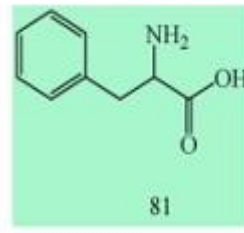
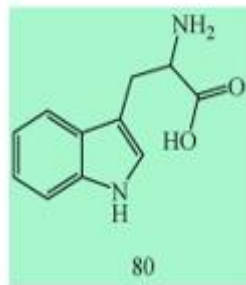
d)

**Acids**



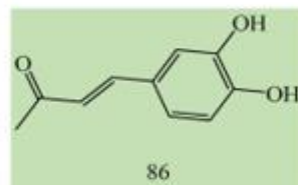
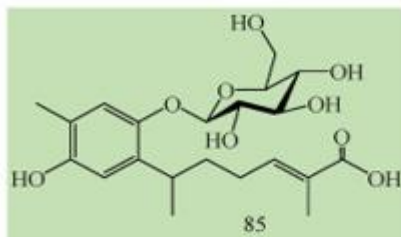
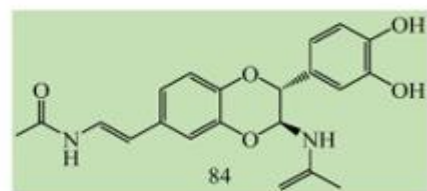
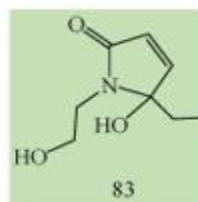
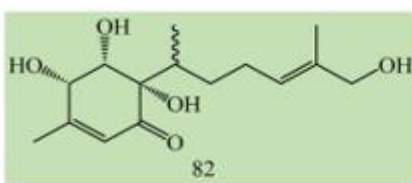
e)

**Amino acids**



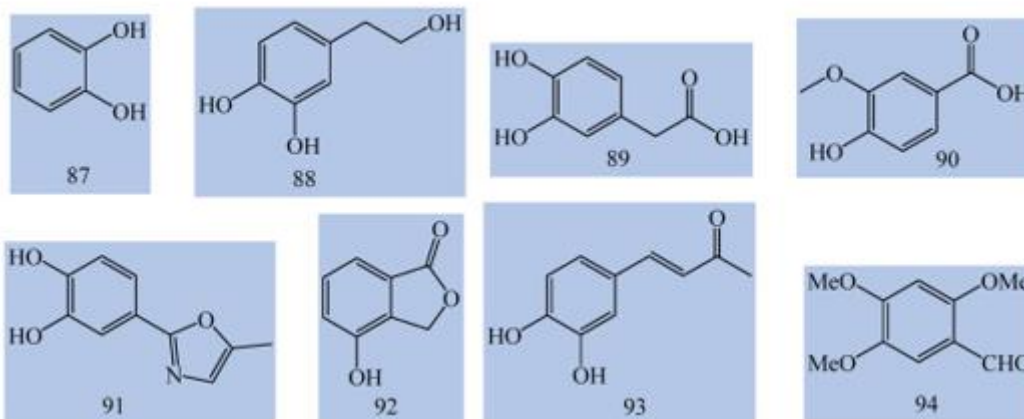
f)

**Sesquiterps**



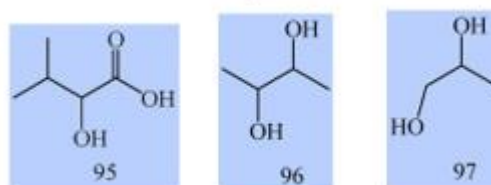
g)

**Compounds containing benzene ring**



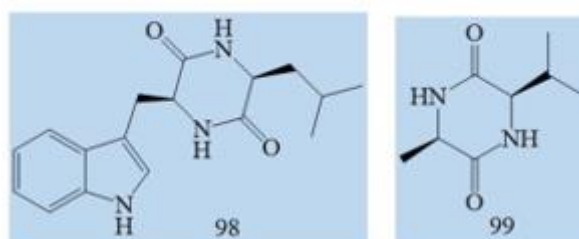
h)

**Small molecule linear compounds**



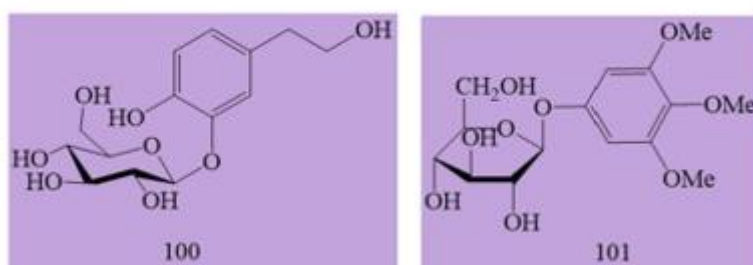
i)

**Cyclic-peptides**

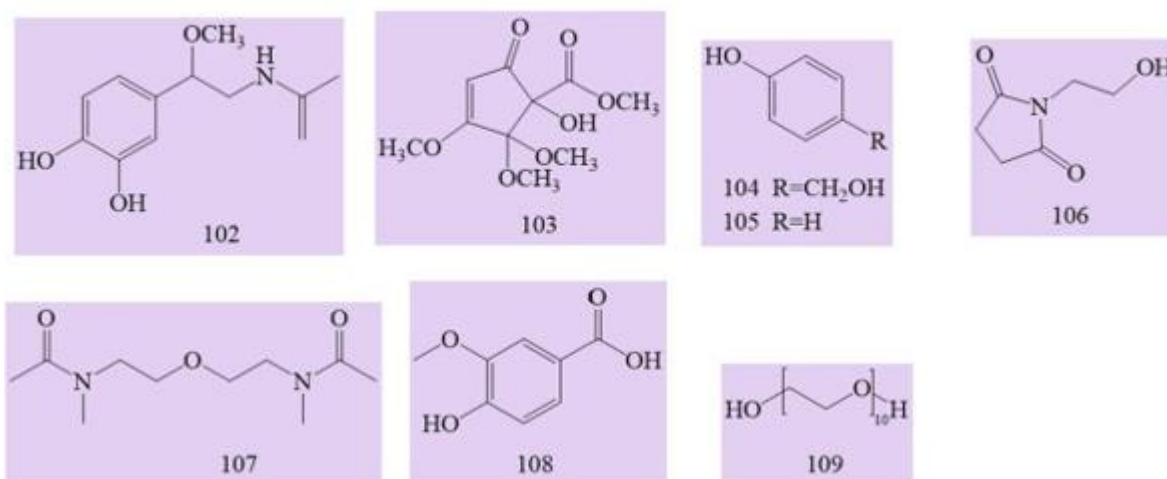


j)

**Glycosides**



k)

**Other compounds**

D)

**Figure 1.** Chemical structures of the primary small-molecule compounds identified in *Coridius chinensis* (compounds 1–109).

**Table 1.** Main small-molecule compounds identified in *Coridius chinensis*

No.	Compound name	Molecular formula	Literature
<b>Dopamine derivatives</b>			
1	cotidione A	C <sub>18</sub> H <sub>17</sub> NO <sub>7</sub>	[15]
2	trans-2-(3',4'-dihydroxyphenyl)-3-acetylamino-7-(N-acetyl-2"-aminoethylene)-1,4-benzodioxane	C <sub>20</sub> H <sub>20</sub> N <sub>2</sub> O <sub>6</sub>	[9]
3	trans-2-(3',4'-dihydroxyphenyl)-3-acetylamino-6-(N-acetyl-2"-aminoethylene)-1,4-benzodioxane	C <sub>20</sub> H <sub>20</sub> N <sub>2</sub> O <sub>6</sub>	[12]
4	trans-2-(3',4'-dihydroxyphenyl)-3-acetylamino-7-hydroxyphenyl-1,4-benzodioxane	C <sub>20</sub> H <sub>22</sub> N <sub>2</sub> O <sub>6</sub>	[9]
5	trans-2-(3',4'-dihydroxyphenyl)-3-acetylamino-6-hydroxyphenyl-1,4-benzodioxane	C <sub>20</sub> H <sub>22</sub> N <sub>2</sub> O <sub>6</sub>	[9]
6	cis-2-(3',4'-dihydroxyphenyl)-3-acetylamino-6-(N-acetyl-2"-aminoethylene)-1,4-benzodioxane	C <sub>20</sub> H <sub>20</sub> N <sub>2</sub> O <sub>6</sub>	[12]
7	1,2-dehydro-N-acetyldopamine	C <sub>10</sub> H <sub>11</sub> NO <sub>3</sub>	[8]
8	L-phenylalanine	C <sub>9</sub> H <sub>11</sub> NO <sub>2</sub>	[16]
9	aspongamides D	C <sub>11</sub> H <sub>15</sub> NO <sub>5</sub>	[17]
10	aspongamides E	C <sub>12</sub> H <sub>17</sub> NO <sub>5</sub>	[17]
11	(±)-periplanamide B	C <sub>11</sub> H <sub>15</sub> NO <sub>5</sub>	[17]
12	N-acetyldopamine-3-O-β-D-glucoside	C <sub>16</sub> H <sub>23</sub> NO <sub>8</sub>	[17]
13	N-acetyldopamine-4-O-β-D-glucoside	C <sub>16</sub> H <sub>23</sub> NO <sub>8</sub>	[17]
14	N-acetyldopamine	C <sub>10</sub> H <sub>13</sub> NO <sub>3</sub>	[9]
15	N-[2-(3,4-dihydroxyphenyl)-2-methoxyethyl]-acetamide	C <sub>11</sub> H <sub>15</sub> NO <sub>4</sub>	[12]
16	N-acetylnoradrenaline	C <sub>10</sub> H <sub>13</sub> NO <sub>4</sub>	[9]
17	aspongopusamide C	C <sub>13</sub> H <sub>19</sub> NO <sub>6</sub>	[9]
18	aspongopusamide D	C <sub>13</sub> H <sub>19</sub> NO <sub>6</sub>	[9]
19	aspongamides C	C <sub>17</sub> H <sub>18</sub> N <sub>2</sub> O <sub>5</sub>	[17]
20	(±)-aspongamide A	C <sub>30</sub> H <sub>31</sub> N <sub>3</sub> O <sub>9</sub>	[10]

21	aspongopusamide A	C <sub>20</sub> H <sub>20</sub> N <sub>2</sub> O <sub>6</sub>	[9]
22	aspongopusamide B	C <sub>20</sub> H <sub>20</sub> N <sub>2</sub> O <sub>6</sub>	[9]
23	Aspongamide B	C <sub>21</sub> H <sub>26</sub> N <sub>2</sub> O <sub>7</sub>	[12]
24	Aspongamide C	C <sub>20</sub> H <sub>24</sub> N <sub>2</sub> NaO <sub>8</sub>	[12]
25	Aspongamide D	C <sub>17</sub> H <sub>18</sub> N <sub>3</sub> NaO <sub>5</sub>	[12]
26	Trans-8-methoxy-3,4,7-trihydroxy-N-acetyldopamine	C <sub>11</sub> H <sub>15</sub> NNaO <sub>5</sub>	[12]
27	Cis-8-methoxy-3,4,7-trihydroxy-N-acetyldopamine	C <sub>11</sub> H <sub>15</sub> NNaO <sub>5</sub>	[12]
28	Trans-7,8-dimethoxy-3,4-dihydroxy-N-acetyl dopa	C <sub>12</sub> H <sub>17</sub> NNaO <sub>5</sub>	[12]
<b>Nucleosides</b>			
29	thymine	C <sub>5</sub> H <sub>6</sub> N <sub>2</sub> O <sub>2</sub>	[16]
30	uracil	C <sub>4</sub> H <sub>4</sub> N <sub>2</sub> O <sub>2</sub>	[9]
31	adenine	C <sub>5</sub> H <sub>5</sub> N <sub>5</sub>	[9, 16, 18]
32	hypoxanthine	C <sub>5</sub> H <sub>4</sub> N <sub>4</sub> O	[18]
33	xanthine	C <sub>5</sub> H <sub>4</sub> N <sub>4</sub> O <sub>2</sub>	[18]
34	asponguanine A	C <sub>11</sub> H <sub>14</sub> N <sub>4</sub> O <sub>3</sub>	[12]
35	asponguanine B	C <sub>11</sub> H <sub>16</sub> N <sub>4</sub> O <sub>2</sub>	[16]
36	aspongadenine A	C <sub>12</sub> H <sub>17</sub> N <sub>5</sub> O <sub>2</sub>	[16]
37	aspongadenine B	C <sub>11</sub> H <sub>17</sub> N <sub>5</sub> O	[16]
38	asponguanine C	C <sub>9</sub> H <sub>10</sub> N <sub>4</sub> O <sub>3</sub>	[16]
39	asponguanine D	C <sub>10</sub> H <sub>12</sub> N <sub>4</sub> O <sub>2</sub>	[16]
40	2'-O-methyluridine	C <sub>10</sub> H <sub>14</sub> N <sub>2</sub> O <sub>6</sub>	[16]
41	deoxyadenosine	C <sub>10</sub> H <sub>13</sub> N <sub>5</sub> O <sub>3</sub>	[16]
42	adenosine	C <sub>10</sub> H <sub>13</sub> N <sub>5</sub> O <sub>4</sub>	[16]
43	cordysin B	C <sub>11</sub> H <sub>15</sub> N <sub>5</sub> O <sub>4</sub>	[16]
44	Uridine	C <sub>9</sub> H <sub>12</sub> N <sub>2</sub> O <sub>6</sub>	[18]
45	thymidine	C <sub>10</sub> H <sub>14</sub> N <sub>2</sub> O <sub>5</sub>	[9]
46	asponguanosine A	C <sub>16</sub> H <sub>23</sub> N <sub>5</sub> O <sub>6</sub>	[12]
47	asponguanosine B	C <sub>16</sub> H <sub>23</sub> N <sub>5</sub> O <sub>6</sub>	[12]
<b>Alkaloids</b>			
48	Aspongerine A	C <sub>17</sub> H <sub>28</sub> NO <sub>6</sub> P	[12]
49	Aspongerine B	C <sub>17</sub> H <sub>28</sub> NO <sub>6</sub> P	[12]
50	Aspongerine C	C <sub>17</sub> H <sub>30</sub> NNaO <sub>6</sub> P	[12]
51	Aspongerine D	C <sub>17</sub> H <sub>30</sub> NNaO <sub>6</sub> P	[12]
52	Aspongerine E	C <sub>14</sub> H <sub>21</sub> NO <sub>3</sub> S	[12]
53	Aspongerine F	C <sub>14</sub> H <sub>21</sub> NO <sub>3</sub> S	[12]
54	Aspongerine G	C <sub>15</sub> H <sub>22</sub> NO <sub>2</sub>	[12]
55	Aspongerine H	C <sub>15</sub> H <sub>22</sub> NO <sub>2</sub>	[12]
56	Aspongerine I	C <sub>21</sub> H <sub>26</sub> NO <sub>3</sub>	[12]
57	Aspongerine K	C <sub>14</sub> H <sub>20</sub> NO <sub>2</sub> <sup>+</sup>	[12]
58	Aspongerine J	C <sub>21</sub> H <sub>26</sub> NO <sub>3</sub>	[12]
59	Aspongerine L	C <sub>17</sub> H <sub>25</sub> NO <sub>4</sub> S	[12]

60	Transtorine	C <sub>10</sub> H <sub>7</sub> NO <sub>3</sub>	[18]
61	choline	C <sub>5</sub> H <sub>14</sub> NO <sup>+</sup>	[16]
62	2-pyridone	C <sub>5</sub> H <sub>5</sub> NO	[16]
63	2-pyrrolidinone	C <sub>4</sub> H <sub>7</sub> NO	[16]
64	valerolactam	C <sub>5</sub> H <sub>9</sub> NO	[16]
65	2-ethyl-3-hydroxy-6-methylpyridine	C <sub>8</sub> H <sub>11</sub> NO	[9]
66	nicodine	C <sub>10</sub> H <sub>14</sub> N <sub>2</sub>	[16]
67	2-quinolinol	C <sub>9</sub> H <sub>7</sub> NO	[16]
68	4-Quinolone	C <sub>9</sub> H <sub>7</sub> NO	[16]
69	aspongpyrazine B	C <sub>7</sub> H <sub>10</sub> N <sub>2</sub> O <sub>2</sub>	[16]
70	nicotinamide	C <sub>6</sub> H <sub>6</sub> N <sub>2</sub> O	[9, 16]
71	N-(2-hydroxyethyl) succinimide	C <sub>6</sub> H <sub>9</sub> NO <sub>3</sub>	[16]
72	indole-β-carboxylic acid	C <sub>9</sub> H <sub>7</sub> NO <sub>2</sub>	[16]
73	indole-3-aldehyde	C <sub>9</sub> H <sub>7</sub> NO	[16]
74	indole-3-carboxylic acid	C <sub>9</sub> H <sub>7</sub> NO <sub>2</sub>	[16]
75	asonglactam A	C <sub>8</sub> H <sub>13</sub> NO <sub>3</sub>	[9]
<b>Glycerides</b>			
76	Aspongester A	C <sub>9</sub> H <sub>16</sub> O <sub>4</sub>	[18]
<b>Acids</b>			
77	Hex-2-enoic acid	C <sub>6</sub> H <sub>10</sub> O <sub>2</sub>	[18]
78	Phenylacetic acid	C <sub>8</sub> H <sub>8</sub> O <sub>2</sub>	[18]
79	Protocatechuic acid	C <sub>7</sub> H <sub>6</sub> O <sub>4</sub>	[18]
<b>Amino acids</b>			
80	Tryptophan	C <sub>11</sub> H <sub>12</sub> N <sub>2</sub> O <sub>2</sub>	[18]
81	Phenylalanine	C <sub>9</sub> H <sub>11</sub> NO <sub>2</sub>	[18]
<b>Sesquiterpenoids</b>			
82	aspongoid A	C <sub>21</sub> H <sub>30</sub> O <sub>9</sub>	[9]
83	aspongoid B	C <sub>21</sub> H <sub>30</sub> O <sub>9</sub>	[9]
84	aspongoid C	C <sub>15</sub> H <sub>24</sub> O <sub>5</sub>	[9]
85	aspongoid D	C <sub>21</sub> H <sub>29</sub> O <sub>9</sub>	[12]
86	3,4-dihydroxybenzalacetone	C <sub>10</sub> H <sub>10</sub> O <sub>3</sub>	[9]
<b>Compounds containing benzene ring</b>			
87	1,2-benzenediol	C <sub>6</sub> H <sub>6</sub> O <sub>2</sub>	[9]
88	3,4-dihydroxybenzene ethanol	C <sub>8</sub> H <sub>10</sub> O <sub>3</sub>	[9]
89	3,4-dihydroxyphenylacetic acid	C <sub>8</sub> H <sub>8</sub> O <sub>4</sub>	[16]
90	vanillic acid	C <sub>8</sub> H <sub>8</sub> O <sub>4</sub>	[16]
91	aspongopusin	C <sub>10</sub> H <sub>9</sub> NO <sub>3</sub>	[8]
92	4-hydroxyisobenzofuran-1(3H)-one	C <sub>8</sub> H <sub>6</sub> O <sub>3</sub>	[16]
93	4-(3,4-dihydroxy-phenyl)-but-3-en-2-one	C <sub>10</sub> H <sub>10</sub> O <sub>3</sub>	[16]
94	2,4,5-trimethoxybenzaldehyde	C <sub>10</sub> H <sub>12</sub> O <sub>4</sub>	[9]
<b>Small molecule linear compounds</b>			
95	2-hydroxy-3-methylbutanoic acid	C <sub>5</sub> H <sub>10</sub> O <sub>3</sub>	[16]

96	2,3-butanediol	C <sub>4</sub> H <sub>10</sub> O <sub>2</sub>	[9]
97	1,2-propanediol	C <sub>3</sub> H <sub>8</sub> O <sub>2</sub>	[9]
<b>Cyclic peptides</b>			
98	cyclo-(L-Leu-L-Trp)	C <sub>17</sub> H <sub>21</sub> N <sub>3</sub> O <sub>2</sub>	[9]
99	cyclo(L-Val-L-Ala)	C <sub>8</sub> H <sub>14</sub> N <sub>2</sub> O <sub>2</sub>	[17]
<b>Glycosides</b>			
100	2-hydroxy-5-(2-hydroxyethyl)phenyl β-D-glucopyranoside	C <sub>14</sub> H <sub>20</sub> O <sub>8</sub>	[9]
101	3,4,5-trimethoxyphenol-β-D-glucopyranoside	C <sub>15</sub> H <sub>22</sub> O <sub>9</sub>	[16]
<b>Other compounds</b>			
102	N-[2-(3,4-Dihydroxyphenyl)-2-hydroxyethyl]acetamide	C <sub>13</sub> H <sub>16</sub> NO <sub>6</sub>	[12]
103	Methyl 1-hydroxy-2-oxo-4,5,5-trimethoxycyclopent-3-ene-1-carboxylate	C <sub>10</sub> H <sub>14</sub> O <sub>7</sub>	[12]
104	6-Hydroxymethyl-3-pyridinol	C <sub>6</sub> H <sub>7</sub> NO <sub>2</sub>	[12]
105	3-Hydroxypyridine	C <sub>5</sub> H <sub>5</sub> NO	[12]
106	N-(2-Hydroxyethyl)succinimide	C <sub>10</sub> H <sub>14</sub> O <sub>7</sub>	[12]
107	N-N'-(Oxydi-2,1-ethane)ylbis-N-methyl-acetamide	C <sub>10</sub> H <sub>20</sub> N <sub>2</sub> O <sub>3</sub>	[12]
108	4-Hydroxy-3-methoxybenzoic acid	C <sub>8</sub> H <sub>8</sub> O <sub>4</sub>	[12]
109	3,6,9,12,15,18,21,24,27-Nonaoxononacosan-1,29-diol	C <sub>20</sub> H <sub>42</sub> O <sub>11</sub>	[12]

#### Peptide compounds

A growing body of research has highlighted antimicrobial peptides as important metabolic substances in insects. These molecules are characterized by their relatively low molecular mass, structural stability, excellent solubility in water, and broad-spectrum antibacterial capabilities. Because they combine potent antimicrobial performance with minimal toxicity, they have emerged as promising candidates for next-generation peptide therapeutics [19]. In the work of Songbai Zhao *et al.*, the hemolymph of *Coridius chinensis* was examined for antibacterial activity, revealing that its inhibitory effect was most pronounced against Gram-positive bacterial strains [20]. Wu Mary and co-researchers separated a low-molecular-weight peptide fraction from hemolymph proteins through gel-filtration techniques; SDS-PAGE analysis showed a single band, corresponding to an approximate mass range of 1–14.4 kDa, and this isolated protein demonstrated noticeable bacteriostatic behavior [21]. Furthermore, Li Shangwei and colleagues purified an antimicrobial peptide named CcAMP1 from *Coridius chinensis*, consisting of 17 amino acids and possessing a molecular mass of 1997.37 [22].

#### Nutrition composition

*Coridius chinensis* contains a wide array of nutritional constituents, notably fatty oils, proteins, vitamins, and other essential dietary elements. Fatty oil is one of the earliest documented nutritional components of this insect and represents a considerably larger proportion than in many other insect species. According to Lunpei Liu *et al.*, analysis of its oil content revealed 12 types of fatty acids, with palmitic acid, oleic acid, and palmitic acid (repeated) being dominant, accounting collectively for 68.58% of total fat content [7]. Similarly, Aiguo Tu *et al.* identified that fatty oil represented 45.87% of the insect's composition and detected 16 fatty-acid-based compounds, predominantly oleic acid, linoleic acid, and palmitic acid [23].

Protein levels in *Coridius chinensis* are also substantial and are considered readily bioavailable. Determinations using the Kjeldahl nitrogen method by Lunpei Liu and Li Li *et al.* showed crude protein levels of 44.3% and 35.0% of dry mass, respectively—figures that surpass many other insect sources [7, 24]. Ying Tian *et al.* reported that the water-soluble extract contained 0.843 mg/mL of protein, with molecular weights mainly distributed across 12, 25, 30, 35, and 75 kDa [25]. Its amino acid spectrum is nutritionally favorable, including eight essential amino acids required by humans and four flavor-enhancing amino acids—glycine, alanine, glutamic acid, and aspartic acid—which together form roughly 15% of total amino acid content [7, 26].

Moreover, *Coridius chinensis* provides a variety of vitamins, with vitamin A and vitamin C levels reported at 214.4 mg/kg [7] and 0.78 mg/g [23], respectively. Other constituents such as polysaccharides [27, 28] and trace minerals [7, 24] have also been documented, though many nutritional features remain insufficiently investigated.

While some products based on *Coridius chinensis* have entered the functional food sector, significant development potential remains untapped. Strengthening research on its edible safety and broadening the application of *Coridius chinensis*-derived ingredients is essential for improving product competitiveness and advancing its use in the food and health industries.

#### Pharmacological activity

Recent investigations into *Coridius chinensis* have emphasized its diverse pharmacological properties, which include anticoagulant, analgesic, reproductive-protective, antioxidant, anticancer, antibacterial, anti-ulcer, and anti-fatigue effects. The main pharmacological actions attributed to compounds from *Coridius chinensis* are summarized in **Table 2**.

**Table 2.** Bioactive Components and Pharmacological Effects of *Coridius chinensis*

Pharmacological Effect	<i>Coridius chinensis</i> Component	Mechanism of Action	Reference
<b>Anticoagulant</b>	Water decoction	Enhances blood circulation and alleviates blood stasis	[29, 30]
1	Water extract with alcohol precipitation	Suppresses platelet aggregation	[31]
<b>Reproductive Protection</b>	Water extract	Increases testosterone levels by upregulating genes involved in steroid synthesis	[32]
3	Petroleum ether extract	Reduces FAK and c-Src expression, inhibiting Mn <sup>2+</sup> -induced BTB marker expression	[33, 34]
4	Diet supplemented with <i>Coridius chinensis</i>	Modulates apoptosis-related genes (Bcl-2, Bax) to prevent cell apoptosis	[35]
5	N-acetylnoradrenaline	Mitigates Mn <sup>2+</sup> -induced TM4 cell injury via the PI3K/c-Src/FAK signaling pathway	[18]
6	(±)-Aspongamide A	Suppresses COX-2 activity and lowers levels of collagen IV, fibrin, and IL-6	[10]
<b>Antioxidant</b>	Alcohol extract	Upregulates antioxidant enzyme genes, boosting enzyme activity in skeletal muscle	[36]
<b>Analgesic</b>	Diet supplemented with <i>Coridius chinensis</i>	Enhances endogenous pain relief by increasing P2X3, P2X4, and P2X7 receptor expression	[37]
<b>Anticancer</b>	Water decoction	Regulates proliferation, apoptosis, and autophagy; inhibits HepG2 cell growth in vitro	[38]
10	Oxazoles and N-acetyldopamine derivatives	Exhibits resistance to Colon38, L210, and MDA cancer cell lines	[8]
11	CHP (anticancer active fraction)	Suppresses tumor cell proliferation and induces apoptosis	[39]
<b>Antibacterial</b>	Hemolymph protein isolate	Active against <i>Escherichia coli</i> and <i>Staphylococcus aureus</i>	[21]
13	Hemolymph	Shows stronger inhibition of Gram-positive bacteria compared to Gram-negative	[20]

14	Antimicrobial peptide CcAMP1	Exhibits enhanced activity against Gram-negative bacteria	[22]
15	Lysozyme CcLys2	Possesses lysozyme enzymatic activity	[40]
<b>Neuroregenerative</b>	Nucleoside base derivatives	Supports adult neural stem cell proliferation; useful in treating nervous system injuries	[12]
<b>Fungal Metabolism Enhancement</b>	Ether extract	Promotes <i>Ganoderma lucidum</i> growth by increasing biomass and extracellular polysaccharide production	[41]
18	Ethanol extract	Elevates extracellular triterpene content in <i>Ganoderma lucidum</i>	[41]
19	Water extract	Stimulates intracellular polysaccharide synthesis in <i>Ganoderma lucidum</i>	[41]

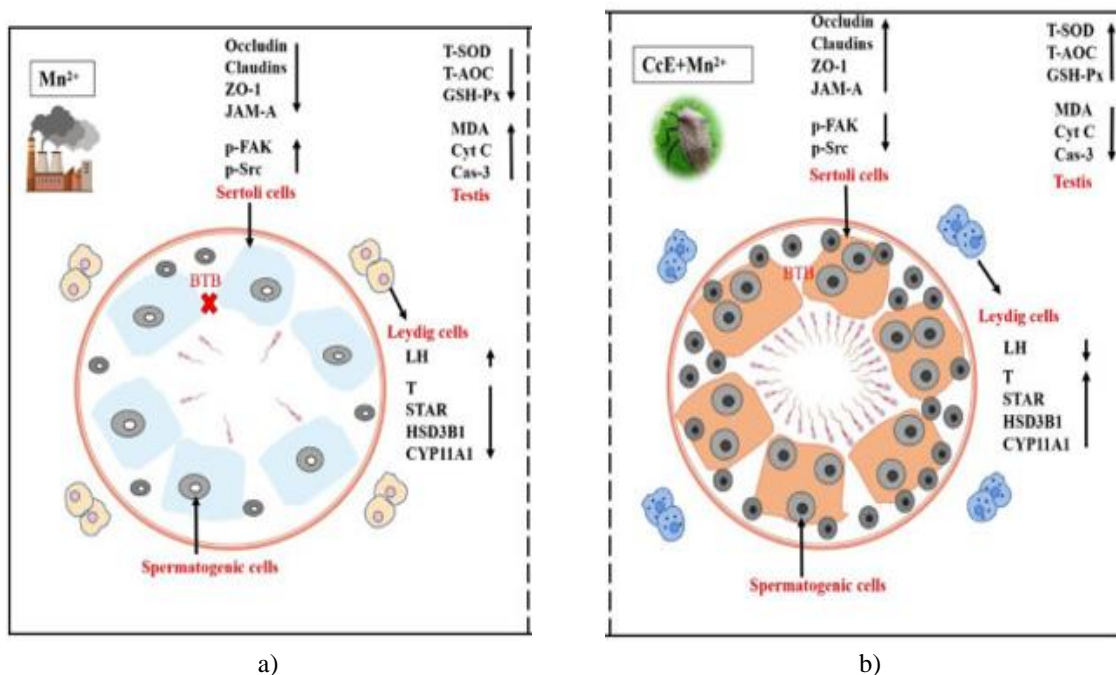
#### *Anticoagulant activity*

*Coridius chinensis* is known for its ability to enhance blood circulation, dissolve blood stasis, promote qi, and alleviate pain, making it a traditional remedy for vascular headaches. It can also be used independently to treat hemangiomas, demonstrating strong fibrinolytic effects on fibrin in laboratory studies. However, the active constituents responsible for these effects may have limited absorption at high doses [29], suggesting that lower doses are preferable for clinical applications targeting these properties. Additionally, *Coridius chinensis* extracts exhibit significant anticoagulant potential. In animal studies, water decoctions of *Coridius chinensis* markedly prolonged clotting times in mice subjected to cold coagulation models, with effects increasing in a dose-dependent manner [30]. Both water and alcohol precipitation extracts have been shown to inhibit platelet aggregation via the endogenous coagulation pathway, contributing to an overall anticoagulant effect [31]. This activity likely arises from the combined action of water-soluble and fat-soluble components rather than a single active compound, though further research is required to clarify these mechanisms [31].

#### *Antioxidant and reproductive protective effects*

With rising environmental pollution and advances in reproductive medicine, there has been growing attention on the reproductive harm caused by toxic exposures. According to the Great Dictionary of Traditional Chinese Medicine, *Coridius chinensis* effectively addresses symptoms related to yang deficiency in the spleen and kidney, such as lower back weakness, impotence, and enuresis [1]. Modern studies have demonstrated that various extracts and small-molecule compounds from *Coridius chinensis* can enhance reproductive function and protect against reproductive damage [18, 33–35, 42–44]. For instance, alcohol extracts of *Coridius chinensis* have been shown to improve exercise performance and increase the activity of antioxidant enzymes in the skeletal muscle of trained rats [36, 45]. Petroleum ether extracts can significantly reduce manganese-induced disruption of the blood-testis barrier (BTB), while water extracts boost testosterone production in Leydig cells and regulate the hypothalamus-pituitary-gonadal axis, preserving testicular structure and function [32–34].

Furthermore, (±)-Aspongamide A, isolated from *Coridius chinensis*, exhibits protective effects against diabetic nephropathy and inhibits COX-2 activity [10]. N-acetylnorepinephrine derived from *Coridius chinensis* has been shown by Xu *et al.* to alleviate manganese-induced damage in TM4 cells [18] (**Figure 2**). Additional studies by Tianmu He *et al.* have identified multiple bioactive components and molecular targets associated with renal protection, supporting a “multi-component, multi-target, multi-pathway” mechanism, which warrants further exploration [46].



**Figure 2.** Mechanism of antioxidant and reproductive protective effects of *Coridius chinensis*.

*Analgesic effects*

Pain is a prevalent clinical symptom and represents a complex interplay of physiological and psychological responses. It serves as a protective mechanism against harmful stimuli, but severe or chronic pain can trigger emotional distress, such as anxiety, as well as physiological complications including shock [47]. Effective pain management is therefore a critical goal in clinical therapeutics. Traditional Chinese medicine (TCM) has a long-standing history of pain management, and *Coridius chinensis*, often combined with other medicinal agents, is widely employed in TCM for various pain conditions, demonstrating notable analgesic efficacy.

For example, Baixin Ji *et al.* developed a formulation targeting biliary colic and gastrointestinal pain, which alleviates both spasms and discomfort [48]. Clinical observations of Jiuxiangyantongning in cancer pain management revealed that it enhanced mice’s tolerance to heat-induced pain, increased pain thresholds, and exhibited significant analgesic effects [49]. Xiaolin Tong formulated three small prescriptions that provided pain relief for stomachaches caused by qi stagnation and blood stasis [50]. Additionally, *Coridius chinensis* has been shown to potentiate the endogenous analgesic system and reduce neuropathic pain in chronic constriction injury (CCI) rat models, offering a theoretical foundation for its clinical application in neuropathic pain management [38]. However, further studies are needed to clarify the precise signaling pathways and receptor activation mechanisms within the periaqueductal gray (PAG) region that mediate these analgesic effects (**Table 3**).

**Table 3.** Analgesic Effects of *Coridius chinensis* Formulations

<b>Coridius chinensis Formulation</b>	<b>Composition</b>	<b>Therapeutic Use</b>	<b>Reference</b>
Zhitong Ling	<i>Coridius chinensis</i> + <i>Saussurea costus</i>	Management of biliary colic and gastrointestinal discomfort	[48]
Jiuxiangyan Tongning	<i>Coridius chinensis</i> , <i>Porcellio</i> , and <i>Corydalis yanhusuo</i>	Relief of cancer-related pain	[49]
Three Small Prescriptions	<i>Santali Albi Lignum</i> , <i>Coridius chinensis</i> , and <i>Trogopterori Faeces</i>	Treatment of stomach pain caused by qi stagnation and blood stasis	[50]

*Anticancer*

Cancer incidence continues to rise worldwide, making it one of the most pressing global health challenges. Although chemotherapy remains a cornerstone of clinical management, its considerable adverse effects often impose a substantial physical and emotional toll on affected individuals. Growing interest in traditional Chinese

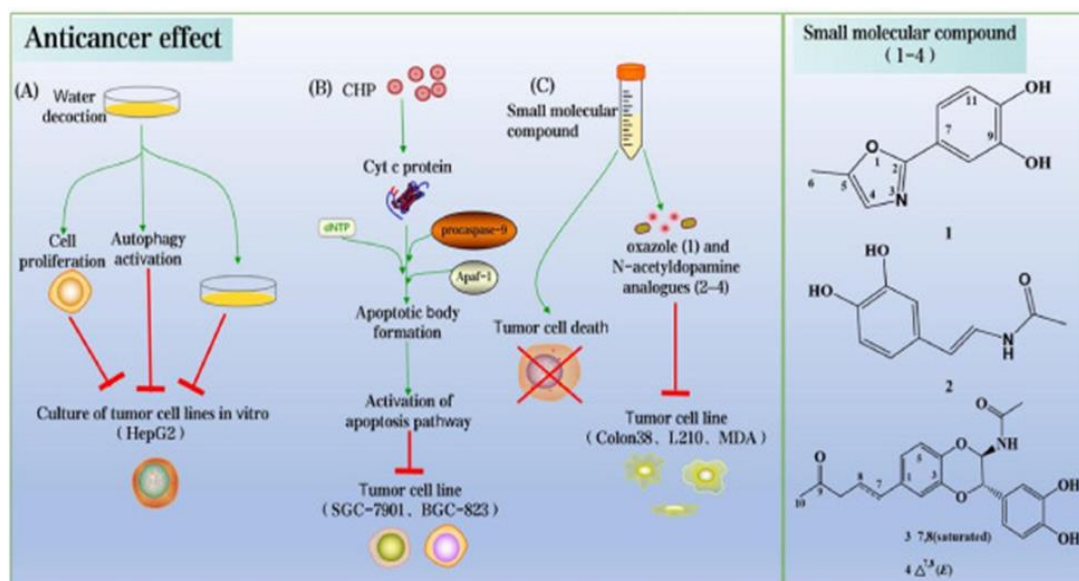
medicine has prompted Chinese researchers to investigate its potential contributions to cancer therapy, positioning natural medicinal resources as promising candidates for discovering new antineoplastic agents [51].

According to Qinjian Yang *et al.*, the serum preparation Xianglong San triggers apoptosis in human gastric cancer HS-746T cells by interfering with the DNA replication stage, and this pro-apoptotic response occurs regardless of drug concentration [52]. In another study, Bo Xu and collaborators applied a powdered extract of *Coridius chinensis* for the management of primary and metastatic tumors at intermediate and late stages, reporting notable clinical benefits [53].

Wentao Song *et al.* observed that selected component combinations from *Coridius chinensis* significantly lowered micronucleus rates in *Vicia faba* root tip cells and mitigated mutagenesis induced by cyclophosphamide [54] (**Table 4**). Additional findings indicate that aqueous extracts of *Coridius chinensis* impede the growth, migration, and invasiveness of non-small cell lung cancer cells [55]. Sha Yang and colleagues further documented that a *Coridius chinensis* decoction suppresses HepG2 cell proliferation in vitro by modulating pathways related to cell division, autophagy, and programmed cell death (**Figure 3a**) [32].

Moreover, Tan *et al.* purified an active anticancer molecule, CHP, from *Coridius chinensis*, demonstrating strong inhibitory effects on tumor cell proliferation (**Figure 3b**) [39]. In complementary work, Luo *et al.* screened *Coridius chinensis* extracts across ten tumor cell lines and identified small-molecule constituents with selective cytotoxicity: compounds 1 and 4 targeted Colon 38 cells, compound 2 acted against L1210 cells, compounds 3 and 4 inhibited U251 N cells, and compound 1 additionally affected MDA cells (**Figure 3c**) [8].

Despite the broad use of *Coridius chinensis* in anticancer applications, the specific mechanisms through which its bioactive substances exert their effects remain insufficiently resolved. Consequently, in-depth investigation of its active compounds and their molecular targets is urgently needed to clarify its therapeutic potential and pharmacological mechanisms.



**Figure 3.** Mechanisms underlying the anticancer effects of *Coridius chinensis*.

**Table 4.** Anticancer effects of *Coridius chinensis* in combination formulations

Compound Preparation	Composition	Anticancer Mechanism	Reference
Xianglong Powder	Pinellia ternata, Scolopendra, <i>Coridius chinensis</i> , <i>Atractylodes macrocephala</i> Koidz <i>et al.</i>	Promotes apoptosis in human gastric cancer cells (HS-746T)	[52]
Cancer Pain Formula	<i>Leiurus quinquestratus</i> , <i>Phlyphaga plancyi</i> , <i>Coridius chinensis</i> , <i>Rheum tanguticum</i> Maxim, <i>Panax ginseng</i> , <i>Ganoderma</i> , <i>Scutellaria baicalensis</i> Georgi <i>et al.</i>	Suppresses proliferation or triggers apoptosis in HepG2 cells	[53]
Mixed Component	<i>Periplaneta americana</i> and <i>Coridius chinensis</i>	Reduces cyclophosphamide-induced mutagenesis	[54]

#### Antibacterial

Antibacterial activity involves processes that either eliminate bacteria or impede their growth, reproduction, and metabolic functions, using physical or chemical approaches. Antibiotics, as powerful antibacterial agents, have historically cured numerous diseases that were previously untreatable, greatly benefiting human health and driving rising demand. Recent studies highlight that insects are a rich source of antibiotics, particularly antimicrobial peptides, with numerous active substances identified in Pentatomidae species [56]. In *Coridius chinensis*, antibacterial compounds are primarily found in the hemolymph and protein isolates [23]. Baisong Zhao *et al.* employed techniques including centrifugation, homogenization, and extraction to obtain *C. chinensis* hemolymph, showing that the bacteriostatic zones against ten bacterial species exceeded 0.7 cm, with Gram-positive bacteria being more sensitive than Gram-negative ones [22]. Similarly, Shangwei Li *et al.* synthesized CcAMP1, an antimicrobial peptide derived from *C. chinensis*, which displayed strong antibacterial effects against both Gram-positive (*Staphylococcus aureus*) and Gram-negative (*Escherichia coli*) bacteria, with a slightly stronger effect on Gram-negative species [22]. These findings support the further exploration of *C. chinensis* as a source of antimicrobial peptides with therapeutic potential. Beyond peptides, Huang *et al.* identified a lysozyme, CcLys2, mainly expressed in the fat body of adult *C. chinensis*, which exhibits enzymatic activity, playing a crucial role in the insect's innate immunity, intestinal bacterial defense, and digestive processes [41]. Collectively, both the purified peptides and the whole organism, hemolymph, or protein extracts of *C. chinensis* demonstrate significant *in vitro* antibacterial effects (**Table 2**).

#### *Additional biological functions*

*Coridius chinensis* also contributes to enhancing metabolic activity and facilitating the conversion of specific substrates. For instance, it can boost the generation of anticancer compounds during the fermentation of *Ganoderma lucidum* [39]. Moreover, nucleoside base derivatives extracted from *C. chinensis* have been reported to stimulate proliferation of adult neural stem cells, suggesting promising applications in the treatment of nervous system disorders [12] (**Table 2**).

#### *Clinical applications*

The medicinal properties of *Coridius chinensis* are diverse, with primary functions including qi regulation, pain relief, warming of the middle, and restoration of yang energy. In modern practice, it is frequently used alongside other traditional Chinese medicines to treat conditions such as gastrointestinal pain, cancer-related pain, and sexual dysfunction. In andrology, decoctions of *C. chinensis* have demonstrated effectiveness for patients with kidney qi deficiency accompanied by waist and knee discomfort [57–59]. It has also been applied to manage chest pain, epigastric discomfort, stomach cold pain, and biliary colic [46, 60]. In gynecological care, formulations like Liver Thinning Pain Relief Soup and Warm Menstrual Pain Capsules have been used successfully for adolescent dysmenorrhea and pain resulting from cold-coagulation and blood stasis [60–62]. Furthermore, *C. chinensis* is combined with other treatments for a broad spectrum of diseases, including bronchitis, neurasthenia, viral hepatitis, coronary heart disease, chest pain from liver depression, damp-heat syndromes, low menstruation, and endometriosis (**Table 5**).

**Table 5.** Clinical applications of *Coridius chinensis*

Disease Category	Formulation / Compatibility	Therapeutic Outcome	Reference
<b>Internal Medicine</b>			
Chest pain & epigastric discomfort	<i>Coridius chinensis</i> , <i>Cyperus Rhizoma</i> , <i>Corydalis Rhizoma</i> , <i>Curcumae Radix</i> , etc.	Pain relief and anti-inflammatory effect	[58]
Cold-induced stomachache	<i>Coridius chinensis</i> , <i>Radix Aucklandiae</i> , <i>Corydalis Rhizoma</i> , <i>Magnoliae Officinalis Cortex</i> , etc.	Reduces cyclophosphamide-induced mutagenesis	[58]
Bile reflux gastritis	<i>Coridius chinensis</i> , <i>Rhei Radix et Rhizoma</i> , <i>Aurantii Immaturus Fructus</i> , <i>Arecae Semen</i> , etc.		[63]
Chronic wheezing bronchitis	<i>Coridius chinensis</i> , egg, sesame or cotton oil	Effective in 21 patients	[63]
<b>Surgical Conditions</b>			

Chest and rib fractures	<i>Coridius chinensis</i> , <i>Benincasae Semen</i> , <i>Dipsacus asperoides</i> , <i>Paeoniae Radix Alba</i> , etc.	17 patients recovered	[63]
Hemangioma	Contents from the abdominal cavity of live <i>Coridius chinensis</i>	4 cases successfully treated	[63]
Lumbar muscle strain	<i>Coridius chinensis</i> combined with Chinese baijiu	Treated 7 patients	[63]
Lumbago	<i>Coridius chinensis</i> with <i>Citri Reticulatae Pericarpium</i>	Pain relief	[63]
<b>Andrology</b>			
Kidney qi deficiency with waist & knee pain	<i>Coridius chinensis</i> soup: <i>Coridius chinensis</i> , <i>Scolopendra</i> , <i>Cyperus Rhizoma</i> , etc.	Positive effect on erectile dysfunction	[57]
Kidney yang deficiency	Sasuke warm tonic: <i>Coridius chinensis</i> , hairy antler powder, <i>Hippocampus</i> , etc.	Improved kidney yang function	[60]
Chronic illness treatment	Sasuke dispels evil: <i>Coridius chinensis</i> , <i>Scolopendra</i> , <i>Bombyx Batryticatus</i> , etc.	Relief for long-term illness	[60]
Qi stagnation with liver & kidney deficiency	Oolong pill: <i>Coridius chinensis</i> , <i>Plantaginis Semen</i> , <i>Citri Reticulatae Pericarpium</i> , etc.	Treated 3 cases of qi stagnation, blood stasis, stomachache, and hypochondriac pain	[59]
Impotence	Nine fragrant rose wine: <i>Coridius chinensis</i> , dried rose flower, rice wine	Tonified kidney and strengthened yang	[63]
<b>Gynecological Conditions</b>			
Adolescent dysmenorrhea	Liver thinning pain relief soup: <i>Coridius chinensis</i> , <i>Paeoniae Radix Alba</i> , <i>Corydalis Rhizoma</i> , etc.	Effective in 68 cases	[61]
Dysmenorrhea with cold coagulation & blood stasis	Warm menstrual pain capsules: <i>Coridius chinensis</i> , <i>Cinnamomi Cortex</i> , <i>Foeniculum vulgare</i> , etc.	Treated 60 cases	[62]
Uterine leiomyoma & ovarian cyst	<i>Coridius chinensis</i> and <i>Phlyphaga plancyi</i>	Promoted blood circulation, reduced fatigue, regulated qi, and resolved syndrome	[63]

### Discussion and prospect

*Coridius chinensis*, an artificially cultivable medicinal insect, shows considerable commercial potential. Its market classification, however, has long been debated due to an inconsistent understanding of its morphology and biology. Before the work of Ji Wenxiang *et al.*, comprehensive information on the structural and biological traits of *C. chinensis* was lacking. Ji Wenxiang *et al.* addressed this gap through a systematic investigation of its morphology, survival strategies, and reproductive behaviors [64], thereby providing a clearer picture of its biology and ecological characteristics. Despite this progress, limitations in artificial cultivation and breeding technologies have created technical challenges, resulting in a notable imbalance between supply and demand for *C. chinensis* resources.

Modern pharmacological research has highlighted multiple therapeutic effects of *C. chinensis*, including antitumor, antibacterial, and reproductive health-enhancing properties, aligning well with its traditional clinical applications in andrology, gynecology, and oncology. Its efficacy in gastric disorders is particularly noteworthy, given the rising prevalence of these conditions, especially among younger populations in China. Elucidating the pharmacological basis and mechanisms of action of *C. chinensis* is therefore of critical importance. While this medicinal insect has been used for centuries in China, the individualized nature of traditional Chinese medicine complicates rigorous, evidence-based evaluation of its clinical efficacy, which in turn limits its broader application and development.

Isolating and identifying the chemical constituents of *C. chinensis* is a key step for understanding its pharmacological potential. Research has repeatedly demonstrated that the biological effects of *C. chinensis* derive from the specific activities and interactions of its natural compounds. Extensive studies have confirmed that many of these isolated compounds are effective in treating a range of diseases. Nonetheless, significant gaps remain in the study of individual components, which is currently one of the major challenges. Often, findings based on crude

extracts cannot be directly translated to clinical practice. Traditional Chinese medicine emphasizes the synergistic balance of ingredients, whereas Western medicine prioritizes safety and precise molecular mechanisms. This highlights the necessity of investigating the pharmacological activity and underlying mechanisms of single compounds derived from *C. chinensis*.

As a natural medicinal resource, *C. chinensis* holds tremendous potential both as a functional food and as a therapeutic agent. Researchers have amassed considerable data regarding its chemical composition, pharmacological effects, and clinical applications, confirming its efficacy and safety in multiple studies. Moving forward, the critical task is to identify its active components and unravel their molecular mechanisms. This step is essential not only to fully understand *C. chinensis* as a novel therapeutic agent but also to support the advancement and clinical utilization of this valuable medicinal insect.

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**Conflict of Interest:** The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

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**Ethics Statement:** None

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