Impact of gall midge (*Orseolia oryzae*) damage on yields of recommended traditional and improved glutinous varieties of lowland rice in the Lao PDR

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**Abstract**

Rice is the most important crop in the Lao PDR and it is grown in three different agro-ecosystems, the irrigated lowland, the rainfed upland and the rainfed lowland environment, which accounts for the largest area (ca. 77%). Gall midge (*Orseolia oryzae*; GM) has become increasingly a problem in the rainfed rice ecosystem of the Lao PDR (Inthavong et al., 1998) where incidences of GM outbreaks have been observed in many provinces.

The screening trial for gall midge resistance (Lao-IRRI, 2001) in recommended traditional and improved rice varieties as well as promising lines was started in the 1999 in farmers’ field in Nasok village in Phalanexai district and in Nakhu village in Outhoumphone district of Savannakhet province. In the wet season 2001 additional trials were set up to assess the impact of GM damage on yields of the three most popular Lao improved and moderately susceptible varieties (Tha dok kham 1, Phone Ngam 1, Thasano 1) and comparing them to the yield potentials of two resistant traditional varieties (Meuang Nga and Mak Ngy). Gall midge incidence was surveyed randomly within 25 hills at 14, 28, 42, 56, 70 and 84 DAT and yields from each treatment were compared. The results showed that GM damage in the three moderately susceptible improved varieties TDK 1, PNG 1 and TSN 1 was generally higher in Nasok village (Phalanexai district) than in Nakhu village (Outhoumphone district), and differed within the growth stages of rice. The percent of affected tillers was comparatively low up to 42 DAT and after 70 DAT and was highest between 56 and 70 DAT. Of all five varieties screened, TDK 1 and TSN 1 were most affected by gall midge with an average of 40% of infected tillers and damage was lowest in the two traditional varieties Meuang Nga and Mak Ngy with only 5% of the tillers infected by gall midge. The correlation between yield and percent of infested tillers was higher in the improved variety TDK 1 than in the local varieties Meuang Nga and Mak Ngy ($r^2=0.0027$).

**Key words:** Gall midge, *Orseolia oryzae*, rainfed rice, Meuang Nga, Standard Evaluation System.
Introduction

Agriculture is the main economic sector in the Lao PDR and rice is the most important crop. Rice is grown in three different agro-ecosystems, the irrigated lowland, the rainfed upland and the rainfed lowland environment, which accounts for the largest area (ca. 77%). Gall midge (Orseolia oryzae; GM) has become increasingly a problem in the rainfed rice ecosystem of the Lao PDR (Inthavong et al., 1998) where incidences of GM outbreaks have been observed in many provinces. The outbreaks are economically important mainly in Phalanexai and Outhoumphone districts in Savannakhet Province.

Attempts to understand and quantify the significance of the problem and to formulate control management strategies began in 1998 by the Agronomic Division of the Savannakhet Agricultural Department in collaboration with the Lao-IRRI Project. An annual wet season screening trial for gall midge resistance (Lao-IRRI, 2001) in recommended traditional and improved rice varieties as well as promising lines was started in the 1999 in two districts of Savannakhet province known for their yearly high losses due to GM outbreaks. In addition to the screening trials, an experiment assessing the impact of GM damage on yields in the most popular Lao improved varieties comparing them the yield potentials of resistant traditional varieties.

Materials and methods

The experiment was conducted in the wet season 2001 in farmers’ field in Nasok village in Phalanexai district and in Nakhv village in Outhoumphone district of Savannakhet province. Fields where there had been high gall midge incident in the previous wet season 2000 were selected. The experiment was set up in two replications comparing the yields of two traditional resistant varieties (Meuang Nga and Mak Ngy) and three moderately susceptible improved varieties (Tha dok kham 1, Phone Ngam 1, Thasano 1). Plot size was 5 x 10 m. Two to three seedlings were transplanted 28 after sowing at a hill spacing of 20 x 20cm. Fertilizer was applied at the recommended rate for improved varieties (90-30-20 kg/ha NPK). Gall midge incidence was surveyed randomly within 25 hills at 14, 28, 42, 56, 70 and 84 DAT. Yields from each treatment were compared.

Results

Gall midge damage in the three moderately susceptible improved varieties TDK 1, PNG 1 and TSN 1 was generally higher in Nasok village (Phalanexai district) than in Nakhv village (Outhoumphone district) and differed throughout the different rice growth stages (Figs. 1 and 2). Damage expressed as percent of affected tillers was comparatively low up to 42 DAT and after 70 DAT and was highest between 56 and 70 DAT. Of all five varieties screened, TDK 1 and TSN 1 were most affected by gall midge with an average of 40% of infected tillers. Damage was lowest in the two traditional varieties Meuang Nga and Mak Ng with only 5% of the tillers infected by gall midge. Despite the much higher percentage of gall midge infested tillers, the yields of the improved varieties were much higher than those of the traditional varieties in the Nakhv site. Unfortunately, yield data for the traditional varieties in the Nasok site are not available. In both locations, however, the correlation between gall midge damage and yield was rather high for the improved varieties (Figs. 3A and B) as opposed to the local varieties Meuang Nga and Mak Ng in Nakhv (Fig. 3C).
Discussion

Comparisons of the resistances to gall midge of different varieties are very important to develop variety and fertilizer recommendations for maximum economic benefit for farmers. This study is important for the transfer of appropriate technologies to farmers in different agro-ecosystem within the country. The present experiment showed, that the three improved varieties: TDK 1, TSN 1 and PNG 1 have a much higher percentage of tiller infestation by gall midge than the two local varieties, Meuang Nga and Mak Ngy which showed an average infestation of tillers lower than 5% only. There was high correlation between gall midge damage and yield for improved varieties that suggests a strong economic impact of gall midge damage on rice production. this is in contrast to the local varieties in which gall midge damage had little impact on yields.

From this experiment following recommendation can be given: In areas where gall midge incident is higher than 31%, Meuang Nga or Mak Ngy varieties should be planted. If areas with gall midge damage lower than 30%, improved varieties like TDK 1, PNG 1 and TSN 1 can be planted, but they should be planted early during end of May to beginning of June.

Conclusions and outlook

- Gall midge damage was higher in the improved varieties TDK 1, PNG 1 and TSN 1 than in the local varieties Meuang Nga and Mak Ngy.
- The correlation between gall midge infested tillers and yield was higher in improved varieties than in the local varieties.
- In areas where gall midge incidence is higher than 31%, Meuang Nga or Mak Ngy varieties should be planted.
- In areas where gall midge damaged lower than 30%, improved varieties like TDK 1, PNG 1 and TSN 1 can be planted, but they should be planted early in the season: end of May to beginning of June.

![Figure 1. Comparison of gall midge damage in three Lao improved and two traditional varieties in two villages of Savannakhet province. TDK 1, Tha dok kham 1; PNG1, Phone Ngam 1; TSN 1, Thasano 1; MKI, Mak Ngy; MGA, Meuang Nga.](image-url)
Figure 2. Gall midge damage over different growth stages of rice in three Lao improved varieties and two traditional varieties in two villages of Savannakhet province. TDK 1, Thadok kham 1; PNG1, Phone Ngam 1; TSN 1, Thasano 1; MKI, Mak Ngy; MGA, Meuang Nga.

Figure 3. Yields of two improved and two traditional rice varieties in two villages of Savannakhet province. A: TDK 1 (improved); B: PGN 1 (improved) and C: Meuang Nga and Mak Ngy (traditional).
Figure 4. Correlation of % damaged tillers and yield in two improved and two traditional rice varieties in two villages of Savannakhet province. A: TDK 1 (improved); B: PGN 1 (improved) and C: Meuang Nga and Mak Ngy (traditional).
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