



Development and Survivorship of *Spodoptera frugiperda* J.E. Smith (Lepidoptera: Noctuidae) on Local Rice Varieties from West Sumatra, Indonesia

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ABSTRACT

Spodoptera frugiperda J.E. Smith (Lepidoptera: Noctuidae), or the fall armyworm (FAW), is an invasive and highly polyphagous pest that threatens various food crops, including rice. This study aimed to assess the effects of several local rice cultivars from West Sumatra on the development and survival of *S. frugiperda* under laboratory conditions. The experiment was arranged in a completely randomized design with five treatments and ten replications. Four local rice cultivars (Cisokan, Batang Piaman, Kuriak Kusuik, and Bujang Marantau) were tested, with corn used as a reference host. Data were analyzed using analysis of variance (ANOVA). The observed parameters included the duration of each developmental stage, as well as the pre-oviposition, oviposition, and post-oviposition periods, fecundity, egg hatchability, larval survival to the pupal stage, pupal weight, adult emergence, and sex ratio. Host plant species significantly affected all developmental and reproductive parameters of *S. frugiperda* ($p < 0.05$). The total developmental duration was shorter on corn (37.20 ± 1.51 days) than on the local rice cultivars, which ranged from 41.54 to 41.90 days. The larval stage lasted longer on rice cultivars (mean 21.40 days) compared with corn (15.86 days). Female longevity and oviposition period were also greater on corn than on rice. Overall survival and the number of females emerging were lower on rice (73.20–78.80 individuals) than on corn (94.20 individuals). These results indicate that *S. frugiperda* is capable of completing its life cycle on local rice cultivars; however, development is slower, and reproductive potential is reduced compared to corn.

Keywords: Fall Armyworm, local rice cultivars, corn, survival rate, life cycle.

Perkembangan dan Kelangsungan Hidup *Spodoptera frugiperda* J.E. Smith (Lepidoptera: Noctuidae) pada Varietas Padi Lokal Asal Sumatera Barat, Indonesia

ABSTRAK

Spodoptera frugiperda J.E. Smith atau fall armyworm (FAW) merupakan hama invasif polifag berpotensi menyerang berbagai tanaman pangan, termasuk padi. Penelitian ini bertujuan untuk mempelajari pengaruh beberapa jenis padi lokal Sumatera Barat terhadap perkembangan dan kesintasan *Spodoptera frugiperda* (Lepidoptera: Noctuidae). Penelitian menggunakan rancangan acak lengkap dengan 5 perlakuan dan 10 ulangan. Data dianalisis dengan ANOVA dan uji lanjut LSD pada taraf 5%. Jenis tanaman yang diuji yaitu empat varietas padi lokal Sumatera Barat (Cisokan, Batang Piaman, Kuriak Kusuik, dan Bujang Marantau) serta jagung sebagai pembandingan di Laboratorium. Parameter yang diamati meliputi lama setiap stadium; Masa oviposisi, pra dan pasca, jumlah telur yang dihasilkan dan yang menetas, jumlah larva yang berkembang sampai pupa, berat pupa. Juga diamati pupa yang jadi adult dan sex ratio. Hasil menunjukkan bahwa jenis pakan berpengaruh nyata terhadap semua parameter perkembangan ($p < 0,05$). Lama hidup *S. frugiperda* pada jagung lebih pendek yaitu $37,20 \pm 1,51$ hari dibanding pada kultivar padi lokal; Cisokan ($41,54 \pm 1,51$ hari), Batang Piaman ($41,62 \pm 1,46$ hari), Kuriak Kusuik ($41,56 \pm 1,55$ hari), dan Bujang Marantau ($41,90 \pm 1,66$ hari). Stadia larva rata rata lebih lama pada seluruh varietas padi (21,40 hari) dibandingkan jagung (15,86 hari). Lama stadia imago betina 9,92 hari dan masa oviposisi 3,80 pada jagung. Pada padi lama hidup betina 9,00 sampai 9,28 dengan masa oviposisi 2,24 - 2,88 hari. Kesintasan total juga lebih rendah pada padi dibandingkan jagung, jumlah betina yang dihasilkan di jagung adalah 94,20 betina, dan di beberapa varietas padi yaitu 73,20 – 78,80 betina. Hasil menunjukkan bahwa *S. frugiperda* mampu menyelesaikan siklus hidupnya pada padi lokal, laju perkembangannya lebih lambat dan potensi reproduksinya lebih rendah dibanding pada jagung.

Kata Kunci: *Spodoptera frugiperda*, varietas padi lokal, jagung, sintasan, siklus hidup

INTRODUCTION

Spodoptera frugiperda (J.E. Smith), widely known as the fall armyworm (FAW), is a pest native to

the Americas that has spread invasively across Africa, Asia, and several other regions over the past decade. As a polyphagous species, FAW poses a significant

threat to major cereal crops, particularly corn. The research indicates that the type of plant affects the life cycle of *S. frugiperda*. This pest (origin from corn plantation) can live on baby corn, broccoli, but reduce performance/fitness when the larvae feed on rice leaf (*Oryza sativa* L. cv. *Ciherang* (Gramineae), and the larvae do not survival on palm oil (Dono et al. 2024). The polipagous of *S. frugiperda* thereby raises serious concerns for food security in areas infested with it. Its rapid dispersal and remarkable ecological adaptability have positioned FAW as one of the most prominent invasive insect species in contemporary plant protection science (Wang et al. 2025).

At the population level, FAW is often characterized by two distinct “strains” associated with preferred host plants: the corn-strain, which is more closely linked to corn, and the rice-strain, which is more commonly associated with rice and various grasses. These strain differences encompass oviposition behavior, feeding preferences, and several genetic distinctions that suggest host-associated differentiation. However, strain identity is not always rigid; both genetic and behavioral evidence indicate a complex dynamic and the potential for host switching or the use of alternative hosts under field conditions (Juárez et al. 2014).

In Southeast Asia and Indonesia specifically, early reports have documented the presence of FAW in corn fields with varying levels of infestation, followed by evidence of rice-associated FAW strains detected in several regions. Moreover, both laboratory and field studies have confirmed the occurrence of FAW on rice, although typically with lower fitness compared to individuals fed on corn. These findings raise concerns that FAW may expand its host range to include rice, particularly in mixed cropping systems or in areas experiencing high ecological pressure (Herlinda et al. 2022). From a physiological and ecological perspective, the ability of herbivorous insects to adapt to novel host plants involves a combination of factors, including the chemical and morphological traits of host leaves, interactions with gut microbiota, behavioral plasticity, and a genetic capacity for rapid selection. Several studies have shown that although larval survival of fall armyworm (FAW) on rice is often low during the initial generations, there is potential for improved performance across successive generations through mechanisms of phenotypic plasticity or local genetic adaptation. This evidence suggests that adaptation to rice is not implausible and should therefore be carefully monitored under field conditions (Hafeez et al. 2021).

In West Sumatra, several local rice cultivars are integral to traditional farming systems and regional food culture, including Cisokan, Kuriak Kusuik, Bujang Marantau, and Batang Piaman. These local cultivars exhibit considerable variation in morphological, physiological, and secondary metabolite characteristics, which may influence their suitability as host plants and the survival of

herbivorous pests such as FAW. Evaluating survival and developmental parameters of FAW (e.g., stage duration, survival rate, pupal weight, and demographic traits) on these rice cultivars, with maize serving as the primary reference host, will provide critical insights into host range potential within the local agricultural context of West Sumatra. Such information is also essential for developing monitoring and management strategies that account for mixed-cropping systems and landscape-level interactions (Ali et al. 2023).

Given the economic and agronomic implications of a potential host shift by FAW, research focusing on its survival and development on local rice cultivars is urgently needed. Biological data on FAW performance on Indonesian local rice varieties remain scarce, particularly with respect to survival and developmental traits. This study aims to address this knowledge gap by assessing the biological performance of FAW on selected local rice cultivars from West Sumatra and determining whether these cultivars can function as alternative hosts capable of supporting FAW development through reproductive generations. The findings are expected to provide empirical evidence on host range expansion and to support the formulation of integrated pest management recommendations for farmers in FAW-affected regions (Kafle and Joshi 2025).

Based on this background, the present study was designed to evaluate the developmental parameters and survival of *Spodoptera frugiperda* reared on four local rice cultivars (Cisokan, Bujang Marantau, Kuriak Kusuik, and Batang Piaman), with corn included as the primary host control. This comparative analysis is expected to identify significant differences in host suitability and to elucidate their ecological and management implications for local agricultural systems.

MATERIALS AND METHODS

Preparation of Rice Plants for *S. frugiperda* Larval Feed

Rice seeds of the Cisokan and Batang Piaman, Kuriak Kusuik, and Bujang Marantau varieties were soaked in water until fully submerged, with a water depth of approximately 2 cm. After soaking, the seeds were sown in trays measuring $30 \times 24 \times 4$ cm³, which were filled with soil. Two weeks after sowing, the seedlings were transplanted into plastic pots (6 cm in diameter and 11.5 cm in height). Each pot was covered with a transparent plastic tube made of mica and sealed with fine mesh cloth to prevent insects from escaping. Each container contained five rice clumps. Watering was carried out every other day.

Rearing of *S. frugiperda*

Larvae of *Spodoptera frugiperda* were collected from a corn plantation in Kuranji District, Padang, West Sumatra, by manual handpicking. Research on *S. frugiperda* was conducted at the Insect

Bio-Ecology Laboratory, Department of Plant Protection, Faculty of Agriculture, Andalas University. The larvae were placed in plastic containers ($4 \times 5.5 \text{ cm}^2$) and transported to the laboratory for rearing. In the laboratory, each larva was transferred into a plastic cup containing five two-week-old rice seedlings. Only one larva was placed per container to prevent cannibalism.

Larvae that reached the prepupal stage and ceased feeding were left in the soil until pupation. One-day-old pupae were then transferred into plastic cups (5 cm in diameter and 10 cm in height) covered with lids to facilitate observation. Adult males and females were provided with a 10% honey solution as a food source. Adults were kept in the containers until mating and oviposition occurred. The eggs produced were collected and maintained until hatching.

Development and Survivorship of *S. frugiperda*

Observations and data collection were conducted daily. Ten pairs of *S. frugiperda* adults were observed to study their biological development. Each pair was placed in a cage and supplied with a 10% honey solution (v:v; 1 ml honey: 10 ml water), absorbed into cotton, and placed at the top of the cage. Observations began with the emergence of newly formed adults, continued through mating and egg production, and lasted until the next generation of adults emerged.

Experimental design

The experiment was conducted using a completely randomized design (CRD) with five treatments and ten replications. The treatments consisted of four local rice varieties (Cisokan, Batang Piaman, Kuriak Kusuk, and Bujang Marantau) and corn, which served as the reference host plant. Each experimental unit consisted of a pair of adult *S. frugiperda*, maintained in an individual rearing cage under laboratory conditions at a room temperature of 25–28 °C. Observations were conducted to assess the biological and behavioral responses of *S. frugiperda*. The parameters observed were as follows:

a. Pre-oviposition Period

The pre-oviposition period was recorded to determine the time required for a female adult from emergence to the deposition of the first egg batch. The time of female emergence was marked as the start of the pre-oviposition period. Newly emerged male and female adults were paired in plastic cups and provided with a 10% honey solution.

b. Oviposition Period (days)

The oviposition period was measured from the time the female began laying the first egg batch until the deposition of the last batch. The number of eggs and egg clusters was recorded daily. The oviposition period ended when the female ceased egg

laying, marking the beginning of the post-oviposition period.

c. Post-oviposition Period (days)

The post-oviposition period was calculated from the time the female stopped laying eggs until her death.

d. Number of Eggs and Egg Masses

Each plastic cup containing a pair of adults was examined to count the number of egg masses and the total number of eggs laid. These data were recorded and documented for each pair.

e. Duration of Egg Stage (days)

The duration of the egg stage of *S. frugiperda* was determined by recording the time from oviposition until hatching of first instar larvae. Observations were made daily to monitor embryonic development.

f. Number of Hatched Eggs

Observations were conducted on eggs laid by five pairs of *S. frugiperda* adults. The number of live and dead larvae was counted daily from the first to the sixth instar. The percentage of larvae hatched from total eggs was calculated using the following formula:

$$\frac{\text{The number of eggs hatched}}{\text{The number of eggs laid}} \times 100\%$$

g. Duration of Larval Stage (days)

The duration of the larval stage of *Spodoptera frugiperda* was observed from the first instar (L_1) to the sixth instar (L_6). Daily observations were conducted to record the developmental time for each instar until pupation.

h. Duration of Pupal Stage (days)

The duration of the pupal stage was recorded from the time the pupa was formed until the emergence of the adult. Pupae that died or failed to develop properly were counted and documented.

i. Number of Larvae Developing into Pupae

Surviving larvae were continuously observed and recorded until they developed into pupae. The percentage of successful pupation was calculated using the following formula:

$$\text{Percentage Pupae formed} = \frac{\text{Number of pupae formed}}{\text{Number of larvae}} \times 100\%$$

j. Pupal Weight (g)

Pupal weight was measured using an analytical balance with an accuracy of 0.0001 g. The weight of each pupa was recorded, and the mean pupal weight was calculated for analysis.

k. Duration of Adult Stage (days)

The duration of the adult stage was measured from the time of adult emergence until death.

Observations were conducted daily to monitor the longevity of adults.

I. Number of Pupae Developing into Adults

Daily observations were made to record the emergence date of each adult. The success rate of adult emergence: from pupae was calculated using the following formula:

$$P = \frac{\text{Number of emerged adults}}{\text{Number of larvae}} \times 100\%$$

m. Sex Ratio

The sex ratio was determined by comparing the number of males and females that emerged. The ratio was calculated using the following formula:

$$\text{Sex Ratio} = \frac{\text{Number of male adults}}{\text{Number of female adults}}$$

Data analysis

Data were analyzed using one-way ANOVA followed by the LSD test at $\alpha = 0.05$, after verifying normality and homogeneity of variance assumptions.

RESULTS AND DISCUSSIONS

Developmental Duration of *Spodoptera frugiperda* on Different Host Plants

The observed developmental duration of each life stage of *Spodoptera frugiperda*, from egg to adult, on rice and corn is presented in Table 1. Larvae reared on the five different host plants originated from ten pairs of adult insects per treatment, which served as replicates. The numbers of eggs and larvae observed for each treatment are shown in Table 2.

Table 1. Developmental duration of *Spodoptera frugiperda* on rice and corn plants.

Stadium	Average development time of <i>S. frugiperda</i> (days) \pm SD				
	Corn	Rice			
		Cisokan	Batang Piaman	Kuriak Kusuik	Bujang Marantau
Egg	2.34 \pm 0.47 c	2.84 \pm 0.37 a	2.68 \pm 0.47 b	2.84 \pm 0.37 a	2.98 \pm 0.14 a
Larvae	15.66 \pm 0.43 c	19.32 \pm 0.33 a	19.44 \pm 0.30 a	19.54 \pm 0.44 b	21.4 \pm 0.40 a
Instar I	2.32 \pm 0.47 c	2.96 \pm 0.19 a	2.82 \pm 0.38 a	2.62 \pm 0.49 b	2.84 \pm 0.37 a
Instar II	2.38 \pm 0.49 b	3.06 \pm 0.23 a	3.14 \pm 0.35 a	3.12 \pm 0.32 a	3.08 \pm 0.27 a
Instar III	2.30 \pm 0.46 c	3.00 \pm 0.00 b	3.36 \pm 0.48 a	3.24 \pm 0.43 a	3.00 \pm 0.00 b
Instar IV	2.52 \pm 0.50 c	3.22 \pm 0.41 ab	3.08 \pm 0.27 b	3.36 \pm 0.48 a	3.08 \pm 0.27 b
Instar V	2.70 \pm 0.46 c	3.20 \pm 0.40 b	3.30 \pm 0.46 ab	3.20 \pm 0.40 b	3.44 \pm 0.50 a
Instar VI	3.44 \pm 0.50 c	3.88 \pm 0.38 ab	3.74 \pm 0.44 b	4.00 \pm 0.00 a	3.96 \pm 0.19 a
Prapupae	1.78 \pm 0.41 c	2.02 \pm 0.65 b	2.22 \pm 0.41 a	2.02 \pm 0.31 b	2.00 \pm 0.00 b
Pupae	7.50 \pm 0.50 c	8.08 \pm 0.52 b	7.96 \pm 0.60 b	8.08 \pm 0.56 b	8.52 \pm 0.50 a
Male	7.08 \pm 0.82 a	6.02 \pm 0.65 c	6.74 \pm 0.52 b	6.58 \pm 0.70 b	6.24 \pm 0.79 c
Female	9.92 \pm 0.63 a	9.28 \pm 0.67 a	9.32 \pm 0.79 b	9.08 \pm 0.89 c	9.00 \pm 0.00 d
Praoviposition	2.54 \pm 0.50 c	3.22 \pm 0.41 b	3.12 \pm 0.47 b	3.26 \pm 0.48 ab	3.44 \pm 0.50 a
Oviposition	3.80 \pm 0.40 a	2.78 \pm 0.41 b	2.88 \pm 0.32 b	2.28 \pm 0.45 c	2.24 \pm 0.43 c
Pasca					
Oviposition	3.58 \pm 0.49 a	3.28 \pm 0.67 b	3.32 \pm 0.55 b	3.54 \pm 0.54 a	3.32 \pm 0.47 b
Life cycle	37.20 \pm 1.51 b	41.54 \pm 1.51 a	41.62 \pm 1.46 a	41.56 \pm 1.55 a	41.90 \pm 1.66 a

Note: Numbers followed by the same lowercase letters within the same row are not significantly different based on the LSD test at the 5% significance level.

Overall, the life cycle of *S. frugiperda* differed significantly between the two host plants. For corn, the average life cycle duration was approximately 37.20 days, whereas for rice, it was longer, ranging from 41.51 to 41.90 days. The durations of the egg, larval, prepupal, pupal, and female adult stages of *Spodoptera frugiperda* differed significantly between corn and rice plants (Table 1). The average duration of the egg stage ranged from 2.34 days on corn to 2.98 days on rice. The larval stage lasted an average of 15.66 days on corn and 21.4 days on rice. The developmental duration across each instar (I–VI) also revealed that larvae reared on corn generally developed faster than those reared on rice.

For the prepupal stage, the average duration ranged from 1.78 days on corn to 2.22 days on rice. The pupal stage also varied, with the most extended duration recorded on rice (8.52 days) and the shortest

on corn (7.50 days). The longevity of adult males and females showed apparent differences, with females living longer than males. Both pre-oviposition and oviposition periods varied between host plants, with oviposition occurring earlier on rice but later on corn.

The duration of the egg stage of *S. frugiperda* also varied among rice varieties. The Batang Piaman variety showed a significantly different egg stage duration compared to Cisokan, Kuriak Kusuik, and Bujang Marantau. Similarly, the larval stage on Kuriak Kusuik differed significantly from that on Cisokan, Batang Piaman, and Bujang Marantau. The prepupal stage on Batang Piaman was significantly different from that on Cisokan, Kuriak Kusuik, and Bujang Marantau. In contrast, the pupal stage on Bujang Marantau differed significantly from those on Cisokan, Batang Piaman, and Kuriak Kusuik.

The duration of the male adult stage on Batang Piaman and Kuriak Kusuik was significantly different from that of Cisokan and Bujang Marantau. In contrast, the female adult stage on Bujang Marantau differed significantly from those of Cisokan, Batang Piaman, and Kuriak Kusuik.

The observed hatching percentage of *S. frugiperda* eggs provides an indication of the success

rate of eggs in completing the initial stage of their life cycle. A high hatching percentage reflects favorable environmental conditions. Similarly, the percentage of pupation increases when larval food sources are more suitable. Both the egg hatching rate and pupation rate were highest on corn compared with rice (Table 2).

Table 2. Average percentage of *S. frugiperda* eggs that hatched into larvae and larvae that successfully developed into pupae under different larval feeds.

Plant tested	N1	Percentage of eggs hatched \pm sd (%)	N2	Percentage of larvae that become pupae \pm sd (%)
Corn	621	87.93 \pm 1.24 a	546.05	49.79 \pm 1.43 a
Rice of Cisokan	537	83.81 \pm 1.32 b	450.06	46.39 \pm 1.32 b
Rice of Batang Piaman	568	84.58 \pm 1.34 bc	480.41	45.62 \pm 1.34 b
Rice of Kuriak kusuik	522	85.58 \pm 1.91 bc	446.73	45.27 \pm 1.91 b
Rice of Bujang Marantau	550	84.98 \pm 1.18 c	467.39	45.02 \pm 1.18 b

Note: N1: number of eggs/female, N2: Number of larvae/female. Numbers followed by the same lowercase letters within the same column are not significantly different based on the LSD test at the 5% significance level.

The highest number of eggs produced by *S. frugiperda* females was recorded on corn, reaching 621 eggs per female. In contrast, egg production on rice ranged from 520 to 268 eggs per female. The percentage of *S. frugiperda* eggs that hatched on corn and several rice varieties also varied. The highest hatching rate was observed in corn (87.93%), which was statistically higher than that in rice. On rice, egg hatchability ranged from 83.81 to 85.58%, with the Cisokan variety showing the lowest rate (83.81%), which differed significantly from Bujang Marantau but was not significantly different from Batang Piaman or Kuriak Kusuik.

Larval development to the pupal stage also differed significantly between corn and rice diets. The percentage of *S. frugiperda* larvae reaching pupation was highest on corn at

49.79%, which was statistically higher than all tested rice varieties. On rice, pupation rates ranged from 45.02% to 46.39%, and these values did not differ significantly among the rice varieties. This suggests that corn offers a more favorable environment for larval development compared to rice (Table 2). Although larvae feeding on rice still developed to the pupal stage, their pupal weight appeared to be affected.

Pupal weight reflects the quality of larval growth during development and thus can serve as an indicator of larval adaptation to each host plant. Variations in pupal weight may also influence survival, subsequent development, and reproductive capacity in the next generation. The pupal weights of *S. frugiperda* developing on corn and rice are presented in Table 3.

Table 3. Mean pupal weight of *Spodoptera frugiperda* reared on rice and corn plants.

Plant tested	N (Number of pupae observed)	Average pupa weight (g) \pm SD
Corn	20	0.12 \pm 0.006 a
Rice of Cisokan	20	0.11 \pm 0.006 b
Rice of Batang Piaman	20	0.11 \pm 0.002 b
Rice of Kuriak kusuik	20	0.10 \pm 0.003 c
Rice of Bujang marantau	20	0.10 \pm 0.006 c

Note: Numbers followed by the same lowercase letters within the same column are not significantly different based on the LSD test at the 5% significance level.

The table above shows that the mean pupal weight of *Spodoptera frugiperda* differed significantly between corn and several rice varieties. On corn, the average pupal weight reached 0.12 g. For the Cisokan and Batang Piaman rice varieties, the mean pupal weight was 0.11 g, which is lower than that observed for corn but higher than the values recorded for the Kuriak, Kusuik, and Bujang Marantau varieties. The Kuriak Kusuik variety exhibited the lowest mean pupal weight (0.10 g), which was not significantly different from Bujang Marantau but was significantly lower than that observed on corn, Cisokan, and Batang Piaman—the percentage. The sex ratio of *S. frugiperda* adults emerging from pupae on corn and rice plants is presented in Table 4.

From the table above, it is evident that the percentage of *S. frugiperda* larvae that developed into adults differed significantly between corn and rice plants. For corn, the percentage of larvae successfully emerging as adults was 36.16% whereas for rice it ranged from 33.78% to 34.78%. Larvae reared on corn produced 94.2 female and 78.2 male adults, which were significantly different from all rice varieties. On rice, the number of female adults ranged from 73.2 to 78.8 individuals. The number of male adults ranged from 61.4 to 66 individuals. For corn, the female-to-male ratio was 1.23:1, indicating that the number of females exceeded that of males. Overall, the average sex ratio between females and males on both corn and rice was close

to 1:1, suggesting no significant dominance of either sex within *S. frugiperda* populations on these host plants.

Survivorship of *Spodoptera frugiperda* on Several Local Rice Varieties and Corn

Observations on the development of *S. frugiperda* reared on four local rice varieties from West Sumatra showed apparent differences compared to those reared on corn. Larvae fed with corn leaves exhibited higher survivorship

and a greater number of individuals successfully developing into adults (Figure 1).

The survivorship curve of *S. frugiperda* (Figure 1) shows a relatively similar pattern of decline in the number of individuals across all diet types. From the initial cohort of approximately 537–600 eggs, only a small proportion of individuals successfully reached the adult stage. The overall survival rate from egg to adult ranged from 33.78 to 34.78%. Local rice cultivar survival was higher on corn at approximately 36.16% (Table 4).

Table 4. Percentage number and sex ratio of *Spodoptera frugiperda* adults emerging on rice and corn plants.

Plant tested	% Adult	Number of adults		Sex ratio
		Female	Male	
Corn	36.16 ± 0.63 a	94.2 ± 8.98 a	78.2 ± 8.04 a	1.2: 1
Rice of Cisokan	34.24 ± 2.02 ab	73.6 ± 5.31 b	61.4 ± 4.27 b	1.1: 1
Rice of Batang Piaman	33.78 ± 1.62 ab	73.6 ± 7.30 b	65.0 ± 8 b	1.1: 1
Rice of Kuriak kusuik	34.78 ± 1.62 b	78.8 ± 3.76 b	66.0 ± 4.30 b	1.1: 1
Rice of Bujang marantau	34.57 ± 1.69 b	73.2 ± 5.40 b	63.8 ± 8.52 b	1.1: 1

Note: Numbers followed by the same lowercase letters within the same column are not significantly different based on the LSD test at the 5% significance level.

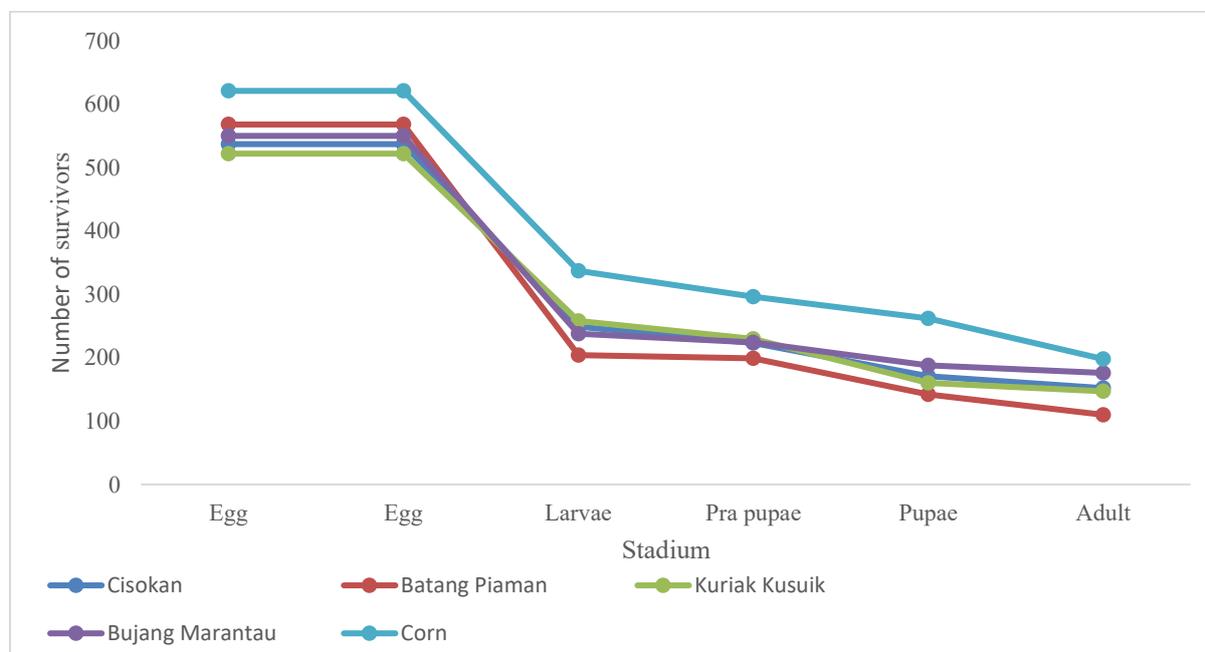


Figure 1. Survivorship curve of *Spodoptera frugiperda* on several local rice varieties and corn as larval feed

Transitions between developmental stages indicated that the highest mortality occurred in the early stages, particularly during the egg and larval phases. Mortality was also observed during the final stages of metamorphosis from pupa to adult. On all rice varieties, approximately 50% of individuals failed to develop or died soon after hatching and before reaching the pupal stage. During the pre-pupal and pupal stages, the mortality rate reached 60–75% before adult emergence.

Overall, the decline in individual numbers from egg to adult on the Cisokan, Batang Piaman, Kuriak Kusuik, and Bujang Marantau rice varieties followed a parallel pattern showing considerably lower survivorship compared to corn. This indicates that although *S. frugiperda* can complete its life cycle on rice, it is less adapted to the nutritional composition and morphological characteristics of local rice leaves than to corn, which serves as its primary host.

The egg incubation period of *S. frugiperda* on corn (2.34 ± 0.47 days) was significantly shorter than on rice, which ranged from 2.68 to 2.98 days. The results indicate that the leaf surface conditions and nutritional composition of corn are more favorable for larval development than those of rice. Physiological factors such as leaf surface moisture and cuticular chemical composition may influence egg hatching speed (Prasanna et al., 2018). According to (Kenis et al. 2023), the egg stage of *S. frugiperda* on corn typically lasts 2–3 days at temperatures of 25–28°C, which is consistent with the findings of the present study.

The larval stage exhibited the most pronounced differences among host plants. The average larval duration on corn was 15.66 ± 0.43 days, whereas on the rice cultivars it ranged from 19.32 to 21.40 days. This suggests that rice is a less suitable host compared to corn, the primary host of FAW. The prolonged larval development period is often associated with lower nitrogen and soluble protein content,

or an unfavorable carbon-to-nitrogen (C/N) ratio in rice leaves (Barros et al. 2010).

The cultivar Bujang Marantau exhibited the most extended larval developmental period (21.4 ± 0.40 days), which may indicate that this cultivar possesses antibiosis resistance factors against FAW, such as higher levels of phenolic compounds or silica content. Such resistance has been reported in several local rice varieties with thicker epidermal structures or higher degrees of lignification (Balakrishnan, 2024). Among the four rice cultivars tested, Bujang Marantau showed the most potent inhibitory effect on larval development, followed by Batang Piaman and Kuriak Kusuik. At the same time, Cisokan exhibited a performance relatively similar to corn. These findings suggest inter-varietal differences in nutritional composition and defensive compounds. This could potentially be exploited in the development of host plant resistance-based management programs. Each variety may harbor specific resistance genes that influence the growth and development of the insect pest.

Among the four tested rice cultivars, Bujang Marantau exhibited the most potent inhibitory effect on larval development, followed by Batang Piaman and Kuriak Kusuik. In contrast, Cisokan showed a performance relatively similar to that of corn. This suggests potential differences in nutrient content and defensive compounds among local rice varieties, which could be utilized in the development of host plant resistance-based pest management strategies. Each cultivar likely possesses distinct resistance genes that influence the insect's ability to grow and develop.

Differences in developmental duration among larval instars across rice cultivars followed a pattern consistent with the total larval period. Larvae feeding on rice exhibited delayed molting at each instar compared with those feeding on corn. The sixth instar on corn lasted 3.44 ± 0.50 days. Whereas on Bujang Marantau rice, it reached 4.00 ± 0.00 days. This finding aligns with Awmack and (Awmack and Leather 2002), who reported that diets with low nutritional quality prolong larval development and increase mortality prior to pupation.

The pre-pupal stage was relatively short across all host plants (1.78–2.22 days), while the pupal stage lasted longer on rice (7.96–8.52 days) than on corn (7.50 ± 0.50 days). This condition reflects compensatory development following an extended larval phase. According to Montezano et al. (2018), variation in pupal duration can result from differences in larval energy reserves depending on diet quality during earlier stages.

The adult lifespan of both sexes also differed significantly among treatments. Female adults lived longer than males on all hosts, with the most extended lifespan observed on corn (9.92 ± 0.63 days). In contrast, adults reared on rice had a reduced lifespan. Reaching only 9.00 ± 0.00 days in the Bujang Marantau cultivar. This factor correlates with reproductive success, as more extended female longevity generally increases total egg production (Chen et al., 2023). The pre-oviposition, oviposition, and post-oviposition periods revealed a pattern in which corn supported a faster reproductive onset and a more extended oviposition period (3.80 ± 0.40 days) compared to the rice cultivars (2.24–2.88 days). These findings suggest that the quality of larval diet directly influences the reproductive capacity of adult females (Scriber and Slansky, 1981).

The total life cycle of *S. frugiperda* from egg to adult female lasted 37.20 ± 1.51 days on corn, while it ranged from 41.54 to 41.90 days on the rice cultivars. The extended life cycle of rice suggests that although FAW can survive and complete its development on rice. Its biological efficiency is

lower than that of corn. This agrees with the observations of Goergen et al. (2016) and (Day et al. 2017), who stated that although FAW is polyphagous, its optimal performance occurs on corn and sorghum.

Significant differences in developmental duration among stages between corn and the local rice cultivars of West Sumatra indicate that rice can serve as an alternative host. Supporting the persistence of FAW populations in rice ecosystems. Albeit suboptimally. This finding is crucial for the implementation of integrated pest management (IPM). Rice cultivated in intercropping or proximity to corn may function as a bridge host. Allowing FAW populations to persist between cropping seasons (Tao et al. 2024).

The results further demonstrate that *S. frugiperda* survival strongly depends on the host plant species. Its life cycle was shorter on corn (36 days) than on rice (41 days). Nearly all life stages from egg to adult differed significantly between corn and rice hosts (Table 1). The percentage of larvae reaching the pupal stage did not differ significantly among rice cultivars, but pupal weight was consistently lower in larvae reared on rice compared with corn. The low survival rates across all four local rice cultivars of West Sumatra indicate that rice, especially local varieties, is not an optimal host for FAW development. Conversely, larvae reared on corn exhibited higher survival rates, supporting the notion that corn is the most physiologically suitable host (Ali et al., 2023; Chen et al., 2023; Liu et al., . The relatively low nitrogen and essential amino acid content, along with higher silica levels in rice leaves, are known to hinder feeding and digestion in FAW larvae (Bhavanam and Stout, 2021). These factors result in slower growth, smaller pupal size, and lower survival rates, consistent with the present findings for Cisokan and Bujang Marantau, which showed high early larval mortality. However, differences among rice varieties were not statistically significant.

High pupal mortality exceeding 60% in several cultivars indicates a significant developmental bottleneck. Previous studies have shown that unbalanced nutritional content in larval diets can reduce energy reserves for metamorphosis, leading to incomplete development of the oriental armyworm, *Mythimna separata* (Walker) (Lepidoptera: Noctuidae) (Sun et al., . As predicted, the high-quality host allowed for overall larger body sizes in both sexes (Seifert 2025). This emphasizes that both host nutritional factors and microenvironmental conditions during pupation must be carefully controlled to obtain representative survival data.

All four local rice cultivars exhibited similar mortality patterns with no significant differences among them. The number of emerged adults was highest in Kuriak Kusuik and Batang Piaman (144.8 and 138.6 individuals, respectively), and slightly lower in Cisokan and Bujang Marantau (135.0 and 137.0 individuals). Variation in adult emergence between corn and different rice cultivars can be associated with leaf morphophysiological traits, such as epidermal thickness and trichome density. Kumar et al. (2022) reported that leaf morphology, including leaf length, leaf width, and plant architecture (such as plant height, number of nodes per plant, and internodal distance), exhibited positive correlations with leaf damage ratings in corn. Balakrishnan et al. (2024) also reported that plant resistance to FAW is positively correlated with total phenolic content and silica concentration. Both of which can reduce feeding and prolong larval development.

This study demonstrates that although FAW can complete its life cycle on local rice cultivars, its success is limited, reflecting partial adaptation rather than complete

suitability. The results of this study are in line with the research of Dono et al. (2024) that *S. frugiperda* originating from corn plants, experienced a decline in its biological characteristics if maintained on rice plants (*O. sativa* L. cv. *Ciherang* (Gramineae)). Our study supports the hypothesis that FAW infestations in rice fields are likely due to migration or dispersal from adjacent corn fields rather than the establishment of resident populations in rice ecosystems. These findings have important implications for FAW management in tropical humid regions such as West Sumatra. Although local rice cultivars are not ideal hosts, early vegetative rice (<30 days after planting) can still support the development of a small portion of the population. Consequently, rice and corn rotation or intercropping may inadvertently prolong FAW persistence across agricultural landscapes (Tambo et al., 2023). Therefore, management strategies should consider habitat connectivity among host plants and synchronize planting schedules to disrupt the continuous FAW life cycle between crops. Identification of rice cultivars with the highest larval mortality (e.g., Cisokan) provides valuable material for breeding programs aimed at improving plant resistance to FAW, as recommended by Zhang et al. (, who suggested that unsuitable host plants can serve as genetic sources for resistance development.

CONCLUSIONS

The results of this study demonstrate that the host plants tested as larval diets significantly influenced the developmental rate, survival, and overall life cycle duration of *S. frugiperda*. Larvae reared on corn exhibited a shorter total developmental time (37.20 ± 1.51 days), compared with those reared on local rice cultivars, including Cisokan (41.54 ± 1.51 days), Batang Piaman (41.62 ± 1.46 days), Kuriak Kusuk (41.56 ± 1.55 days), and Bujang Marantau (41.90 ± 1.66 days). The larval stage lasted longer on all rice varieties (21.40 days on average) than on corn (15.86 days). Female adults lived for 9.92 days, with an oviposition period of 3.80 days on corn. In contrast, on rice, their longevity ranged from 9.00 to 9.28 days, with an oviposition period of 2.24 to 2.88 days. Total survival was also lower on rice compared with corn, with 94.20 females produced on corn, and 73.20–78.80 females on the tested rice varieties. These findings indicate that although *S. frugiperda* is capable of completing its life cycle on local rice cultivars, its developmental rate is slower and its reproductive potential is reduced. Local rice cultivars may therefore function as alternative hosts that contribute to sustaining *S. frugiperda* populations within mixed rice and corn agroecosystems.

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