Title: Yang-Tonifying Herbal Medicine Cynomorium songaricum Extends Lifespan and Delays Aging in Drosophila.

Authors: Hsin-Ping Liu, Rong-Fu Chang, Yih-Shyuan Wu, Wei-Yong Lin, Fuu-Jen Tsai.

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Speaker: 白佳哲
Moderator: 蔡維倫
Advisor: Prof. Pei-Fen Liu

Abstract

Aging is highly correlated with the progressive loss of physiological function, including cognitive behavior and reproductive capacity, as well as an increased susceptibility to diseases; therefore, slowing age-related degeneration could greatly contribute to human health. Cynomorium songaricum Rupr. (CS) is traditionally used to improve sexual function and treat kidney dysfunction in traditional Chinese medicine, although little is known about whether CS has effects on longevity. The purpose of this study is to use Drosophila as an animal model to study the anti-aging effect of Cynomorium songaricum and explore its possible mechanisms. Here, we show that CS supplementation in the diet extends both the mean and maximum lifespan of adult female flies. The increase in lifespan with CS was correlated with higher resistance to oxidative stress and starvation and lower lipid hydroperoxides (LPO) levels. Additionally, the lifespan extension was accompanied by beneficial effects, such as improved mating readiness, increased fecundity, and suppression of age-related learning impairment in aged flies. These findings demonstrate the important antiaging effects of CS and indicate the potential applicability of dietary intervention with CS to enhance health and prevent multiple age-related diseases.

1. Introduction

Age is the most important risk factor for the progressive loss of physiological function, increased susceptibility to diseases and mortality due to the gradual accumulation of damage at the cellular, molecular, and tissue levels. A main focus in study of aging is energy homeostasis and metabolic processes. In systems ranging from unicellular yeast to worms, flies, rodents, and primates, a decrease in nutrient uptake by organisms during dietary restriction (DR) has been demonstrated to effectively extend the lifespan and exert beneficial effects in delaying the progression of age-related diseases. Accumulating evidence suggests that nutritional supplementation also increases lifespan and delays age-related syndromes. Cynomorium songaricum Rupr. (CS), also known by its Chinese name, Suoyang, is a parasitic plant that grows in northwest China. Despite its various documented beneficial effects, the correlation between CS and its effects on oxidative stress resistance, anti-aging, and cognitive function has not been elucidated. To investigate the mechanisms underlying the role of CS in anti-senescence, we adopted a pharmacological approach using Drosophila, which is an ideal organism for in vivo aging studies. Our data show significant extension of lifespan, improved resistance to environmental stress, and suppressed age-related syndromes, suggesting the possible clinical utility of CS in slowing the aging process.
3. Results and discussion

3.1. CS Supplementation Increases Lifespan in Flies:
Our results suggest that the addition of CS into the diet significantly extends lifespan. Because female flies were more responsive to CS, this sex was used for further experiments.

3.2. CS Supplementation Increases Resistance to Oxidative Stress and Starvation:
These results reveal that treatment with CS can improve resistance to some oxidative stress, suggesting that the lifespan extension induced by CS might be associated with an increase in anti-oxidative defense.

3.3. CS Increases Catalase Activity and Decreases LPO Levels:
CS supplementation not only increased antioxidant activity through a change in catalase activity but also decreased LPO formation, suggesting that CS protects tissue from ROS attacks.

3.4. Effects of CS on Courtship Behavior:
Our observations indicate that females fed CS tended to engage in mating activity with males, and a higher CS dose caused females to shorten the mating process.

3.5. Effects of CS on Reproductive Capacity:
We found significant increases in the daily number of eggs laid per female by 55.8, 26.9, and 50.0% in aged flies treated with 10, 20, and 30mg/mL CS compared with the CS-free controls, respectively (P < 0.01, 0.05, and 0.05, resp.), but for young flies, the higher dose of CS (30mg/mL) caused a moderate decrease in egg-laying ability (19.5%, P < 0.05), suggesting that CS could facilitate increased egg production in aged but not young flies.

3.6. CS Delays Age-Related Learning Impairment:
We found that flies supplemented with CS had a higher performance index of learning (59.7 ± 1.0) than control flies (46.0 ± 2.8) (P = 0.0011), suggesting that CS has a beneficial effect on the maintenance of learning ability with age.

4. Conclusions
The present results provide clues as to how CS could alleviate age-related syndromes, especially in terms of brain function, courtship behavior, and reproductive capacity, when CS is provided at a younger age. Our study provides some basic evidence supporting clinical treatment of replenishing the vital essence in traditional Chinese medicine and might provide valuable insight for developing new drugs or food additives to delay aging and the progression of age-related diseases.

5. References


