SAWASDEE

Effect of Thai Silkworm Pupa Extract on Activation of Vasodilation

W. Kaewruang[1/] S. Chomduang[2/] D. Wangmao[2/]

P. Kongthaweelert[3/] N. Duangnin[3/] N. Mahayossanun[4/] S. Apinyanuwat[4/]

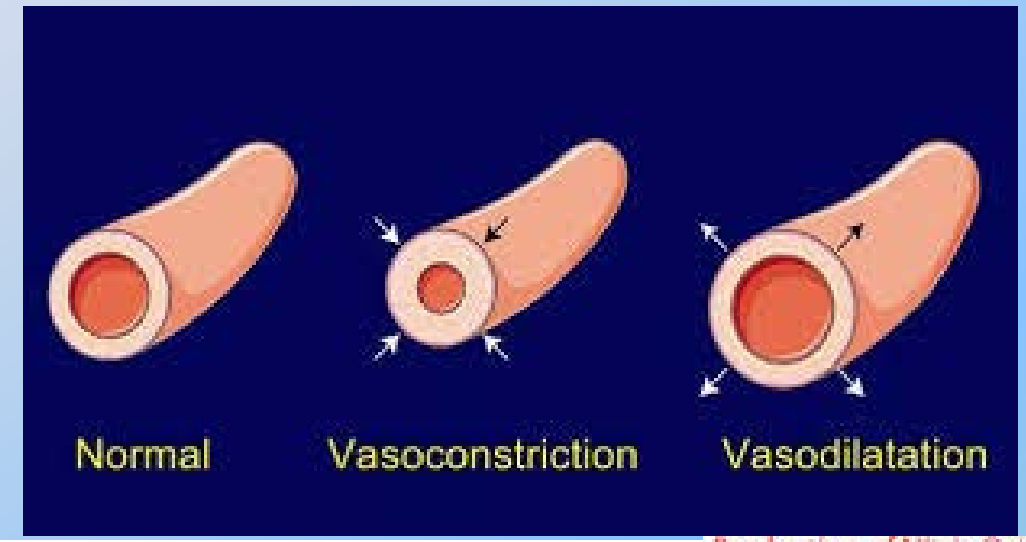
J. Jamkrathoke[5/] S. Limmanee[1/] A. Chumjai[1/] and S. Pholcharoen[1/]

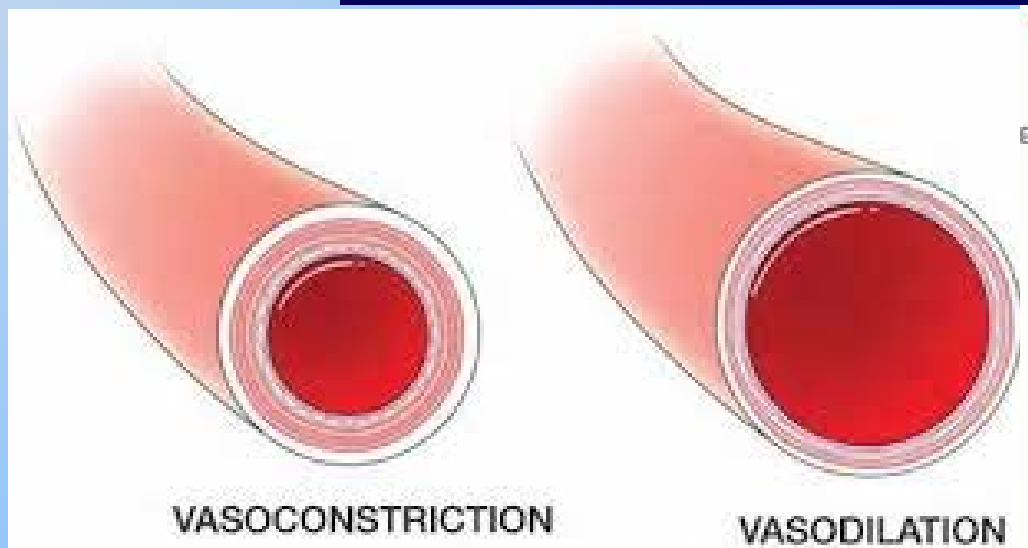
[1/] The Queen Sirikit Department of Sericulture [2/] Faculty of Agro-Industry, Chiang Mai University

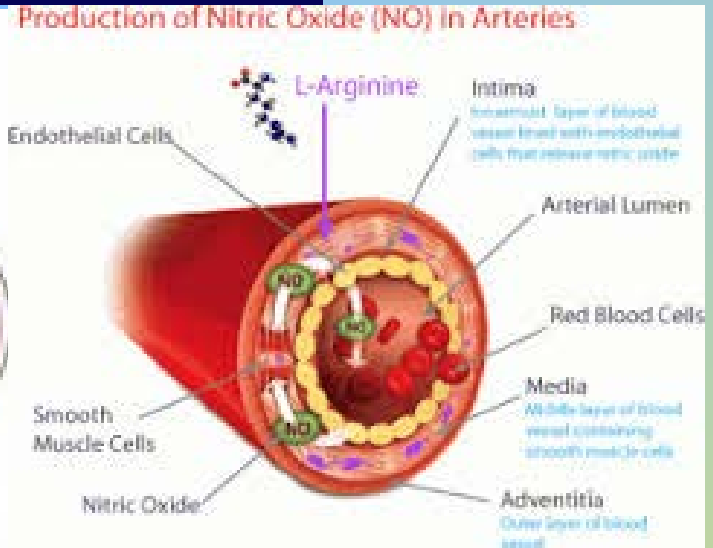
[3/] Queen Sirikit Sericulture Center (Chiang Mai) [4/] Faculty of Medical Science, Chiang Mai University

[5/] Queen Sirikit Sericulture Center (Nakhorn Ratchasima)

Vasodilation=The dilatation of blood vessels







Introduction

Insects

- Largest group — all animals
- Protein source — 23.4 – 39.8 g / 100 g
  (Meat 14.1 – 20.2 g)
- Favor — Around the world
- Transportation — Light weight

Silkworm Pupa

High Quality Protein (Nunthaya *et al.*, 2006)

Amono acids of edible insects (mg / gProtein)

Kind of insects	Iso leucine 40	Leucine 70	Iysine 55	Methionine + Cystine 35	Phenylalanine+ Tyrosine 60	Threonine 40	Tryptophan 10	Valine 50	Amino Acid Score	Limiting Amino Acid
Silkworm pupa	46.09	70.59	77.24	36.28	121.98	45.31	18.97	52.15	100	leucine
Cricket	29.82	60.89	46.11	30.89	62.40	28.99	24.41	34.37	68.7	valine
Bombay locust	32.72	59.45	35.71	20.92	59.97	22.30	17.33	35.59	55.8	Threonine
Bamboo caterpilla	33.89	60.02	55.97	41.75	100.72	34.89	41.11	38.76	77.5	valine

Source: http://nutrition.anamai.moph.go.th/temp/main/view.php?group=&id=120. March 2016

Food from Silkworm Pupa

Silkworm Pupa

Media of Cordyceps Cultivation


BOSUN
宝鼻园
虫草
子实体

Silkworm Pupa

Fat : Glyceride and Fatty acid

- **Essential fatty acid**
  - **Polyunsaturated fatty acid (PUFA)**
- **Non essential fatty acid**
  - **Saturated fatty acid (SFA)**
  - **Monounsaturated fatty acid (MUFA)**

Silkworm Pupa

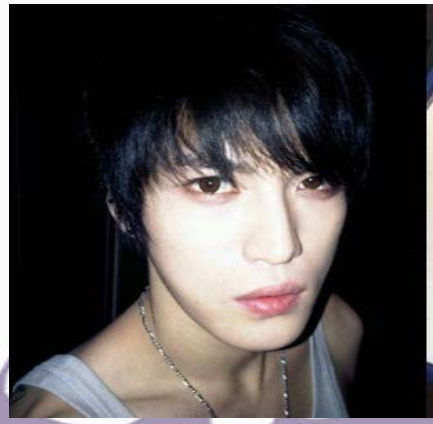
- **Unsaturated fatty acid (67%)** (Sukritanon *et al.*, 2003)
- **Linolenic (O_3)** **eyesight, learning, temper**
- **Linoleic (O_6)** **brain, blood vessels**

Silkworm Pupa

- Learning increased, neuron death reduced (Kaewruang, 2011)
- Alzheimer's disease protection (Kongpha *et al*., 2012)
- Nitric oxide synthase's activities increased
- Nitric oxide (NO) increased (Ahn *et al*., 2008)

- eNOS (endothelial nitric oxide synthase) : Vasodilation

- iNOS (inducible nitric oxide synthase) : arteritis



Silkworm Pupa

- **Antioxidant (Meetali *et al.*, 2014)**
- **Pupa : Nangnoi Srisaket-1 and Luang Surin silkworm varieties (Wangmao, 2016)**

Materials and Methods

1. Silkworm pupa varieties : Nangnoi Sisaket-1, Luang Surin
2. Silkworm pupa extract's materials and methods, Sildenafil (Viagra)
3. Toxicity test of arteritis's materials and methods
4. NO increased activating test of vasodilation's materials and methods

Duration and Location

- October 2014– September 2015
- The Queen Sirikit Department of Sericulture
- Faculty of Agro-Industry, Chiang Mai University
- Queen Sirikit Sericulture Center (Chiang Mai)
- Faculty of Medical Science, Chiang Mai University
- Queen Sirikit Sericulture Center (Nakhorn Ratchasima)

Methods

Preparation of silkworm pupa extract

- silkworm pupa, Nangnoi Srisaket-1 and Luang Surin
- dried by freeze dryer and ground as powder

Luang Surin (left)

Nangnoi Srisaket-1 (right)

Methods

Extracted by Ethanol 80% and water

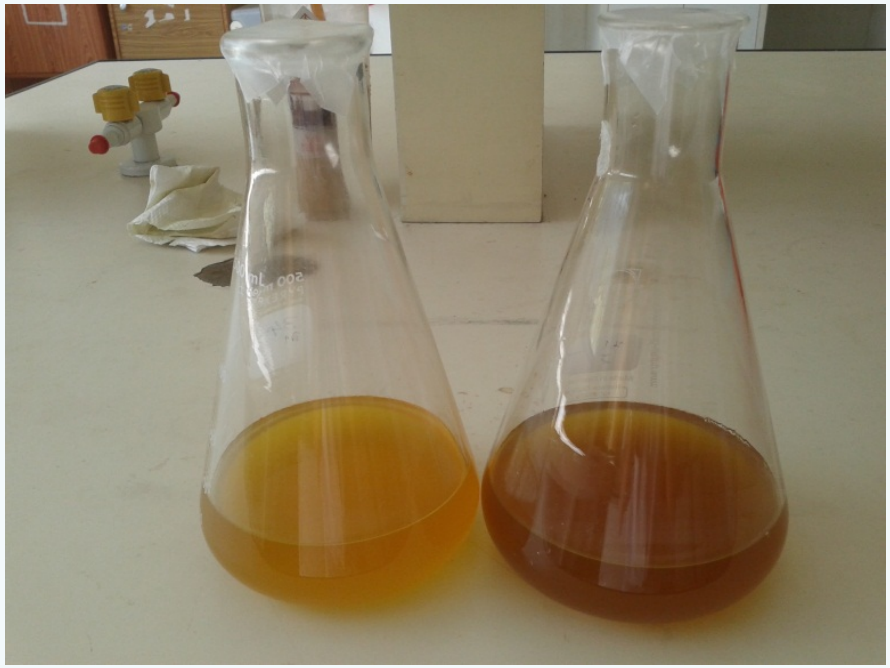
Methods

The mixture was blended and centrifuged at 3000 rpm for 5 minutes. Residue from the first extraction was extracted again, totally 3 times.

Methods

Residue from the first extraction was extracted again, totally 3 times.

Methods



Liquid from ethanol(left), Liquid from water (right)

Methods

Liquid from ethanol and distilled water layer were dehydrated by rotary evaporator

Methods

1. Silkworm pupa extracts kept at-20 degree Celcius for 24 hrs.

2. Dried them by freeze dryer for 48 hrs.

(Freeze dryer)

Methods

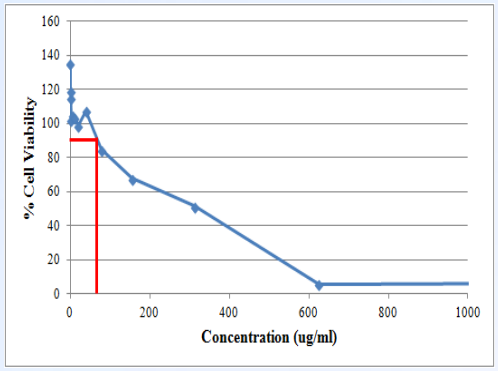
Dried silkworm pupa extract

Result and Discussion

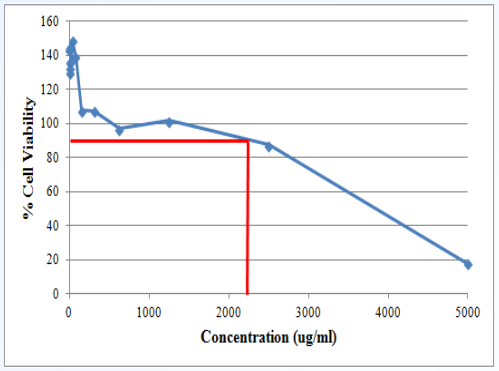
Table 1 Production yield of extracted powder from silkworm pupae of 2 variety

Solvent	Silkworm pupae extract yield (%)	
	Nangnoi Srisaket-1	Luang Surin
Ethanol $^{ns.}$	2.80 ±0.11	2.48 ±0.18
Water	7.26^{a}±0.14	5.30^{b} ±0.09

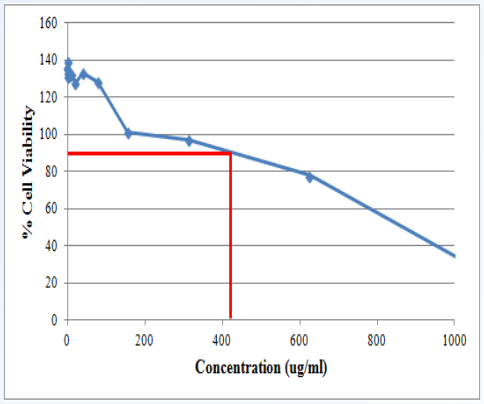
A. Nangnoi Srisaket-1 (Ethanol)



B. Nangnoi Srisaket-1 (Water)



C. Luang Surin(Ethanol)



D. . Luang Surin(Water)

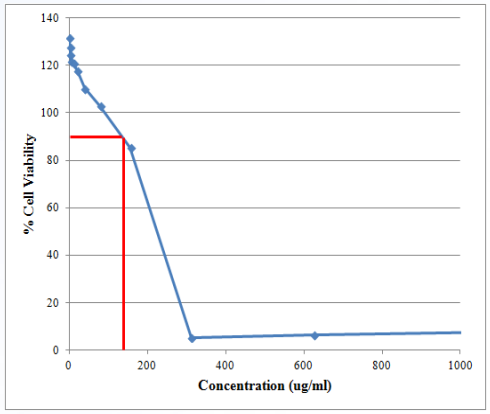


Figure 2. Effect of silkworm pupa extract by ethanol and water to cell viability (at 90%)

Table 2 Activation of nitric oxide production by extract from silkworm pupae compared to standard solution

Silkworm pupa variety	Solvent	Extract conc. (µg/ml)	NO conc. (µg/ml)	Amount of NO compared to Sildenafil (%)
Nangnoi Srisaket -1	Ethanol	60	2.083	101.57
	water	2200	1.793	80.83
Luang Surin	Ethanol	410	2.083	102.55
	water	125	1.752	79.30
Sildenafil	DS	25	2.041	100.00

Table 3 Mechanism of activation nitric oxide production by silkworm pupae extract

Silkworm pupa (Variety)	Solvent	Extraction conc. (μg/ml)	eNOS (related to β-Actin)	iNOS (related to β-Actin)
Nangnoi Srisaket-1	Ethanol	60	2.7	1.1
	Water	2200	2.6	1.2
Luang Surin	Ethanol	410	1.8	3.4
	Water	125	2.2	2.6
Sildenafil	DS	25	3.1	0.65

Conclusion

Silkworm pupa : **1. Nangnoi Sisaket-1 showed higher potential than Luang Surin in activated Vasodilation as Sildenafil or Viagra**

2. Supplementary food to reduce Erectile dysfunction

3. Need to studies more in animal model and clinical trial

Acknowledgement

- Prof. Dr.P. Tzenov, Dr. Y. Shukurlu and Ms. N. Kabulova, The 8th BACSA Conference in Azerbaijan
- Staff of Faculty of Ago-Industry and Faculty of Medical Science, Chiang Mai University and The Queen Sirikit Department of Sericulture
- Miss Jeeranun Basungnoen for preparing Power Point presentation








Beautiful Ladies : Beautiful Silk

How to grow mulberry tree

How to rear silkworm

Beautiful Ladies : Beautiful Silk

Beautiful Ladies : Beautiful Silk

Beautiful Ladies : Beautiful Silk

Mulberry and Silk make you are beautiful as Miss…