Original Article

# BIOECOLOGY OF *Spodoptera frugiperda* (Smith, 1757) IN DIFFERENT COVER CROPS

# BIOECOLOGIA DE *Spodoptera frugiperda* (Smith, 1757) EM DIFERENTES PLANTAS DE COBERTURA

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**ABSTRACT:** The objective of this work was to evaluate the biological variables of *Spodoptera frugiperda* on species of cover crops. The experiments were conducted in laboratory and greenhouse using the following species: sunflower (*Helianthus annuus*), sun hemp (*Crotalaria juncea*), brachiaria (*Urochloa decumbens* e *Urochloa ruziziensis*), millet (*Pennisetum americanum*), black oat (*Avena stringosa*), white lupin (*Lupinus albus*), forage turnip (*Rafanus sativus*) and maize (*Zea mays*). In laboratory the *S. frugiperda* larval survival varied from 57%, on *L. albus,* to 93% on *H. annuus* and the survival of the pre-imaginal phase varied from 45% on *U. decumbens* to 81.6% on *Z. mays*. On *C. juncea* the larval biomass was lower and the development period of the young and larval stage was higher. The adaptation index was less on *C. juncea* in greenhouse and laboratory. In greenhouse the larval survival at 14 days was similar for all plants and at 21 days was the lowest on *C. juncea.* There was less accumulation of biomass at 14 days on *C. juncea* and at 21 days on *C. juncea and A. stringosa*. Regarding damage, *C. juncea* presented less susceptibility to *Spodoptera frugiperda* attack, which together with the other evaluated parameters, indicated this plant as the most appropriate for soil cover before cultivation of maize.

**KEYWORDS:** Cover crops. Fall armyworm. No-tillage. *Zea mays*.

## INTRODUCTION

The search for sustainable solutions in agriculture has been stimulated in Brazil (FALEIROS, 2011). In this scenario, we highlight the low-carbon agriculture that aims to reduce greenhouse gas emissions through more sustainable farming practices. The initiative consists of various mitigation techniques such as conservation tillage, which consists in sowing a crop of economic interest on the residue of the previous crop, improving the soil physical, chemical and biological properties (AZIS et al., 2013).

No-tillage it is one way to improve physical, chemical and biological soil conditions. However, if is not properly conducted it can favor increased plant health problems. To secure system maintenance there is a need of cultivating cover crops, which precede the main crop and have physical protection function against soil erosion, germination of weed and soil water loss (BOER et al., 2007).

No-tillage was introduced in southern Brazil in the early 1970s, but underwent greater expansion in the 1990s. According to Sá et al. (2009), this growth is due to the system associating conservation management and low energy cost principles, thus providing a greater financial return. No-tillage has the characteristic of being a management system which avoids tillage, thus creating a new ecological environment, different from that existing in the conventional system. As a result, it has a number of benefits for the farmer and for the environment. Some advantages can be highlighted: erosion control, soil moisture conservation, weed control, improved soil structure and plant health (CRUZ, 1999). Moreover, it can also favor the local biodiversity maintenance, contributing to the persistence of many insects, including potential natural enemies, because the accumulated cover crop residue favors the soil macrofauna communities (MARCHÃO, 2007; SILVA et al., 2007).

According to Alvarenga et al. (2001), to choose the right cover crops, it is necessary to understand the adaptation to the region and the ability to grow in a less favorable environment since the commercial crops are established at more favorable times. One should also take into consideration the phytomass and soil cover productivity (NUNES et al., 2006; ANDRIOLI et al., 2008) and the potential of these plants to be, or not, hosts for pests or diseases (BARROS et al., 2010).

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However, the implementation of no-tillage has led to the formation of the "green bridge", i.e. the uninterrupted sequence of crops that benefits polyphagous pests (OLIVEIRA et al., 2014) such as the Fall armyworm, *Spodoptera frugiperda* (J. E. Smith, 1797) (Lepidoptera: Noctuidae). This insect is considered a key pest in maize, causing production losses of around 34% (CRUZ, 1995).

Despite having maize as its preferred host, Pogue (2002) cites more than eighty species of *S. frugiperda* host plants, demonstrating the high adaptability of this insect in various plant species. Boregas et al. (2013) has reported the development of this species in several common host plants in Brazil. Thus, due to the high degree of polyphagia, a study on this insect pest as to its development on and adaptability to potential cover crops is necessary to support the choice of maize predecessor plants that are not hosts preferred by *S. frugiperda*.

In this study, we will test the hypothesis that among the cover plants used in central region of Minas there is at least one that is unfavorable to the biological development of *S. frugiperda*.

The aim of this study was to evaluate the biological variables (survival, biomass, development period, adaptation and damage) of the fall armyworm in cover crops, under laboratory and greenhouse conditions.

## MATERIAL AND METHODS

### Laboratory bioassays

To obtain the leaves used in feeding caterpillars, cover crops were sown in the experimental field of Embrapa Maize and Sorghum, Sete Lagoas - MG, located 19º28'30 " latitude S, 44º15'08 " W longitude and 732 meters above the sea level. The cover crops grown in the bioassays were the same used by Moreira et al. (2014) to the central region of Minas Gerais: sunflower (*Helianthus annuus* L. - Compositae), sunn hemp (*Crotalaria juncea* L. - Leguminosae), brachiaria [*Urochloa decumbens* (Stapf) - Poaceae], millet [*Pennisetum americanum* (L.) Leek var. ADR 500- Poaceae], black oat (*Avena stringosa* Schreb. - Poaceae) and white lupin (*Lupinus albus* L. - Leguminosae). To obtain leaves at a suitable vegetative state, sowing in the field was conducted in four consecutive weeks. The leaves were collected 30 days after sowing. This same methodology was adopted to obtain the leaves of maize hybrid P30F35 (stage V5), considered the standard plant for *S. frugiperda* development.

After harvesting, the leaves were cut and placed in plastic 50 ml cups, totaling 48 repetitions per host. The leaves were arranged in a whorl and replaced every 48 hours throughout the larval period. For dealing with different plants, we used a sufficient amount leaves to fill the cup and maintain adequate moisture for the insect development. For the larvae survival evaluation, two neonate larvae were placed per cup 48 hours after hatching, and after this period, one larva per cup was maintained. The cups were sealed with acrylic lids and stored in a controlled environment at a temperature of 25 ± 2°C and relative humidity of 70 ± 10%.

The parameters evaluated were: larval survival, pre-imaginal survival, larval biomass at 11 days, pupa biomass, larval period, immature period. For determination of survival every four individuals was considered as a repetition. The experimental design was completely randomized and the data were subjected to analysis of variance and means were compared by Scott-Knot test at 5% probability.

The cover crops were analyzed comparatively, using the Adaptation Index (AI) proposed by Boregas et al. (2013). To calculate the index the following formula was used:

AI=LS (%)*FDA/LDP

Where AI = adaptation index, LS = larval survival, FDA = fecundity of adults and LDP = larval development period. To determine this index the fecundity parameter was replaced by pupal biomass, for presenting correlating.

After calculated of adaptation index, the Relative Adaptation Index (RAI) was found, which is the ratio between the AI of an insect on a given host and AI on maize.

RAI=100*(AIc)/( AIm)

Where AIc= adaptation index of *S. frugiperda* on the cover crops, AIm= adaptation index of *S. frugiperda* on maize.

### Bioassay in greenhouse

The experimental plot consisted of a 5L pot of soil containing four plants of each cover species. In this study, besides the species studied in the laboratory test, the *Urochloa ruziziensis* Germain & Evrard cv - Poaceae and forage turnip (*Rafanus sativus* L. - Brassicaceae ) were used. Under the laboratory conditions, it was not possible to maintain the turgidity of these two plant species to determine biological aspects. Twenty-two days after planting, when the maize reached the V5 stage, each plant was infested with five newly-hatched *S. frugiperda* larvae from the laboratory colony. The damage evaluations were performed at 7, 14 and 21 days after infestation, using a grading scale from 0 to 5, adapted from Carvalho (1970). A grade of zero corresponds to undamaged plants; Grade 1 to plants with scraped leaves; Grade 2 to plants with perforated leaves; Grade 3 to plants with partially destroyed leaves; Grade 4 to plants with only stems after the attack and Grade 5 corresponds to completely destroyed plants.

At 14 days after infestation half the number of pots of each treatment was withdrawn for the removal of larvae from soil and plants. These larvae were individually placed in 50 ml plastic cups and sent to the laboratory for biomass determination. After 21 days of infestation, the same procedure was performed with the other pots, removing the pupae from the soil for biomass evaluation.

The greenhouse was maintained in a controlled environment at a temperature of 28 ± 2°C and relative humidity of 50 ± 10%

The experimental design was completely randomized with ten replicates and the larvae and pupae biomass accumulation data was subjected to analysis of variance and means were compared by Scott-Knot test at 5% probability.

Cover plants were analyzed comparatively, using the Adaptation Index (AI) and Relative Adaptation Index (RAI), as described earlier for lab results.

To determine this index the fecundity parameter was replaced by pupal biomass at 21 days.

Simultaneously, samples of field-grown cover crops were collected to perform bromatological analysis using the combustion method of Dumas for determination of nitrogen (SADER et al., 2004).

## RESULTS AND DISCUSSION

### Laboratory bioassays

Larval survival of *S. frugiperda* was lower in the cover crops: *U. decumbens*, millet, white lupin and sunn hemp with a mean survival of 69% (Table 1). On the other hand, oat maize and sunflower plants stood as those that provided higher average survival rate of the larvae (89%).

**Table 1.** Survival (%) of *Spodoptera frugiperda* fed on six cover crops and maize during the larval and pre-imaginal stages under laboratory conditions at 25 ± 2°C, 70% RH.

| Cover crops | Larval stage survival | Pre-imaginal stage survival |
|---|---|---|
| Oats | 83.33±5.61a | 64.58±6.49a |
| *B. decumbens* | 72.91±7.18b | 45.83±7.43b |
| Millet | 77.08±4.82b | 58.33±7.74b |
| Maize | 90.00±3.27a | 81.66±3.83a |
| White lupin | 57.69±6.56b | 51.92±7.73b |
| Sunflower | 93.75±3.26a | 56.25±9.29b |
| Sunn hemp | 70.83±7.43b | 68.75±6.96a |

* Means followed by the same letter in the column do not differ by Scott-Knot test at 5% probability.

The survival rate of the *S. frugiperda* pre-imaginal stage on *U. decumbens* plants, millet, white lupin and sunflower was low (53%). Maize was the host that provided the highest percentage of pupal survival (81.6).

Among the cover crops evaluated, sun hemp was found to provide the lowest larval biomass (158.59 ± 15.69 mg) (Table 2). On white lupin and sunflower *S. frugiperda* showed higher biomass (552 mg). According to Sá et al. (2009), usually the larvae accumulate biomass until the beginning of the pre-pupa period while feeding, but end up spending a lot of energy to reach the pupal stage. Thus, hosts that lead insects to accumulate less biomass up to the pre-pupa stage can be considered less appropriate for their development.

The larval period of *S. frugiperda* of 18.7 days on *U. decumbens* and sunn hemp was significantly higher than on other cover plants (Table 2). For other hosts, the larval period was 16 days. According Boregas et al. (2013), usually the shortest larval period indicates greater suitability of the host for insect development since the faster the cycle is completed, the higher the number of generations. Sá et al. (2009) reported a larval period of 12 days for insects reared on maize, indicating it as the host preferred by *S. frugiperda*.

In this study, we verified that *S. frugiperda* showed lower larval biomass and increased larval period on sunn hemp, as well as lowest larval survival rates, indicating less suitability of this plant for insect development.

For pupal biomass, it was found that millet and maize resulted in lower values (230mg) (Table 2). The average biomass of pupae in the other cover crops was 268 mg. In general, pupal biomass is a parameter with low variability, as it is a phase of lower body water accumulation. Furthermore, according to Pencoe & Martin (1981), there is a direct correlation between the pupal biomass and adult fertility, being that heavier pupae lead a larger proportion of fertile adults.

**Table 2.** Biomass of larvae and pupae larval and immature development period (mean ± SE) of *Spodoptera frugiperda* caterpillars fed on leaves of six cover crops and maize in laboratory conditions at 25 ± 2°C, 70%RH.

| Cover crops | Larval Biomass (mg) | Pupal Biomass (mg) | Larval development (days) | Immature development (days) |
|---|---|---|---|---|
| Oats | 454.42±27.28b | 266.32±5.01a | 15.66±0.41d | 25.00±0.39c |
| *U. decumbens* | 262.72±16.85d | 266.01±6.85a | 18.00±0.22b | 26.83±0.35b |
| Millet | 343.09±18.84c | 225.34±5.91c | 16.69±0.44c | 26.03±0.33b |
| Maize | 419.68±20.91b | 235.90±4.38c | 16.70±0.28c | 26.43±0.20b |
| White lupin | 585.07±17.44a | 283.65±8.23a | 15.65±0.16d | 24.88±0.26c |
| Sunflower | 519.61±18.80a | 275.84±5.42a | 15.63±0.14d | 24.72±0.22c |
| Sunn hemp | 158.59±15.70e | 252.25±4.14b | 19.46±0.42a | 28.19±0.33 a |

* Means followed by the same letter in the column do not differ by Scott-Knot test at 5% probability.

The development period of the juvenile phase of *S. frugiperda* was highest in sunn hemp (28.2 days) (Table 2), as well as millet, maize and *B. decumbens* (26 days). The shortest immature phase duration was 24 days, on sunflower, white lupin and oats. In this case, is important to note that the longer the immature period of an individual, the longer the exposure to this external factors that can influence its survival. Furthermore, an insect that takes longer to complete the cycle is consequently exposed longer to biotic and abiotic factors of mortality and consequently has a smaller number of generations and thus lower host suitability (BOREGAS et al., 2013)

The *S. frugiperda* adaptation index was highest in sunflower (AI = 1.61) (Table 3). oats (AI = 1.41) and maize (AI = 1.24) and lowest in *U. decumbens* (AI = 1.05), millet (AI = 1.05), white lupin (AI = 1.07) and sunn hemp (AI = 0.90). Boregas et al. (2013) found higher rates for maize (AI = 2.0) and millet (AI = 1.7), that were the two species common to this work.

**Table 3.** Adaptation Index (AI) and Relative Adaptation Index (RAI) of *Spodoptera frugiperda* in cover crops tested in the laboratory and in the greenhouse.

| | Laboratory experiment | | | Greenhouse experiment | | |
|---|---|---|---|---|---|---|
| Cover crops | Larval stage survival (%) | AI | RAI (%) | Larval stage survival (%) | AI | RAI (%) |
| Oats | 83 | 1.41 | 114.45 | 55 | 0.48 | 77.58 |
| *U. ruziziensis* | - | - | - | 52 | 0.63 | 101.92 |
| *U. decumbens* | 72 | 1.05 | 85.18 | 56 | 0.63 | 100.98 |
| Millet | 77 | 1.05 | 84.90 | 62 | 0.76 | 123.40 |
| Maize | 90 | 1.24 | 100.00 | 58 | 0.62 | 100.00 |
| Turnip | - | - | - | 67 | 0.77 | 123.95 |
| White lupin | 57 | 1.07 | 86.46 | 47 | 0.52 | 83.51 |
| Sunflower | 93 | 1.61 | 130.28 | 38 | 0.45 | 73.34 |
| Sunn hemp | 70 | 0.90 | 72.85 | 44 | 0.39 | 62.59 |

The relative adaptation index of *S. frugiperda* also followed the same previous pattern. Sunflower (RAI = 130.28%) and oats (RAI = 114.45%) showed the highest levels unlike *B. decumbens* (RAI = 85.18%), millet (RAI = 84.90%), white lupin (RAI = 86.46%) and sunn hemp (RAI = 72.85%) (Table 3).

According to Marschner (1995), selection of the insect for a given host can be influenced by nutrient availability, since it alters the chemical composition and morphology with the development of the plant.

**Bioassays in greenhouse**

When kept on sunn hemp, *S. frugiperda* had the lowest biomass at 14 days (213.14 ± 13.95 mg) (Table 4). However, at 21 days, the *S. frugiperda* biomass was lower on sunn hemp and oats, 185 and 183 mg, respectively. It should be stated, however, that at 14 days under the same experimental conditions, this pest species fed on the entire oat plant. Thus, the reduced food availability may have accelerated the development of insects that entered the pupal stage, leading to the finding of lower values for this variable. In the other cover crops the biomass was higher, being that on white lupin, maize, *U. decumbens* and turnip the average biomass was 232 mg, different from sunflower, millet and *U. ruziziensis,* with 254.9 mg. Meagher et al. (2004) also found lower biomass accumulation for *S. frugiperda* kept on sunn hemp corroborating the data found herein.

Larval survival of *S. frugiperda* at 14 days was around 50% (Table 4), regardless of the host plant. At 21 days, on sunn hemp, *S. frugiperda* had the lowest pupal survival (7%) followed by white lupin, sunflower and oats (32.6%). On millet, turnip, maize and *U. decumbens*, pupal survival was 66.7%, and *U. ruziziensis* stood out as the cover crop that resulted in the highest pupal survival (91 ± 2.91%).

**Table 4.** Biomass and survival (%) at 14 and 21 days (mean ± SE) of *Spodoptera frugiperda* fed on leaves of eight cover crops and maize under greenhouse conditions.

| Cover crops | Biomass at 14 days (mg) | Biomass at 21 days (mg) | Survival at 14 days (%) | Survival at 21 days (%) |
|---|---|---|---|---|
| Oats | 358.76±16.35b | 183.45±7.48c | 55±10.95a | 40±04.47c |
| *U. ruziziensis* | 467.68±22.96a | 254.91±2.76a | 52±11.68a | 91±02.92a |
| *U. decumbens* | 418.31±17.67a | 234.52±3.49b | 56±10.08a | 70±05.48b |
| Millet | 401.99±17.62a | 258.87±4.84a | 62±4.90a | 53±13.00b |
| Maize | 389.21±20.50b | 224.14±4.20b | 58±7.18a | 70±04.18b |
| Turnip | 356.10±18.14b | 240.60±4.15b | 67±6.04a | 74±07.31b |
| White lupin | 330.34±24.73b | 231.36±11.87b | 47±9.43a | 25±07.12c |
| Sunflower | 341.92±33.27b | 251.03±6.12a | 38±4.19a | 33±02.98c |
| Sunn hemp | 213.14±13.95c | 185.01±14.74c | 44±9.67a | 07±03.00d |

* Means followed by the same letter in the column do not differ by Scott-Knot test at 5% probability.

Regarding the degree of damage, maize and millet had leaves partially destroyed in all phases of evaluation (Figure 1). *U. ruziziensis*, sunflower and turnip had pierced leaves the first two evaluations and partially destroyed leaves in the last assessment. *For U. decumbens,* pierced leaves were observed on the seventh day and partially destroyed leaves in subsequent evaluations. On white lupin, leaves were pierced in the first damage assessment and consecutive increase in damage in the following evaluations. Oats was the cover crop preferred by *S. frugiperda* for feeding, with the damage progress at each evaluation, being the only crop that presented completely destroyed plants after 21 days.

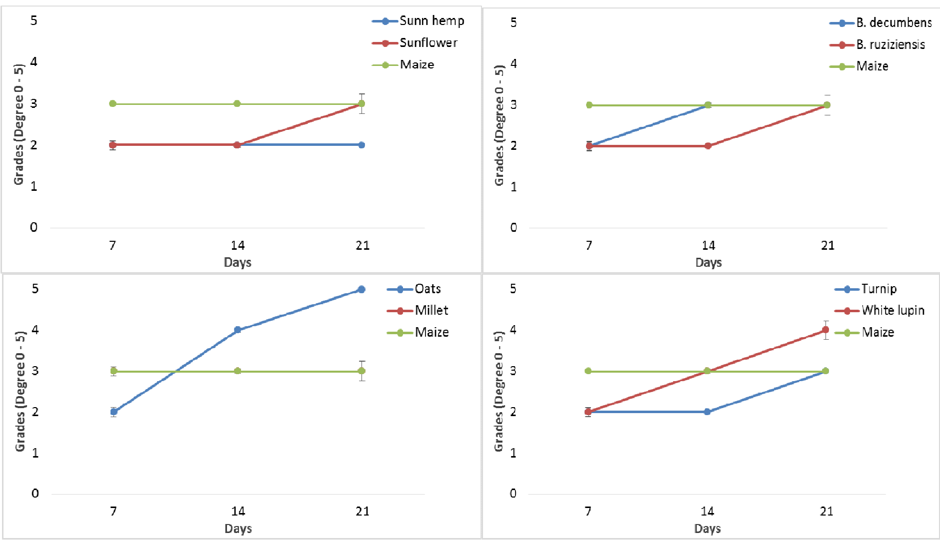


**Figure 1**. Degree of damage (damage grades ranging from 0-5) (± CI, p = 0.005) at 7, 14 and 21 days in eight cover crops and maize, infested with *Spodoptera frugiperda* in a greenhouse.

On the other hand, sunn hemp showed the lowest susceptibility in relation to leaf damage caused by *S. frugiperda,* with a predominance of pierced leaves in all evaluations, which can be explained by lowest insect survival on this host.

The grasses were generally more favorable to the development of *S. frugiperda* in the greenhouse, although their bromatological analysis indicated less nitrogen compared to those broadleaf hosts evaluated in this study (Table 5). It is noteworthy that the biology of the insect is strongly affected by food source offered, altering its performance in response to physical, chemical and biological characteristics of the food eaten, as well as the interactions of these foods with biotic and abiotic factors of the agro ecosystem. Among the constituent elements of plants, nitrogen is described as the most important from an insect nutrition point of view, playing a key role in all metabolic processes and genetic coding (PANIZZI; PARRA, 2009). In terms of available quantity and quality, nitrogen usually limits the growth and fecundity of insects.

**Table 5.** Bromatologic analysis of cover crops.

| Cover crops | Nitrogen content (%) |
|---|---|
| Oats | 4.18 |
| *U. ruziziensis* | 2.41 |
| *U. decumbens* | 3.66 |
| Millet | 3.16 |
| Maize | 6.12 |
| Turnip | 6.56 |
| White lupin | 6.13 |
| Sunflower | 5.27 |

According to Veenstra et al. (1995), the host plant has a significant effect on many biological variables of *S. frugiperda,* including the larval biomass, the larval period and pupal biomass. The results indicate that in sunn hemp, *S. frugiperda* showed less adaptability to the bio-ecological parameters evaluated. In this work, it was apparent the negative influence of sunn hemp when provided to *S. frugiperda*. This influence was found due to lower larval biomass, longer duration of the larval stage in the laboratory and lower biomass at 21 days in the greenhouse. Allied to this data, sunn hemp plants showed the least damage in the greenhouse. McSorley et al. (2009) found that factors such as the architecture of the branches and the density of the sunn hemp, associated with increased humidity and temperature reduction, favor areas of refuge and shelter for parasitoids and predators.

Although field studies could be conducted to validate the indications found here, the data presented in this study is consistent with those of McSorley et al. (2008), who showed that sunn hemp plays a significant role in Integrated Pest Management programs. As such, it can be used in crop systems to attract or repel pests, natural enemies and other organisms (SANTOS et al., 2008).

The results obtained in the laboratory and greenhouse bioassays suggest, respectively, that chemical and morphological characteristics of cover crops can influence the survival and development of *S. frugiperda*. The chemical factors can be evaluated especially regarding nutritional composition of each plant and the morphological factors are related to plant architecture. The latter proved to be one of the possible variables that influenced the development of the insect, since the amount and insertion of the leaves interfere, facilitating or harming feeding, egg laying and pest protection against natural enemies. This factor may explain the increased damage observed in oats, that has the highest leaf density and arrangement in the greenhouse, in contrast to less damage observed in sunn hemp.

Literature data indicate that the leaves of grasses form a whorl, a favorite feeding site of *S. frugiperda* (BOREGAS, 2009). Furthermore, relative adaptation index of *S. frugiperda,* better in the grasses, indicates that these plants are more favorable for insect development.

The adaptation index of *S. frugiperda* was higher in turnip (AI = 0.77) and millet (AI = 0.76) and lower in sunn hemp (AI = 0.39) (Table 3). Following the same previous pattern, the relative adaptation index of *S. frugiperda* in turnip (RAI = 123.95%), millet (RAI = 123.4%) and lower in sunn hemp (RAI = 62.59%).

Both in the laboratory and in the greenhouse, the sunn hemp was the plant that showed the lowest adaptation index and consequently, the lowest relative adaptation.

However, laboratory tests indicate only the food quality of the substrate, as the plant is in a state of lower turgidity compared conditions in the field. As such, the results with for turnip and *U. ruziziensis* obtained in the laboratory were not used because of the inability to maintain a turgid state. However, in the greenhouse it is also possible to evaluate the effect of plant architecture on *S. frugiperda*, although the result closest to the real would be that obtained in the field.

Taking into consideration health criteria for selecting a plant that avoids formation of the "green bridge" and enables its use as a forerunner to maize in no-till cultivation, reducing the incidence of *S. frugiperda* in the area, *C. juncea* stood out as the cover crop less susceptible to pest development and damage.

## CONCLUSION

For the biological parameters of *S. frugiperda* evaluated, C. *juncea* is less suitable as its food and for its development and therefore has potential use as a cover crop to maize in the no-tillage system.

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**RESUMO:** O objetivo do trabalho foi avaliar variáveis biológicas de *Spodoptera frugiperda* (J.E. Smith, 1757) em espécies de plantas de cobertura. Os ensaios foram conduzidos em laboratório e casa de vegetação. Foram utilizadas as seguintes espécies: girassol (*Helianthus annuus*), crotalária (*Crotalaria juncea*), brachiaria (*Urochloa decumbens e Urochloa ruziziensis*), milheto (*Pennisetum americanum*), aveia preta (*Avena stringosa*), tremoço (*Lupinus albus*), nabo forrageiro (*Rafanus sativus*) e milho *(Zea mays*). Em laboratório, a sobrevivência larval de *S. frugiperda* variou de 57% em *L. albus* a 93% em *H. annuus* e a sobrevivência da fase pré-imaginal de 45% em *U. decumbens* a 81% no milho. Em *C. juncea,* a biomassa larval de *S. frugiperda* foi menor e o período de desenvolvimento da fase jovem e larval maior. O índice de adaptação foi menor em *C. juncea* em casa de vegetação e laboratório. Em casa de vegetação, a sobrevivência larval, aos 14 dias, foi similar em todas as plantas e, aos 21 dias, menor em *C. juncea*. Houve menor acúmulo de biomassa, aos 14 dias, em *C. juncea* e, aos 21 dias, em *C. juncea* e *A. stringosa*. Quanto à injúria, *C. juncea* apresentou menor susceptibilidade ao ataque de *S. frugiperda.* Os resultados indicam *C. juncea* como planta promissora para cobertura do solo antecedendo a cultura do milho.

**PALAVRAS-CHAVE:** Plantas de Cobertura . Lagarta-do-cartucho. Plantio direto. *Zea mays*.

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