

Advances in Modern Pharmacology Research of Tabanus

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Abstract: Tabanus is a traditional Chinese medicine. In recent years, various protein active components derived from the Tabanus salivary gland have been explored, and many promising components were found to have therapeutic effect. The rich active components in its salivary gland have pharmacological effects, such as anti-platelet aggregation, anti-inflammatory, anti-infection, immunosuppression, anti-angiogenic, and anti-tumor effects. This paper summarizes findings from the related articles about Tabanus in recent years with a special focus on its pharmacological effects so as to provide reference for its further development and utilization.

Keywords: Tabanus; Salivary gland; Protein active substance; Pharmacological action

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1. Tabanus

Tabanus is the whole dry female of multicarrier or other insect of the same genus of the family ophididae, diptera, Brachycera, Class Insecta. It is a traditional Chinese medicine. Tabanus, commonly called gadfly, is used to overcome blood addiction, expel blood stasis and dredge meridians. It is mainly used to cure the accumulation of blood stasis, blood storage and closure of blood stasis meridians.

2. Various components of Tabanus

Certain studies found that the salivary gland (SGE) of tabanus contains protein peaks with pharmacological activities ^[1,2]. A large number of fatty acids and other substances were identified in the components of Tabanus ^[3]. Jin et al. extracted mucopolysaccharide, which is the anticoagulant component, from Tabanus ^[4]. Jiang et al. found that gadfly is rich in copper, chromium, manganese, strontium, iron and zinc ^[5].

3. Pharmacological action of Tabanus

It was found that cecropin-TY1, immunomodulatory protein HA and immunoregulin TPs in Tabanus SGE had strong immune and anti-inflammatory effects ^[2,6,7]. Immunomodulatory protein HA inhibits the maturation and phagocytosis of macrophages ^[6]. Tabimmunoregulins increased the production of IL-10 and decreased IFN- γ secretion ^[2]. Zhai found that Tabanus extract had inhibitory effect on the ear swelling in mice ^[3]. Li et al. found that Tabanus compound decoction can inhibit the swelling of mice, reduce the writhing times of mice, prolong the pain threshold of hot stimulation in mice, and has anti-inflammatory and analgesic effects ^[8].

Tablysin ^[1] and tabhibitins ^[2] compete with fibrinogen to bind GPIIb/IIIa and inhibit platelet aggregation. Tabkunins can inhibit the hydrolytic activity of trypsin, thrombin, elastase and chymotrypsin on the chromogenic substrate ^[1]. Zhang et al. proved that vasotab TY combined with GPIIb/IIIa can easily

pass through the lung tissue, and the liver is the main target organ ^[9]. The vasodilation activity of *Tabanus* SGEs is resistant to high temperature ^[10]. Another study showed that *Tabanus* pod may act as a blocker of integrin receptor-mediated cell adhesion ^[11]. Apyrase TY can inhibit adenosine diphosphate (ADP)-induced platelet aggregation ^[1,12]. Apyrase removes inorganic phosphorus from adenosine triphosphate (ATP) and ADP, thereby preventing platelet aggregation.

Another experiment found that antigen 5-like protein (named TabRTS) in *Tabanus* salivary gland can significantly inhibit angiogenesis *ex vivo* and *in vivo* ^[13]. TabRTS may play an anti-angiogenic role by targeting $\alpha 1 \beta 1$ integrin. Tablysin-15 can inhibit endothelial cell proliferation induced by fibroblast growth factor (FGF) and inhibit angiogenesis *in vitro* ^[14]. Deng et al. found that Tlysin-15 has anticancer effect on human melanoma cells and binds integrin $\alpha V \beta 3$ to inhibit proliferation, migration and invasion of tumor cells ^[15]. Deng et al. found that Tlysin-15 binds to $\alpha V \beta 3$ *in vitro* to inhibit the proliferation, migration and invasion of breast cancer cell lines ^[16]. Si and Lang described the potential of MTs as biomarkers for cancer diagnosis and prognosis ^[17].

Defensin-Ty1, cecropin-Ty1 and atactin-Ty3 in *Tabanus* SGE showed anti-bacterial activity against the tested microorganisms ^[2]. Cecropin-Ty1 is an adenosine monophosphate (AMP) with anti-bacterial activity ^[2]. Cecropin-Ty1 plays an important role in anti-inflammatory treatment of sepsis and endotoxic shock caused by Gram-negative bacterial infection ^[18].

The vasoactive substance vasotab in *Tabanus* SGE may have a similar effect on myocardium as calcium channel antagonist ^[10]. Vasodilation occurs through the mechanism of strong calcium channel blocking. Takác et al. experimented with the extract of *Tabanus* SGE and found that SGE increased coronary blood flow and made the ventricle contract without affecting the heart rate or rhythm ^[19].

Metallothionein (MTs) TY1 and TY2 of *Tabanus* SGE ^[2] are metal binding proteins that protect cells and tissues from metal toxicity and oxidant damage ^[20]. Tablysin-15 significantly inhibited bone loss in mouse models and reduced the expression of osteoporosis marker genes, including *MMP-9*, *TRAP*, *CTSK* and *c-Src* ^[21].

4. Discussion

In recent years, experiments on various components of *Tabanus* salivary gland to explore their anti-platelet aggregation, anti-inflammatory, immunosuppression, anti-angiogenic, anti-oxidation, and anti-cancer effects as well as their efficacy in the treatment of osteoporosis have laid a foundation for the further research and development of *Tabanus*. This also provides a new idea for drug development. The immunosuppressive active components of *Tabanus* salivary gland hold immense research prospect and potential, but the research on whether there are immunosuppressive components in *Tabanus* extract is not sufficient at present. The role of *Tabanus* and its salivary gland in angiogenesis is recognized. More data are still needed for their applications in treating angiogenesis diseases, including tumor, psoriasis, internal rheumatoid arthritis, and cerebral infarction. Some scholars regard its value in analgesia, but the in-depth studies on the mechanism of analgesia remain scarce. Hence, the value of *Tabanus* as a valuable insect traditional Chinese medicine needs to be further explored and developed.

Disclosure statement

The authors declare no conflict of interest.

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