



*Celebrating **150** years of agriculture*

# Ergot: An Ancient Enemy and Modern Friend

Mindy Liu, Ph.D.

## Abstract:

Ergot — the hard, dark resting body of *Claviceps* species — contains a spectrum of potent toxins known as ergot alkaloids that have played roles as the cause of gruesome “disease”, the secret of mystic rites, the hope for the patients of dreadful disease through history. Accidental ingestion of a large amount of ergot or continuing consumption of small amount for a long period of time causes a syndrome known as ergotism in humans and animals, with symptoms including convulsions, respiratory distress, vomiting, diarrhea, tremors, burning sensations and coldness of the extremities, gangrene, limb loss and even fatal epileptic seizures. *Claviceps* infects various crops and grasses but rye is most susceptible. Historically, large epidemics of ergotism occurred where rye was planted as a staple food, and the “disease” was referred as “St. Anthony’s fire” or “holy fire” due to its burning symptom and the mysterious cause. Since the early 20th century, with increasingly stringent screening systems applied to control grain qualities, ergotism has disappeared as a public health issue. Nevertheless, economic losses are still substantial due to the disposal of large volumes of ergot grains and reduced yield of crops. Some close relatives of *Claviceps*, i.e. *Epichloe*, and *Balansia*, growing inside of cool-season grasses can produce a slightly different spectrum of ergot alkaloids that prove to be beneficial to their hosts’ fitness, and inhibit feeding by animals and insects. However, livestock grazing on the forage grasses infected with these fungi can develop ergotism causing economic losses. Despite their obnoxious detrimental effects, when being used in a proper dosage, some compounds have medical effects. Folk physicians used ergot to help childbirth and to treat excessive bleeding even though the application was highly risky; their hallucinogenic features were used for recreation in mystic rites. To date, the investigation of their chemical compositions and functions discovered bountiful beneficial pharmaceutical uses. Structurally-simple clavines have anti-microbial and anti-tumor functions, while lysergic acid and amides (LSD) and complex ergopeptines have been used to develop major drugs for treatment of hypertension, migraines, Parkinsonism, and reproductive disorders. Understanding the genetic diversity of ergot alkaloid producing fungi allows us to mitigate their toxic effects on humans and livestock, but also offers hope for the healing of some presently incurable diseases.

## Biography:

Dr. Miao Liu (Mindy) studied on taxonomy and molecular systematics of insect pathogenic fungi, *Aschersonia*, *Hypocrella* and *Moelleriella* (*Clavicipitaceae*, *Ascomycota*) under the supervision of Dr. Kathie Hodge, and received her doctoral degree in Mycology from Department of Plant Pathology, Cornell University in year 2005. Since then, she has worked as a postdoctoral fellow in University of Kentucky, Agriculture and Agri-Food Canada, and U. S. Department of Agriculture, researching on systematics, molecular diagnostics and population evolution of rust fungi and secondary metabolite gene evolution of fungal endophytes. Her current research interests include phylogenetics, diagnostics, population evolution and genomics of plant related fungi in *Ascomycota*.

