



ISSN (E): 2277- 7695

ISSN (P): 2349-8242

NAAS Rating: 5.03

TPI 2018; 7(4): 206-208

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www.thepharmajournal.com

Received: 17-02-2018

Accepted: 20-03-2018

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## Condition of the biliary and bile-forming function of rat liver damaged with tetrachlormethane after the use of hosta lancifolia dry extract

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### Abstract

Recently, the attention has been focused on the problem of the search and creation of herbal medical products having hepatoprotective properties. This interest has grown due to the wide spectrum of pharmacological effects of phytomedicine and the minimum number of side effects in the case of long-term use.

*Hosta lancifolia* is not an officially registered healing plant, but is cultivated throughout the world due to its decorative properties. The plant contains a number of biologically active substances, including flavonoids and hydroxycinnamic acids.

The purpose of this research work was to find out the effect of *Hosta lancifolia* dry extract on the biliary function of rat liver damaged with tetrachlormethane (CCl<sub>4</sub>).

Experiments with of bile duct system and bile-forming liver function were performed on the white mongrel male rats with induced acute tetrachloromethane hepatitis. The affected animals were fed with a dry extract of *Hosta lancifolia* at a dose of 100 mg / kg body weight of the animal. A choleric herbal remedy "Flamin" was used as a comparison medication which animals received at a dose of 250 mg / kg. The biliary and bile-forming liver function was evaluated at the 4th, 7th and 14th days of the experiment. All the rules of the Convention on the protection of vertebrate animals were observed during the experiments.

The obtained results showed that the use of dry extract from *Hosta lancifolia* led to the normalization of biliary function of the liver, indicating an increase in the volume of bile and the rate of bile formation by animals affected with tetrachloromethane in all three terms of the experiment. *Hosta lancifolia* extract demonstrated a visible positive effect on bile liver function. There was a probable decrease in the concentration of bile acids and the bilirubinconcentrationlevelafter its use in rat blood serum of animals affected with tetrachloromethane.

**Keywords:** *hosta lancifolia*, extract, tetrachloromethane damage, bile duct function.

### Introduction

The task of modern pharmaceutical science is focused on the search for domestic herbal sources of biologically active substances and the creation of medications based on them. Herbal remedies are popular due to their high efficiency, good tolerance and long-standing use in traditional medicine <sup>[1, 2]</sup>.

One of the most important issues of current interest is the problem of toxic liver damage <sup>[3]</sup>, which may be caused by the negative effect of industrial chemical products, speedy life, stressfulness <sup>[4]</sup>, uncontrolled use of medications, and ignoring of prescribed dosage and userecommendations <sup>[3]</sup>. All these factors lead to the intensified free radical processes in the body and damage to hepatocytes <sup>[5]</sup>. The bile and bile acids in particular (BA) are specific products of hepatocyte activity <sup>[6]</sup>. Regardless of the damaging factors, the majority of the hepatobiliary system failures lead to disorders of the biliary tract function of the liver <sup>[7]</sup>.

Testing of bile acid content is an informative lab marker, since one of the functions of bile is to promote cholesterol excretion and prevent the formation of stones in the gallbladder <sup>[2]</sup>. Modern therapeutic treatment protocols suggest the use of medicines with hepatoprotective properties, since biliary dysfunction of the liver is accompanied with destructive changes in cellular membranes of hepatocytes <sup>[7]</sup>.

We focused our attention on *Hosta lancifolia*, which belongs to *Hosta* plant genus. The genus is currently placed in the family Asparagaceae, subfamily Agavoideae and is cultivated throughout the world due to its decorative properties. Researched data show that the herb contains a number of biologically active substances (BAS), including flavonoids having a

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wide spectrum of pharmacological activity: choleric, antioxidant, anti-inflammatory, anti-viral, and also hydroxycholic acids, which have antioxidant and antiradical properties and show hepatoprotective and choleric effects<sup>[8-11]</sup>. The purpose of this research was to find out the effect of dry extract from *Hosta lancifolia* on bile duct and bile-forming function of the animal liver damaged by tetrachloromethane (CCl<sub>4</sub>).

**Material and methods of research**

Investigation of bile duct and bile-forming functions of the liver was performed on a model of the liver damaged by tetrachloromethane. Tetrachloromethane was injected intraperitoneally in the form of 50% of the oil solution at a dose of 1 ml / kg of body weight, twice daily every other day. After the last CCl<sub>4</sub> injection, one experimental group of animals was given a dry extract of *Hosta lancifolia* at a dose of 100 mg / kg of animal body weight. Flamin was used as a comparison medication given orally to the animals in doses of 250 mg / kg<sup>[12]</sup>. The experimental animals were divided into 4 groups: 1 - intact rats, 2 - affected rats (CCl<sub>4</sub>), 3 - affected + Flamin corrected, 4 - affected + corrected by the extract. The biliary and bile-forming liver function was evaluated at the 4th, 7th and 14th days of the experiment. In the course of the research, the general principles of animal experiments approved at the National Congress on Bioethics (Kyiv, Ukraine, 2001) and in line with the provisions of the European Convention for the Protection of Vertebrate Animals used for experimental and other scientific purposes

<sup>[13]</sup> were used.

The catheterization of the common bile duct was performed under the thiopental anesthesia (60 mg / kg)<sup>[14]</sup>, and bile was collected in hourly batches during 3 hours<sup>[15]</sup>. The secretory function of the liver was evaluated by the rate of secretion of bile per hour of observation (mg / min / 100) and the total amount of bile throughout the experiment (mg / 100)<sup>[15, 16]</sup>.

The biliary function of the liver was evaluated by the concentration of bile acids in blood serum<sup>[17]</sup> and the content of total bilirubin, which was determined with standard "Felicite - Diagnostics" set of reagents.

Animals were withdrawn from the experiment under thiopental anesthesia, and blood samples were taken for further studies.

**Results and discussion**

The analysis of the results obtained (Table 1) indicates a clear violation of biliary function of the liver of the rats affected by CCl<sub>4</sub>, as evidenced by a possible reduction compared to the intact group of animals, the rate of secretion of bile and bile volume in three experimental periods.

The use of *Hosta lancifolia* extract has resulted into the normalization of these parameters in the blood serum of the affected animals. At the 14th day of the experiment, the use of *Hosta lancifolia* extract showed an increase in bile volume and bile secretion rate by 10.9% and 16.7% respectively, as compared to the affected rats. After the use of Flamin as the comparator over the same period of study, the data increased by 15.2% and 20.7% as compared to the affected animals.

Table 1: Influence of *Hosta lancifolia* extract and Flamin on biliary function of the liver with acute tetrachloromethane damage (M ± m; n = 60)

Indicators	Animal groups	4-th day	7-th day	14-th day
Bile volume mg / 100 g	Intact	0,92±0,03		
	Affected	0,59±0,02*	0,55±0,02*	0,61±0,01*
	Affected+extract	0,69±0,02**	0,71±0,01**	0,71±0,01**
	Affected + Flamin	0,7±0,03**	0,72±0,02**	0,75±0,01**
The rate of bile secretion mg / min × 100	Intact	5,08±0,2		
	Affected	3,92±0,24*	3,5±0,18*	3,98±0,19*
	Affected+extract	4,75±0,15**	4,88±0,15**	4,83±0,15**
	Affected+Flamin	4,92±0,1**	5,03±0,13**	5,03±0,12**

Note: here and in the following tables - \* - probable changes between intact and affected animals (p≤0,05); \*\* - probable changes between the affected and treated animals (p≤0,05).

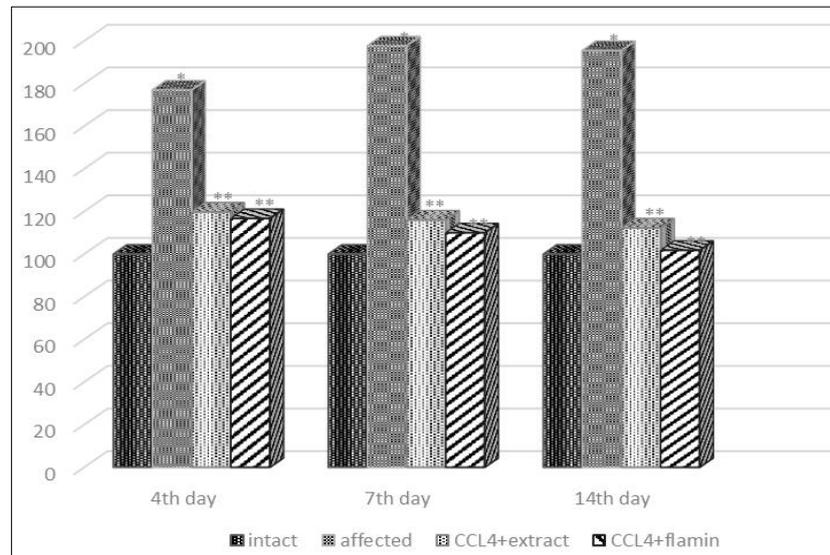
An important factor in toxic hepatitis, apart from the disturbance in the formation of bile, is the delay in its outflow. This causes the intoxication of the body with bile components (development of cholemia), primarily bile acids and bilirubin, which penetrate the blood<sup>[18]</sup>. Therefore, the state of external secretory liver function in terms of tetrachloromethane damage and after correction by *Hosta*

*lancifolia* extract and Flamin comparison medicine was evaluated according to the dynamics of biochemical parameters of bile, namely bilirubin and bile acids.

The use of corrective relieving factors contributed to the decrease in the bile acid concentration (Table 2) and the content of bilirubin (Fig. 1) in blood serum of affected animals.

Table 2: Influence of *Hosta lancifolia* extract and Flamin on the concentration of bile acids (g / l) in blood serum of rats affected with tetrachloromethane (M ± m; n = 60)

Animal groups	4-th day	7-thday	14-th day
Intact	4,25±0,34		
Affected	6,17±0,38*	7,25±0,46*	7,08±0,57*
Affected+ extract	4,67±0,31**	5,33±0,31**	5,00±0,34**
Affected + Flamin	4,5±0,32**	4,83±0,28**	4,5±0,32**



Note: \* - probable difference between intact and affected animals ( $p \leq 0, 05$ );  
 \*\* - probable difference between affected and treated animals ( $p \leq 0, 05$ ).

**Fig 1:** Influence of *Hosta lancifolia* extract and Flamin on the concentration of total bilirubin in blood serum of rats affected with tetrachloromethane, %

The extract and Flamin showed the same therapeutic effects by reducing the bile acid concentration by the 14th day as compared to the group of affected animals by 1.4 and 1.6 times, respectively. The use of corrective factors led to the normalization of the total bilirubin content in the blood serum of affected animals.

### Conclusions

The results of the studies and performed experiments showed that the dry extract from *Hosta lancifolia* proves to have a normalizing effect on the biliary and bile-forming functions of the liver of the rats affected by tetrachloromethane, which can be confirmed by the manifestation of hepatoprotective properties of the medication.

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