Cannibalistic nature and time of habitat occupancy of invasive maize fall armyworm, *Spodoptera frugiperda* are the key factors for competitive displacement of native stem borer, *Sesamia inferens* in India

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Invasion of fall armyworm (FAW), *Spodoptera frugiperda* (Lepidoptera: Noctuidae) has been implicated in reducing the incidence of native stem borers in India. The present study aimed to verify the reasons for the displacement of native stem borers using *S. frugiperda* and pink stem borer, *Sesamia inferens* (Walker) (Lepidoptera: Noctuidae). Field incidence of FAW and *S. inferens* was recorded during the 2020 and 2021 wet seasons, indicating negligible field incidence of *S. inferens* compared to FAW. In controlled greenhouse experiments, the competition was measured by releasing larvae at different densities into the maize whorl and also by varying their release at two-day intervals among the two species tested. In competition assays, the frequency of cannibalism increased with increasing density. The study documents that cannibalistic nature and early habitat occupancy in the whorls by FAW are the key factors involved in reducing the incidence of native stem borer, *S. inferens*.

Keywords: Cannibalistic nature, competitive displacement, fall armyworm, habitat occupancy, larval density, stem borer.

COMPETITIVE displacement of a native species by an introduced species is a common phenomenon in nature. In most cases, the reason for displacement is attributed to an increased incidence of the introduced species in the absence of natural enemies. Invasive species have superior competitive ability compared to native species[1]. Even the food is plentiful, competition does occur when utilizing resources from common niche that changes the structure of arthropod communities[2,3].

Species displacement involves the removal of native species by an exotic species, a previously established exotic species by another exotic one, or the displacement of one native species by another. More than 100 displacement events involving insects and related arthropods have been reported[4]. About 78% of the displacements were triggered by the invasion or introduction of an exotic species, although other environmental factors may drive this phenomenon[4]. Identifying the factors that determine the displacements is necessary to understand the interactions better. The fall armyworm (FAW), *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera: Noctuidae), is a recently invading pest of the Indian subcontinent, causing a serious loss in maize[5,6]. Invasive species have to compete with native species in order to identify their own niche and survive. This provides an opportunity to study and understand if any such ecological consequences have occurred due to the invasion of FAW. Our previous studies demonstrated that the incidence of native stem borer pests has reduced to a negligible level after the invasion of FAW[7]. The FAW infestation starts when the crop is 10–20 days old[8], compared to *Sesamia inferens* Walker, which starts infesting maize at the two-leaf stage. Hence, the present study aimed to verify the reasons for the displacement of one such native stem borer, *S. inferens* by the invasive FAW in maize fields.

Materials and methods

Incidence of S. frugiperda and S. inferens on maize during 2020 and 2021 wet season

Roving surveys were conducted in maize fields in four districts, viz. Chikkamagaluru, Shivamogga, Davanagere and Chitradurga, Karnataka, India, which belong to two different agroclimatic regions (southern transition zone and central dry zone). In each district, five maize fields were selected and surveyed at an interval of one week to determine the incidence of FAW and *S. inferens*. In each field, the incidence of two pests was recorded by walking a 5 m area in

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Table 1. Competition scenarios for evaluation of the effect of time of habitat occupancy and density of larvae between *Spodoptera frugiperda* and *Sesamia inferens*

	S. frugiperda vs *S. inferens*		*S. inferens* vs *S. frugiperda*	
Density of larva	First release*	Second release**	First release*	Second release**
1	Small	Small	Small	Small
	Small	Large	Small	Large
	Large	Small	Large	Small
	Large	Large	Large	Large
2	Small	Small	Small	Small
	Small	Large	Small	Large
	Large	Small	Large	Small
	Large	Large	Large	Large
4	Small	Small	Small	Small
	Small	Large	Small	Large
	Large	Small	Large	Small
	Large	Large	Large	Large

*Larvae were released first; **Larvae were released two days after the first release.

a zigzag manner in five spots. In each 5 m area walked, the total number of plants and the total number of damaged plants by the two lepidopteran pests were recorded, and the % incidence was calculated[7].

Insect culture

Insect culture of both species used in the study was initiated with field-collected larvae and pupae. They were reared in a plastic rearing box (5 cm diameter with a mesh on the top lid; HiMedia) in an insect growth chamber at 25° ± 1°C, RH 80% and 14L : 10D using a natural diet (maize stalk from hybrid Pioneer 3550) for the supply of larvae for the experiments.

Effect of time of habitat occupancy and density on competitive displacement

To study the effect of time of habitat occupancy and density of larvae on the competitive displacement between *S. frugiperda* and *S. inferens*, experimental manipulations were made by releasing the larvae on pot-grown maize plants using a completely randomized design.

When the plants were 40 days old, larvae of known age (small – second instar, large – fourth instar) were released into the whorl. The plants were covered using a nylon net with four staking poles at the four sides. The net was tied with a thread to the pots to avoid larval escape and parasitization/predation by natural enemies. For each competition scenario, ten plants were maintained and totally a set of 240 plants were maintained for the experiment in which different combinations of the density of larvae were tested. In each treatment, at first, the larvae of one species were released into the whorl and the competitor species larvae were released two days after the larvae of the first species. During the experiment, each plant was infested with one, two and four larval densities of either small or large larvae (Table 1), assuming that the pre-released larvae get established and will have a competitive advantage. A maximum larval density of four was selected, as previous reports suggested that the maximum *S. frugiperda* larvae per plant was 3.50 (refs 9–11).

The survival of larvae and displacement were recorded ten days after the release of larvae of the second species in each treatment. Survival of the larvae was examined by the destruction of the entire plant and the potting mixture was also examined for pupae of *S. frugiperda* to check the effect of density of larvae on displacement. Chi-square test (χ^2; $P \leq 0.05$; SPSS version 20) for independent samples was used to compare the survival of larvae at different time intervals and across different densities.

Results and discussion

Incidence of S. frugiperda and S. inferens on maize

During the wet season of 2020, the incidence of FAW varied from 9.28% to 15.26% in different districts, while the incidence of stem borer *S. inferens* was negligible (0.01% to 0.11%) (Figure 1 *a*). During the wet season of 2021, the average incidence of FAW ranged from 9.26% to 11.15%. However, the incidence of *S. inferens* was negligible (0.01% to 0.10%) (Figure 1 *b*).

The *S. frugiperda* and *S. inferens* are intraguild competitors in maize[7]. Reports from India and Africa also support our hypothesis that after the introduction of FAW, the incidence of other native stem borers has decreased[7,12,13]. A survey revealed that FAW was well distributed across the maize-growing regions of Karnataka with 44–100% field infestation[13]. However, the incidence of native maize stem borers *Chilo partellus* (Swinhoe) and *S. inferens* was less than 5% of the plants[7,13].

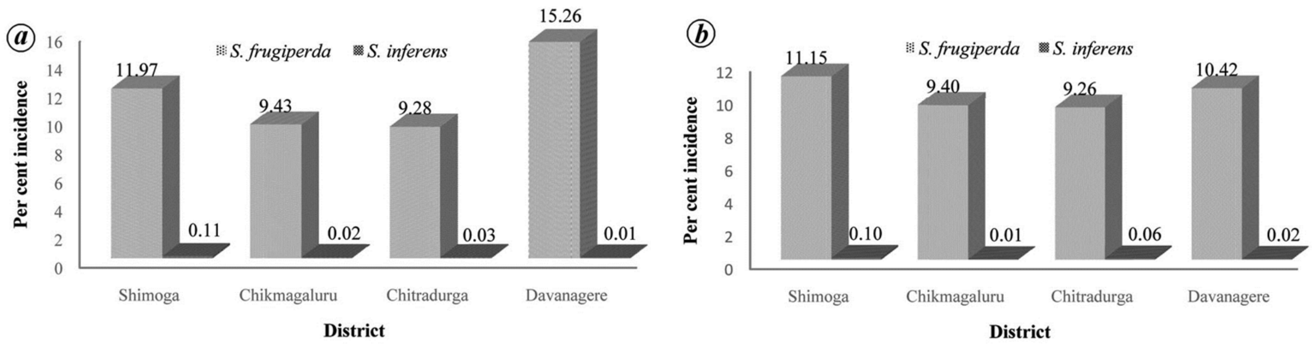

Figure 1. Incidence of *Spodoptera frugiperda* and *Sesamia inferens* on maize during the wet season in (***a***) 2020 and (***b***) 2021.

Table 2. Survival of *S. frugiperda* in different competition scenarios with *S. inferens* when larvae were released at different time intervals

Density of larva/plant	When *S. frugiperda* occupied the habitat first: First release *S. frugiperda*	Second release (two days later) *S. inferens*	Survival of *S. frugiperda* vs *S. inferens** Live	Percentage	When *S. inferens* occupied the habitat first: First release *S. inferens*	Second release (two days later) *S. frugiperda*	Survival of *S. frugiperda* vs *S. inferens** Live	Percentage	χ^2	*P*-value
1	Small	Small	10 (10)[#]	100.00	Small	Small	9 (10)[#]	90.00	0.00^{NS}	1.00
	Small	Large	10 (10)	100.00	Small	Large	10 (10)	100.00	–	–
	Large	Small	9 (10)	90.00	Large	Small	9 (10)	90.00	0.55^{NS}	0.45
	Large	Large	10 (10)	100.00	Large	Large	10 (10)	100.00	–	–
2	Small	Small	11 (20)	55.00	Small	Small	10 (20)	50.00	0.00^{NS}	1.00
	Small	Large	12 (20)	60.00	Small	Large	12 (20)	60.00	0.10^{NS}	0.74
	Large	Small	11 (20)	55.00	Large	Small	13 (20)	65.00	0.93^{NS}	0.33
	Large	Large	14 (20)	70.00	Large	Large	9 (20)	45.00	1.63^{NS}	0.20
4	Small	Small	14 (40)	35.00	Small	Small	15 (40)	37.50	0.21^{NS}	0.64
	Small	Large	15 (40)	37.50	Small	Large	16 (40)	40.00	0.21^{NS}	0.64
	Large	Small	17 (40)	42.50	Large	Small	18 (40)	45.00	0.20^{NS}	0.65
	Large	Large	20 (40)	50.00	Large	Large	17 (40)	42.50	0.20^{NS}	0.65

*Ten days after release; [#]Figures in parenthesis indicate the total number of larvae released; NS, Non-significant; χ^2 for per cent survival.

Survival of S. frugiperda against S. inferens

At density one: The survival of *S. frugiperda* larvae was 100%, except in the competition scenario large vs small (90%) when *S. frugiperda* larvae occupied the habitat two days earlier than *S. inferens* larvae. Similarly, when *S. frugiperda* larvae occupied the habitat two days later than their competitor *S. inferens*, the survival of the former was 100%, except in two competition scenarios, viz. small vs small (90%) and small vs large (90%). Hence, there was no significant difference ($P > 0.05$) in the survival of *S. frugiperda* between early and late occupant larvae (Table 2).

At density two: In this competition scenario, the survival of *S. frugiperda* larvae ranged from 55% to 70% when they occupied the habitat two days earlier than *S. inferens* larvae. The survival ranged from 45% to 65% when *S. frugiperda* larvae occupied the habitat two days later than *S. inferens*. However, there was no significant difference ($P > 0.05$) in the survival of *S. frugiperda* larvae against *S. inferens* larvae between early and late occupant larvae than the competitor *S. inferens* (Table 2).

At density four: The survival of *S. frugiperda* larvae ranged from 35% to 50% irrespective of the competition scenarios when the larvae occupied the habitat two days earlier than the *S. inferens* larvae. When *S. frugiperda* larvae occupied the habitat two days later than the *S. inferens* larvae, the survival of the former ranged from 37.50% to 45%. However, there was no significant difference ($P > 0.05$) in the survival of *S. frugiperda* when the larvae occupied the habitat two days earlier or two days later than the competitor *S. inferens* larvae (Table 2).

Survival when larvae were released at different densities

Let us consider the case when *S. frugiperda* larvae occupied the habitat first (two days earlier than the *S. inferens* larvae).

Table 3. Survival of *S. frugiperda* in different competition scenarios with *S. inferens* when larvae were released at different densities

Competition scenario	Survival of *S. frugiperda* (larva/larvae) compared across different densities (χ^2)					
	When *S. frugiperda* occupied the habitat first			When *S. inferens* occupied the habitat first		
	One and two	Two and four	One and four	One and two	Two and four	One and four
Small × small	4.46* (0.03)#	1.44^{NS} (0.22)	11.06** (0.00)	3.03^{NS} (0.08)	0.42^{NS} (0.51)	6.85** (0.00)
Small × large	3.60^{NS} (0.05)	1.89^{NS} (0.16)	10.12** (0.00)	3.60^{NS} (0.05)	1.41^{NS} (0.23)	9.26** (0.00)
Large × small	2.26^{NS} (0.13)	0.41^{NS} (0.52)	5.45* (0.01)	1.04^{NS} (0.30)	1.41^{NS} (0.23)	4.83* (0.02)
Large × large	2.10^{NS} (0.14)	1.43^{NS} (0.23)	6.38* (0.01)	6.47* (0.01)	0.00^{NS} (0.92)	8.45** (0.00)

#Figures in parenthesis indicate the *P*-value; *Significant at $P < 0.05$; **Significant at $P < 0.01$; NS, Non-significant at $P > 0.05$.

Comparison between density one and two

There was no significant difference in the survival of *S. frugiperda* larvae in the competition scenarios like small vs large, large vs small and large vs large when compared between larval densities one and two. Whereas in the competition scenario of small vs small, the survival of *S. frugiperda* larvae significantly differed between densities one and two ($\chi^2 = 4.464$; $P = 0.0346$) (Table 3). The survival of *S. frugiperda* was 100% and 55% at larval densities one and two respectively (Table 2).

Comparison between density two and four

There was no significant difference ($P > 0.05$) in the survival of *S. frugiperda* larvae against *S. inferens* larvae when the *S. frugiperda* larval survival was compared between densities two and four (Table 3).

Comparison between density one and four

The survival of *S. frugiperda* larvae significantly differed between density one and four in all the competition scenarios (Table 3). In the competition scenario of small vs small, the survival of *S. frugiperda* larvae was 100% in density one and 35% in density four. In the competition scenario of small vs large, the survival of *S. frugiperda* larvae was 100% and 37.50% at larval densities one and four respectively. Similarly, in the competition scenarios of large vs small and large vs large, the survival of *S. frugiperda* larvae was highest in density one (90% and 100%) than in density four (42.50% and 50%) respectively (Table 2).

Next, let us consider the case when *S. inferens* larvae occupied the habitat first (two days earlier than *S. frugiperda* larvae).

Comparison between density one and two

The survival of *S. frugiperda* larvae did not differ statistically between two larval densities (one and two) in the competition scenarios small vs small, small vs large and large vs small. While in the competition scenario large vs large, a statistically significant difference was observed in the survival of *S. frugiperda* larvae between density one and two ($\chi^2 = 6.477$; $P = 0.0109$) (Table 3). The survival of *S. frugiperda* larvae was 100% and 45% in density one and two respectively (Table 2).

Comparison between density two and four

The survival of *S. frugiperda* larvae against *S. inferens* larvae did not differ significantly ($P > 0.05$) between densities two and four (Table 3).

Comparison between density one and four

A significant difference was observed in the survival of *S. frugiperda* larvae when the survival was compared between densities one and four (Table 3). In all the competition scenarios, the survival of *S. frugiperda* was highest in larval densities one than in larval density four. In the competition scenarios like small vs small and small vs large, the survival of *S. frugiperda* larvae was 90% and 100% in larval density one, and 37.50% and 40% in density four respectively. Similarly, the survival was 90% and 100% in larval density one, and 45% and 42.50% in larval density four in the competition scenario large vs small and large vs large respectively (Table 2).

Survival when larvae were released at an interval of two days

At density one: The survival of *S. inferens* larvae ranged from 10% to 20% irrespective of the competition scenario when they occupied the habitat two days earlier than the competitor *S. frugiperda*. The survival of *S. inferens* larvae ranged from 0% to 30% when they occupied the habitat two days later than the *S. frugiperda* larvae. Hence, the survival of early occupant *S. inferens* larvae against *S. frugiperda* larvae did not differ significantly from the late occupant larvae (Table 4).

At density two: Regardless of the competition scenarios, the survival of *S. inferens* ranged from 20% to 35% and 35% to 55% when the larvae were released two earlier and two days later than the *S. frugiperda* larvae (competitor species)

Table 4. Survival of *S. inferens* in different competition scenarios with *S. frugiperda* when larvae were released at different time intervals

	When *S. frugiperda* occupied the habitat first				When *S. inferens* occupied the habitat first					
	First release	Second release (two days later)	Survival of *S. inferens* vs *S. frugiperda**		First release	Second release (two days later)	Survival of *S. inferens* vs *S. inferens**			
Density/plant	*S. frugiperda*	*S. inferens*	Live	Percentage	*S. inferens*	*S. frugiperda*	Live	Percentage	χ^2	*P*-value
1	Small	Small	1 (10)[#]	10.00	Small	Small	3 (10)[#]	30.00	2.81^{NS}	0.09
	Small	Large	2 (10)	20.00	Small	Large	0 (10)	0.00	0.55^{NS}	0.45
	Large	Small	1 (10)	10.00	Large	Small	2 (10)	20.00	1.56^{NS}	0.21
	Large	Large	2 (10)	20.00	Large	Large	3 (10)	30.00	1.06^{NS}	0.30
2	Small	Small	4 (20)	20.00	Small	Small	7 (20)	35.00	2.00^{NS}	1.15
	Small	Large	5 (20)	25.00	Small	Large	6 (20)	30.00	0.50^{NS}	0.47
	Large	Small	7 (20)	35.00	Large	Small	9 (20)	45.00	0.93^{NS}	0.33
	Large	Large	6 (20)	30.00	Large	Large	11 (20)	55.00	3.68^{NS}	0.05
4	Small	Small	9 (40)	22.50	Small	Small	15 (40)	37.50	2.91^{NS}	0.08
	Small	Large	15 (40)	37.50	Small	Large	19 (40)	47.50	1.27^{NS}	0.25
	Large	Small	22 (40)	55.00	Large	Small	21 (40)	52.50	0.00^{NS}	1.00
	Large	Large	18 (40)	45.00	Large	Large	22 (40)	55.00	1.25^{NS}	0.26

*Ten days after release; [#]Figures in parenthesis indicate the total number of larvae released; NS, Non-significant; χ^2 for per cent survival.

respectively. However, there was no significant difference in the survival of *S. inferens* between the early occupant and late occupant larvae than the *S. frugiperda* larvae (Table 4).

At density four: At a higher larval density of four, the survival of *S. inferens* ranged from 22.50% to 55% and 37.50% to 55% when the larvae were released two days earlier and two days later than the *S. frugiperda* larvae respectively. However, there was no significant difference in the survival of *S. inferens* larvae between different times of larval release (Table 4).

Survival when larvae were released at different densities

The survival of *S. inferens* larvae against *S. frugiperda* larvae was compared across different larval densities and the results are presented (Table 5).

Let us consider the case when *S. frugiperda* larvae occupied the habitat first (two days earlier than *S. inferens* larvae).

Comparison between density one and two

There was no significant difference in the survival of *S. inferens* larvae against *S. frugiperda* larvae when compared between density one and two (Table 5).

Comparison between density two and four

The survival of *S. inferens* larvae against *S. frugiperda* larvae in density two did not differ significantly from density four in all the competition scenarios (Table 5).

Comparison between density one and four

The survival of *S. inferens* larvae did not differ significantly between the density one and four in the competition scenarios, small vs small, small vs large and large vs large. Whereas, in the competition scenario large vs small, the survival of *S. inferens* larvae was significant ($\chi^2 = 8.459$; $P = 0.0036$) (Table 5) with the highest survival in density four (55%) and lowest survival in density one (10%) (Table 4).

Next, let us consider the case when *S. inferens* larvae occupied the habitat first (two days earlier than *S. frugiperda* larvae).

Comparison between density one and two

In the competition scenarios small vs small, large vs small and large vs large, the survival of *S. inferens* larvae against *S. frugiperda* larvae did not differ significantly between in densities one and two. In the competition scenario small vs large, the survival of *S. inferens* larvae was significant ($\chi^2 = 5.859$; $P = 0.0155$) (Table 5) with 30% survival in density two and 0% in density one (Table 4).

Comparison between density two and four

The survival of *S. inferens* larvae against *S. frugiperda* larvae in density two did not differ significantly from density four (Table 5).

Comparison between density one and four

In the competition scenarios small vs small and large vs large, the survival of *S. inferens* larvae in density one did

Table 5. Survival of *S. inferens* in different competition scenarios with *S. frugiperda* when larvae were released at different densities

Competition scenario	Survival of *S. inferens* (larva/larvae) compared across different densities (χ^2)					
	When *S. frugiperda* occupied the habitat first			When *S. inferens* occupied the habitat first		
	One and two	Two and four	One and four	One and two	Two and four	One and four
Small × small	1.47^{NS} (0.22)#	0.30^{NS} (0.57)	1.75^{NS} (0.18)	0.46^{NS} (0.49)	0.22^{NS} (0.63)	0.65^{NS} (0.41)
Small × large	0.58^{NS} (0.44)	1.58^{NS} (0.20)	2.01^{NS} (0.15)	5.85* (0.01)	2.47^{NS} (0.11)	9.81** (0.00)
Large × small	3.60^{NS} (0.05)	3.01^{NS} (0.08)	8.45** (0.00)	3.03^{NS} (0.08)	0.67^{NS} (0.41)	4.83* (0.02)
Large × large	1.04^{NS} (0.30)	1.95^{NS} (0.16)	3.25^{NS} (0.07)	2.82^{NS} (0.09)	0.07^{NS} (0.78)	3.12^{NS} (0.07)

#Figures in parenthesis indicate the *P*-value; *Significant at $P < 0.05$; **Significant at $P < 0.01$; NS, Non-significant at $P > 0.05$.

not differ significantly from density four. Whereas, in the competition scenario small vs large, there was a significant difference in the survival of *S. inferens* larvae between density one and four ($\chi^2 = 9.810$; $P = 0.0017$) (Table 5). The survival was 0% at larval density one and 47.50% at larval density four (Table 4). Similarly, the survival of *S. inferens* larvae differed significantly between density one and four in the competition scenario large vs small larvae ($\chi^2 = 4.836$; $P = 0.0279$) (Table 5). The survival of *S. inferens* was highest in larval density four (52.50%) than in larval density one (20%) (Table 4).

Our previous study[7] and the present study including the published literature on the incidence of different pests after the invasion of FAW have ascertained that there has been a reduction in the incidence of stem borers in general. There was a negligible incidence of *S. inferens*, whereas the incidence of FAW varied from 9.28% to 15.26% and 9.26% to 11.15% during 2020 and 2021 respectively. Similar displacement of stem borers in maize fields by FAW that led to increased damage to sorghum has been reported from Uganda[14]. A general trend in reduction in stem borer incidence after the invasion of FAW has also been reported in Kenya[12].

The survival of FAW was higher at lower larval density, i.e. when a single *S. frugiperda* larva competed with a single *S. inferens* larva, the survival was almost 100% irrespective of the time of release. This higher survival of FAW was due to the non-cannibalistic and less aggressive nature of *S. inferens*.

At larval density two, the survival of *S. frugiperda* ranged from 50% to 70% regardless of the competition scenario and time of habitat occupancy by the larvae. Similarly, at a larval density of four, the survival ranged from 35% to 50% irrespective of the competition scenario and time of habitat occupancy. This lower survival at higher larval density is due to the prevalence of cannibalism in late larval instars of *S. frugiperda*, which was not observed with the presence of an intraguild competitor, *S. inferens*. This indicates why several small larvae are frequently found in the same whorl, but more than one later instar larva of *S. frugiperda* never cohabits in the same maize whorl[15,16].

Cannibalism was frequent in the laboratory population of *S. frugiperda* even when food was not a limiting factor[1,2]. The frequency of cannibalism increased with increasing larval density. In a previous study, about 40% to 60% of the potential victims in density two and 53–83% of the potential victims in density four were cannibalized when FAW larvae of the same age cohorts were reared together[3]. The presence of a greater number of conspecifics reduced larval development, especially under limited food conditions. So, cannibalism at higher larval density benefits an individual (cannibal) by eliminating the competitor.

Regardless of the competition scenario and time of habitat occupancy by the larvae, the survival of *S. inferens* was greatly reduced when it competed with *S. frugiperda*. There was no significant difference in survival between early and late whorl occupant larvae. This indicates that neither early nor late occupancy of the whorl by the larvae had any significant effect on their survival. However, the presence of an intraguild competitor *S. frugiperda* had a negative effect with a reduction in per cent survival of *S. inferens* larvae. Even when *S. inferens* occupied the whorl early, the survival was not significantly high. This indicates that the larvae of FAW first eliminate the competitor larvae from their niche, making it an enemy-free space and then continue feeding in the whorl. The possibility of the orientation of FAW larvae to the volatiles produced by *S. inferens*-damaged plants also cannot be eliminated[17].

At density one and two, two and four, the survival of *S. inferens* larvae did not differ significantly irrespective of their early or late whorl occupancy. However, at densities one and four, the survival of *S. inferens* larvae differed significantly only in the competition scenario of large vs small, irrespective of the time of habitat occupancy. The survival of *S. inferens* larvae was highest at density four (55% and 52.50%) than at density one (10% and 20%). Hence, at higher density, large *S. inferens* larvae may escape from small competitor (*S. frugiperda*) larvae. This might be because the larger *S. inferens* larvae may move deep into the stem for pupation, emerging as adults and escaping predation by the smaller FAW larvae.

In general, the differential time of habitat occupancy and larval density did not have any significant effect on the survival of FAW. However, the survival of *S. inferens* larvae was greatly reduced in competition with *S. frugiperda* due to predation on the former. Kfir[18] found that an exotic stem borer *C. partellus* was able to infest the crops earlier than the native stem borer, *Busseola fusca* (Fuller), and might have displaced the native stem borer in Africa. The same is the case for *S. frugiperda*, which can infest the crops earlier than *S. inferens*[6,14]. So, the results of the present study reveal that *S. frugiperda* is a potential intraguild competitor for *S. inferens* and can replace the latter species due to intraguild predation.

Conclusion

There was a negligible incidence of *S. inferens* compared to FAW in the maize fields, indicating the successful spread of FAW in them. This study ascertains that there is a reduction in the incidence of stem borers after the invasion of FAW. As the larval density increased, the survival of *S. frugiperda* was reduced. The study confirms that the cannibalistic nature and early habitat occupancy of FAW in the whorls are the key factors in eliminating the native stem borer, *S. inferens* from the maize ecosystem.

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