Short Communication

First Report on Natural Occurrence of *Metarhizium rileyi* (Farlow) Samson Against *Spodoptera frugiperda* J.E. Smith (Lepidoptera: Noctuidae) in Thailand

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Abstract

Fall armyworm, *Spodoptera frugiperda* J.E. Smith is currently one of the most destructive pests of corn in Thailand and elsewhere. During October to November 2020, cadavers of FAW covered with fungal mycelium were observed in corn field at National Corn and Sorghum Research Center, Pakchong, Nakhon Ratchasima, Thailand. The fungus was later identified as *Metarhizium rileyi* (Farlow) Samson, an entomopathogenic fungus. This is the first report of natural occurrence of *M. rileyi* against FAW in Thailand. Although the natural occurrence was low, results from preliminary test under laboratory conditions were promising. More researches should be conducted to reveal the potential of this fungus as a microbial control agent against this devastating insect.

Keywords : fall armyworm, *Spodoptera frugiperda*, *Metarhizium rileyi*, entomopathogenic fungus

Fall armyworm (FAW), *Spodoptera frugiperda* J.E. Smith (Lepidoptera: Noctuidae) has been reported to invade Thailand since December 2018 (IPPC, 2018). Thereafter, this insect has spread throughout the country posing threat to every major corn production area. Efforts from both public and private sectors have been put forth to keep this insect under control. Several research activities have been focused on finding effective pesticides for the emergency outbreaks. However, some research programs in Thailand were looking for local biological control agents to combat this pest (Plant Protection Research and Development Office, 2019). These included the studies on predators (green lacewing, stink bug and earwigs), parasitoids (*Trichogramma pretiosum*), and microbial agents (nematodes, fungi, bacteria and viruses).

In this report we surveyed FAW population from 3 non-pesticide corn fields at National Corn and Sorghum Research Center, Faculty of Agriculture, Kasetsart University, Nakhon Ratchasima, Thailand during October-November, 2020. The center was located at 14.6422°N, 101.3152°E with the altitude of 388 m above mean sea level. The weather during the survey according to the local agrometeorological station was 32.9°C max. temperature, 17.5°C min. temperature, 24.8°C ave. temperature, 99% max. RH, 34% min. RH, 79% ave. RH, and 37.2 mm. max rainfall. The objective of the survey was to search for any entomopathogenic fungus which caused mortality to FAW. Dead FAW larvae which appeared mummified (hard bodies with or without fungal mycelia and spores)

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were collected and placed individually in glass vials. They were transferred to Entomology and Plant Pathology Laboratories within the center for further identification and tests.

We found out that natural mortality with mummy-like symptom was low (less than 20%). Similar results were also observed by Mallapur *et al*. (2018). The collected cadavers were placed individually in moistened Petri dish to allow mycelial growth and sporulation. The obtained mycelia and spores were then sampled for microscopic observation while the remaining were isolated and cultured on potato dextrose agar (PDA). The cultured fungus produced white mycelia with green conidiospores on PDA (Figure 1). The results from preliminary identification using morphological characteristics indicated that this entomopathogenic fungus was *Metarhizium rileyi* (Farlow) Samson. This is the first report of natural occurrence of *M. rileyi* against FAW in Thailand.

In order to confirm its entomopathogenicity, the PDA-cultured fungus was bioassayed against laboratory colony of FAW. The tested insect population was originally collected from corn fields in Pakchong, Nakhon Ratchasima and mass-reared in laboratory for a few generations. Neonate larvae were fed with pieces of corn leaves sterilized with 0.1% W/V sodium hypochlorite until reaching the desired stage. Various concentrations of conidia suspension ranging from 10^3 to 10^7 conidia ml^{-1} were prepared from 14 days old PDA culture. Pieces of corn leaf (approx. 3x4 cm^2) previously surface sterilized with 0.1% W/V sodium hypochlorite were sprayed with designated spore suspensions before being placed individually in plastic cups while distilled water was sprayed in untreated control. One second- or third-instar larva was put in each cup. A new piece of sterilized corn leaf was fed to each tested FAW daily. They were maintained under laboratory conditions for 10 days and observed for mortality with mummy-like symptoms. Larval mortality began to appear since day 5. However, mortalities at 10 days after treatment were calculated only from dead FAW with white mycelia and/or green conidia.

The results from our preliminary test were comparable to those of Montecavo and Navasero, (2021). High concentration of *M. rileyi* conidia ($\geq$ $1x10^6$ spores ml^{-1}) could produce 100.00% mortality against the second instar larvae and more than 90.00% mortality against the third instar larvae (Table 1) while low concentration ($1x10^3$ spores ml^{-1}) caused only 33.33 - 39.58% mortality. More research must be conducted to confirm the identity of this entomopathogenic fungus and also its efficacy under both laboratory and field conditions before further recommendation could be given. However, there is a potential that the fungus could be used as an integral component of FAW pest management program. Mallapur *et al*. (2018) reported that field application of *M. rileyi* could reduced FAW population by 62.50 - 66.46% at 15 days after application. We have already planned to mass-produce the fungus for further experimentation.

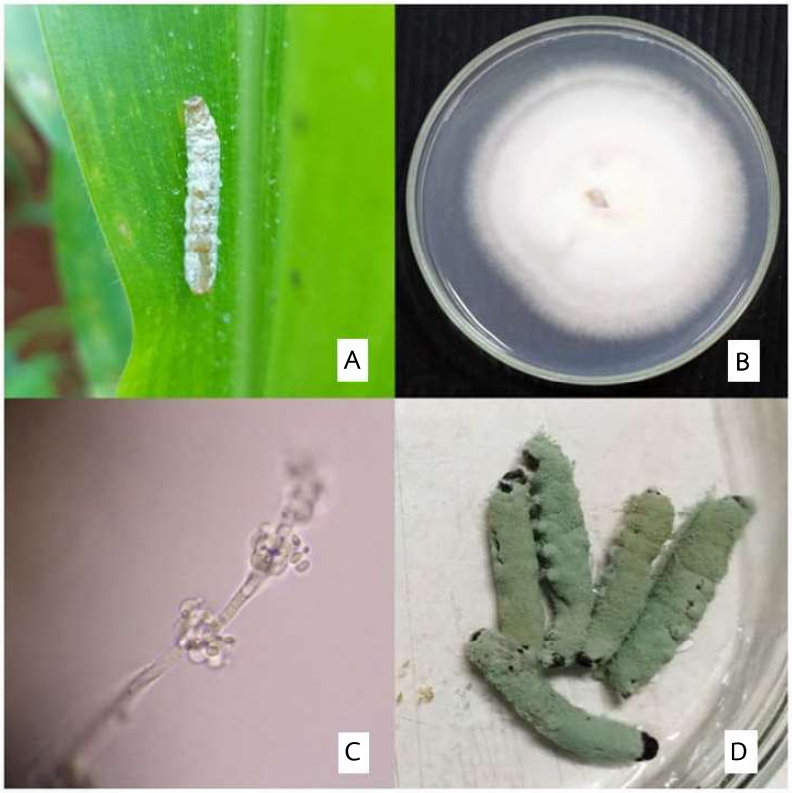

Figure 1 The entomopathogenic fungus, *Metarhizium rileyi* (Farlow) Samson
A. cadaver of fall armyworm on corn plant
B. fungal colony on potato dextrose agar
C. conidiospore under microscope
D. fall armyworm larvae with green conidiospores.

Table 1 Mortalities of second- and third-instar fall armyworm, *Spodoptera frugiperda* J.E. Smith, at 10 days after single feeding with corn leaves treated with various conidia suspensions of *Metarhizium rileyi* (Farlow) Samson.

Concentration of conidia suspension (conidia ml^{-1})	Second-instar larvae		Third-instar larvae	
	n	Larval mortality (%)	n	Larval mortality (%)
1×10^3	48	39.58	66	33.33
1×10^4	20	65.00	40	55.00
1×10^5	22	86.36	42	85.71
1×10^6	20	100.00	32	96.88
1×10^7	14	100.00	33	93.94
Untreated Control	41	0.00	60	0.00

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