

## Endophyte toxins (Ergovaline and Lolitrem B)

Endophytes (endophytic fungi) are artificially infected for the purpose of improving cold tolerance and insect resistance in plants, and are infective in its progenies and its surroundings.

There is a symbiotic relationship between plants and endophytes. But some chemical substances produced by endophytes are harmful to grazing animals. They are called endophyte toxins.

### 1. Ergovaline

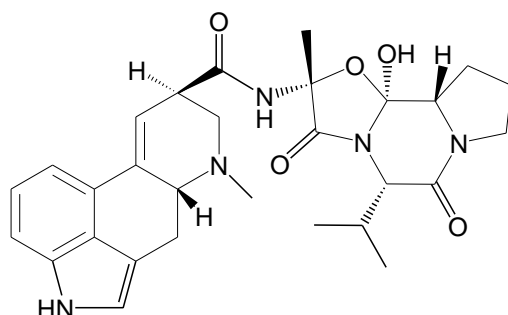
Ergovaline is an ergot alkaloid produced by *Neotyphodium coenophialum* infected to tall fescue or by *Neotyphodium lolii* infected to perennial ryegrass.

Name: Ergovaline

Molecular formula:  $C_{29}H_{35}N_5O_5$

Molecular weight: 533.62

Structure:



#### 1-1. Toxicity

Ergovaline causes poisoning called “fescue toxicosis”. In summer, it notably causes symptoms such as reduction of weight gain, accentuation of saliva secretion, rise of body temperature and breathing rate, aggravation of conception results, and reduction of milk yield etc., and in winter, it causes hematogenous disorder (gangrene around hoofs and tips of ear and tail).

Poisoning in grazing animals such as cattle, horses and sheep etc. have been found including oversea cases. The Oregon State University set the threshold level for each livestock, reporting that fescue toxicosis appear at roughly 500 to 825 ppb (equivalent to the concentration in total diet). However, fescue toxicosis may be seen below the threshold level depending on the family, individual, sex, age, environment and nutritional status of the animals.

#### 1-2. Contamination

In Japan, ergovaline is detected mainly in imported grass straw of perennial ryegrass and tall fescue.

The concentration of endophyte toxin defers according to the weather of the year, harvest time, field and the part of the plant (It is especially high in the ear).

### 1-3. Regulations

[Japan]

No regulatory limit is established.

However, it is recommended that the concentration of ergovaline in feed should be lower than 500 ~ 825 ppb (equivalent to the concentration in the total given feed) as a reminder.

[Overseas]

No regulatory limit is established in main countries.

## 2. Lolitrem B

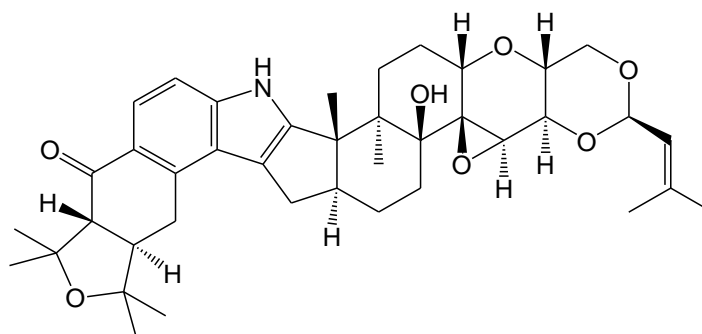
Lolitrem B is a toxin produced by endophytes that have been infected to perennial ryegrass. One of major microorganisms which produce lolitrem B is *Neotyphodium lolii*. *N. lolii* also produces ergovaline.

Name: Lolitrem B

Molecular formula:  $C_{42}H_{55}NO_7$

Molecular weight: 685.89

Structure:



### 2-1. Toxicity

Lolitrem B is a neurotoxin which causes poisoning by the intake of highly contaminated pasture or straw. Cervical spasm, fever and staggers may be seen for mild poisoning, and muscle spasms, gait abnormalities, astasia, and severe spasm that lead to death may be seen for serious poisoning.

Poisoning in grazing animals such as cattle, horses, sheep, deer, alpaca and so on have been found including overseas cases. The Oregon State University set the threshold level for each livestock, reporting that poisoning symptoms appear at roughly 1800 to 2000 ppb (equivalent to the concentration in total diet). However, poisoning symptoms may be seen below the threshold level depending on the family, individual, sex, age, environment, and nutritional status of the animals.

## 2-2. Contamination

In Japan, lolitrem B is detected in imported straw of perennial ryegrass. The concentration of endophyte toxins differs according to the weather of the year, harvest time, field, and the part of the plant (It is especially high in the seed).

## 2-3. Regulations

[Japan]

No regulatory limit is established.

However, it is recommended that the concentration of lolitrem B in feed should be lower than 1800 ~ 2000 ppb (equivalent to the concentration in total diet) as a reminder.

[Overseas]

No regulatory limit is established in main countries.

## 3. Measures for preventing contamination

It is not possible to remove endophyte once it is infected, however, it is reported that endophyte toxins are reduced by certain humidity and ammonia treatment.

However, to prevent poisoning, it is desirable that the importer of tall fescue or ryegrass verifies the concentration of ergovaline and lolitrem B, and that intake of endophyte toxins is decreased by mixing tall fescue or ryegrass with other grass hay, straw, and formula feed to dilute the concentration of endophyte toxins in total diet.

## 4. Reference

- 1) S. Miyazaki, M. Fukumura, M. Yoshioka, and N. Yamanaka: Detection of Endophyte Toxins in the Imported Perennial Ryegrass Straw, *J. Vet. Med. Sci.*, **63(9)**, 1013-1015 (2001).
- 2) S. Aldrich-Markham, G. Pirelli, and A.M. Craig: Endophyte Toxins in Grass Seed Fields and Straw Effects on Livestock, Oregon State Univ. Extension Service, EM 8598-E, :  
<http://oregonstate.edu/endophyte-lab/public/alkaloidLevels>  
<http://extension.oregonstate.edu/catalog/pdf/em/em8598-e.pdf>
- 3) To handle imported straw safely:  
<http://niah.naro.affrc.go.jp/disease/poisoning/file/guide-L.pdf>
- 4) Endophyte poisoning:  
<http://niah.naro.affrc.go.jp/disease/poisoning/endophyte.html>
- 5) The use of imported grass hay for feed:  
<http://www.famic.go.jp/ffis/feed/obj/19031914023.pdf>