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Succession of sucking pests infesting okra and their associated defenders at Raipur, Chhattisgarh

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Abstract

A field experiment on succession of okra sucking pests along with their defenders was conducted at PNB training centre, Pirda Road, Jora during the rabi of 2021–2022. Results revealed that the population of sucking was recorded during the vegetative stage except, mealy bug which was recorded during the reproductive stage of crop and the defenders such as spiders and coccinellids were present throughout the crop season. Infestation of aphid, jassid and white fly commenced during the month of February and attained their maximum peak activity period in the month of March whereas, population of mealy bug was initiated in the month of March and reached its peak population in the month of April. Two predatory spiders, namely, *Neoscona theisi* and *Telamonia dimidiata* and four species of lady bird beetles viz., *Menochilus sexmaculata*, *Coccinella septempunctata*, *Micraspis* spp. and *Brumus* spp. were recorded as major bio-agents. The population of defenders synchronized with the population of sucking pests in okra crop. Correlation studied depicted that the mean population of aphid ($r = 0.975$ and $r = 0.849$), jassid ($r = 0.747$ and $r = 0.890$) and whitefly ($r = 0.719$ and $r = 0.824$) exhibited a significant positive association with the population of spiders and coccinellid beetles whereas, population of mealy bug also showed positive relation but non-significant with both the predators.

Keywords: *Menochilus sexmaculata*, *Coccinella septempunctata*, *Micraspis*

Introduction

Okra, *Abelmoschus esculentus* (L.) Moench, is a significant vegetable crop grown around the world in tropical and subtropical regions. It belongs to the family Malvaceae and has multipurpose uses. Okra has tremendous nutritional value, and its economic value is further enhanced by its potential to improve food security. In Chhattisgarh, it covered an area of 32.60 lakh hectares and produced 358.81 lakh tones in 2021-22, with a productivity of 11.01 MT per hectare (Anonymous, 2021) [1]. Among the various constrains in okra cultivation, the most considerable production barrier is insect pests attack at different crop stages. As many as 72 insect species have been recorded on okra (Pal *et al.*, 2013) [4].

Sucking pests usually attack right from early seedling stage to last fruit harvesting stage. The important sucking pests are jassid/ leafhopper (*Amrasca biguttula biguttula* Ishida) (Hemiptera: Cicadellidae), whitefly (*Bemisia tabaci* Gennadius), aphid (*Aphis gossypii* Glover) and mealy bug (*Phenacoccus solenopsis* Tinsley). As a result of jassids attack, the leaves acquire necrotic regions that cover the whole surface and curl upward along the tip and edges, resulting in hopper burn. Nymphs and adults of aphids and whiteflies suck the cell sap causing reduction in vigour and photosynthesis. Whiteflies (*B. tabaci*) not only inflict direct damage to plants, but they also cause indirect damage as vectors by spreading diseases caused by the yellow vein mosaic virus. *A. biguttula biguttula* reduces yield by 54-66%, while *B. tabaci* produces a yield loss of 54% (Rai *et al.*, 2014) [6]. The mealy bug affected plants become stunted and produce fewer fruits that are reduced in size. The leaves also develop distortions, become yellow, and eventually fall off.

Insects that feed on plants can be prevented from building up damaging populations with the support of natural enemies. It is important to be aware of how to manage agro-ecosystems to take advantage of the services of natural enemies. Predatory insects, such as ladybird beetles, spiders and green lacewings, which devour aphids and other soft-bodied insects, keep in check to those pests that infest okra.

Therefore, if we go for complete pest control, it is crucial to understand when pests are most prevalent and when infestations are at their worst in connection to their presence of natural enemies. In light of these facts, the present investigation was conducted to gather data on the succession of significant pests and predators in the okra ecosystem.

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Material and methods- The experiment was conducted at the PNB training centre, Pirda Road, Jora during the rabi of 2021–2022 with the popular okra variety “Kashi kranti”. Record of succession of the sucking pests along with their defenders, was done in the Control plot which was kept free from insecticide application.

Method of recording observations

Observations on succession were recorded at weekly interval starting from their appearance to last picking of fruits of the crop. Each observation was taken from 10 randomly selected plants from control plot.

A. Sucking insects

The population of nymphs and adults of sucking insect pest viz., aphid (*Aphis gossypii*) (Glover), jassid (*Amrasca biguttula biguttula*) (Ishida) and whitefly (*Bemisia tabaci*) (Gennadius) was recorded in early morning hours by visual counting on three leaves (upper, middle and lower leaves of the plant). For the population of mealy bug (*Phenacoccus solenopsis*) (Tinsley) observations of nymphs and adults were recorded on 10 cm shoot and fruit length. Later, mean number of sucking pests per plant was calculated.

B. Defenders

Natural enemies such as, coccinellids and spiders was recorded by counting their number on ten plants selected randomly and was expressed as number per plant.

The periodic mean incidence of the main sucking pests and their natural enemies was calculated in order to identify the succession of sucking pests and their natural enemies. Using the weekly mean occurrence of the sucking pests and their defenders, a simple correlation between them was determined (Steel and Torrie, 1980)^[9].

Result and Discussion

(A) Sucking pests of okra

Aphid (*Aphis gossypii* Glover)

In Rabi 2021-2022, the population of aphid ranged from 3.61 to 20.32 nymphs and adults per 3 leaves as shown in the (Table 1). Initially, the population of aphid was observed during the second week of February (7th SMW) with a mean population of 3.61 nymphs and adults per 3 leaves. The population increased to its peak during the second week of March (11th SMW) with a mean of 20.32 nymphs and adults of aphid per 3 leaves. Then the activity of this pest declined towards the end of harvesting stage.

Suman *et al.*, (2022)^[10] also reported that maximum population of aphids were observed during vegetative stage of crop.

Jassid (*Amrasca biguttula biguttula* Ishida)

The data presented in (Table 1) revealed that during Rabi, 2021-2022 the population of jassid ranged between 1.12 to 11.32 nymphs and adults per 3 leaves. The incidence of jassid commenced from the third week of February (8th SMW) with a mean population of 1.12 nymphs and adults per 3 leaves. The highest mean population of 11.32 nymphs and adults per 3 leaves was recorded on second week of March (11th SMW). Thereafter activity of the pest was observed to fluctuate at various time intervals but remained till harvesting of crop.

The current investigation are similar to the findings of Kumari *et al.*, (2009)^[2] stating that jassid infestation initiated (3.53

jassid/ leaf) at 21 days old crop and attained its high density (17.33 jassid / leaf) when the crop was 63 days old and then followed declining trend.

Whitefly (*Bemisia tabaci* Gennadius)

The result presented in (Table 1) depicts that the population of whitefly was very low which ranged from 1.92 to 9.62 nymphs and adults per 3 leaves during Rabi 2021-2022. The mean number of nymphs and adults of whitefly noticed was 1.92 per 3 leaves in first appearance during fourth week of February (9th SMW) which steadily increased. The maximum mean population of 9.62 nymphs and adults per 3 leaves was recorded during the fourth week of March (13th SMW). Afterwards the activity of the pest gradually declined till the harvesting stage.

Similar findings was reported by Thangjam (2017)^[11] who also observed that the whitefly (*Bemisia tabaci*) activity was noticed from 2nd week of February with 0.2 whiteflies per 3 leaves and their maximum population reached during last week of March (4.9 whiteflies/3 leaves) on okra.

Mealy bug (*Phenacoccus solenopsis* Tinsley)

The observations on mealy bug counts presented in (Table 1) and revealed that in Rabi 2021-2022, the mealy bug population ranged between 3.42 to 25.26 nymphs and adults per ten plants. Initial population of mealy bug was seen during third week of March (12th SMW) with a mean population of 3.42 nymphs and adults per ten plants. Thereafter, population build up of the insect increased sharply and observed on almost all the aerial parts of the plant and fruits except the stem at ground level and reached its maximum infestation of 25.26 nymphs and adults per plant on third week of April (16th SMW) at reproductive stage of crop. After which the population was sharply declined.

Pal *et al.*, (2013)^[4] reported that the mealy bug population started to appear at the time of flower initiation and peaked at the reproductive stage of the crop and continued to grow strongly throughout the first three weeks of May and rapidly declining thereafter.

(B) Defenders

Spider

Two predatory spiders, namely, *Neoscona theisi* and *Telamonia dimidiata* were found preying upon sucking pests throughout the cropping season. The result presented on (Table 1) depicted that population fluctuation of spider during Rabi 2021-2022, in okra ranged from 0.08 to 0.99 spiders per plant. The population of spiders were first recorded on third week of February (8th SMW) with a mean population of 0.08 spider per ten plants. The peak activity of spiders were initially observed during second week of March (11th SMW) with a mean of 0.99 spider per ten plants. Later the number decreased gradually till the end of season.

During Rabi 2021-2022, the population of aphids ($r = 0.975$), jassids ($r = 0.747$) and whitefly ($r = 0.719$) was significant and positively influenced by spider population but mealy bug ($r = 0.275$) had non-significant positive correlation with population of spiders at 5 % level of significance as discussed in (Table 2). The results on correlation indicated that the population of predatory spiders synchronized with the population of sucking pests in okra crop.

Wagen and Wagen (2015) revealed that predatory spiders had significant positive correlation with sucking pests. Shanti *et*

al., (2020) also reported that the population of spiders was significant and positively correlated with the leafhopper and aphids in weeded plot (0.820**) and (r=0.807**) respectively which further supports the current findings.

Coccinellid beetles

Four species of lady bird beetles viz., *Menochilus sexmaculata*, *Coccinella septumpunctata*, *Micraspis* spp. and *Brumus* spp. were recorded as major bio-agents. Lady bird beetle was found feeding on nymphs and adults of aphids and jassids. Data presented in (Table 1) revealed that in Rabi 2021-2022, the population of beetles ranged between 0.09 to 1.03 grub and adult per ten plants. The first appearance of beetle was noted one week after the appearance of prey in the field on third week of February (8th SMW) with a mean of 0.09 grub and adult per ten plants. The maximum population of grub and adult was seen during second week of March (11th SMW) with a mean of 1.03 grub and adults per ten plants. Its population disappeared along with sucking pests as the crop matured.

The population of coccinellid beetles was in accordance with the population of sucking pests. During Rabi 2021-2022, it was evident by the correlation studies that aphids (r =0.849), jassids (r =0.890) and whitefly (r = 0.824) exhibited significant positive correlation with coccinellid beetles but mealy bug (r = 0.027) exhibited non-significant positive correlation with population of coccinellids at 5 % level of significance as in (Table 2) Thus, it can be concluded that, the population of coccinellids had positive association with the population of sucking pests.

Shahito *et al.*, (2011) reported population of predator i.e. coccinellids found positively correlated with mealybug *P. Solenopsis*, but agrees with the views of Lal *et al.*, (2020) [3]

and Pathan *et al.*, (2018) [5] also reported that the coccinellid beetle was significant and positively associated with aphid (r = 0.95* and r = 0.88*, respectively).

Conclusion

From the present investigation it can be concluded that in Rabi 2021-2022, the population of aphid, jassid and whitefly were observed at the vegetative stage whereas mealy bug was recorded during the reproductive stage of crop and the defenders like spider and coccinellids were present throughout the crop season. Infestation of Aphid, *Aphis gossypii* started during 2nd week of February and reached to the peak during 2nd week of March. Population of jassid, *Amrasca biguttula biguttula* initiated during 3rd week of February and attained its peak during 2nd week of March. Infestation of white fly, (*Bemisia tabaci*) initiated during 4th week of February and reached the peak during the 4th week of March. Initiation of mealy bug, *Phenacoccus solenopsis* population was observed during 3rd week of March and reached its peak during the 3rd week of April. Initiation of spider and coccinellid grubs and adult population was noticed during 3rd week of February and reached their peak population during 2nd week of March. Correlation studies between predatory spiders and sucking pests (r = 0.975, r = 0.747 and r = 0.719) and (r = 0.926 and r = 0.958) depicted that mean population of aphid, jassid and whitefly exhibited significant positive association with spider population, respectively. Similarly, correlation studies between coccinellids and sucking pests (r =0.849, r =0.890 and r = 0.824) and (r = 0.909 and r = 0.886) revealed that population of aphid, jassid and whitefly showed significant positive association with grubs and adults of coccinellid beetle, respectively.

Table 1: Succession of sucking pests and their associated defenders recorded on okra during Rabi, 2021-2022

Month/Week	SMW	Number of sucking pests per 3 leaves			Number/ 10 cm shoot/ fruit per plant	Number of natural enemies per plant	
		Aphid	Jassid	Whitefly		Mealy bug	Spider
Feb – II	7	3.61	0	0	0	0	0
III	8	6.23	1.12	0	0	0.08	0.09
IV	9	11.44	3.01	1.92	0	0.53	0.29
March- I	10	17.87	8.55	3.89	0	0.74	0.58
II	11	20.32	11.32	5.77	0	0.99	1.03
III	12	16.1	9.43	7.56	3.43	0.64	0.8
IV	13	12.05	7.87	9.62	9.54	0.56	0.6
April- I	14	10.33	5.36	5.12	13.76	0.43	0.54
II	15	7.48	4.98	4.36	20.03	0.31	0.46
III	16	5.24	3.11	3.42	25.26	0.23	0.43
IV	17	3.56	6.32	2.16	15.13	0.14	0.34
May- I	18	1.77	5.87	1.11	8.49	0	0.24
II	19	0	3.91	0.65	4.88	0	0.1

Table 2: Correlation coefficient (r) between sucking pests infesting okra crop and their associated defenders during Rabi 2021-2022

Sucking pests of Okra	Defenders	
	Coccinellids	Spiders
Jassid	0.890*	0.747*
Aphid	0.849*	0.975*
Whitefly	0.824*	0.719*
Mealy bug	0.027	0.275

Level of significance at 5%

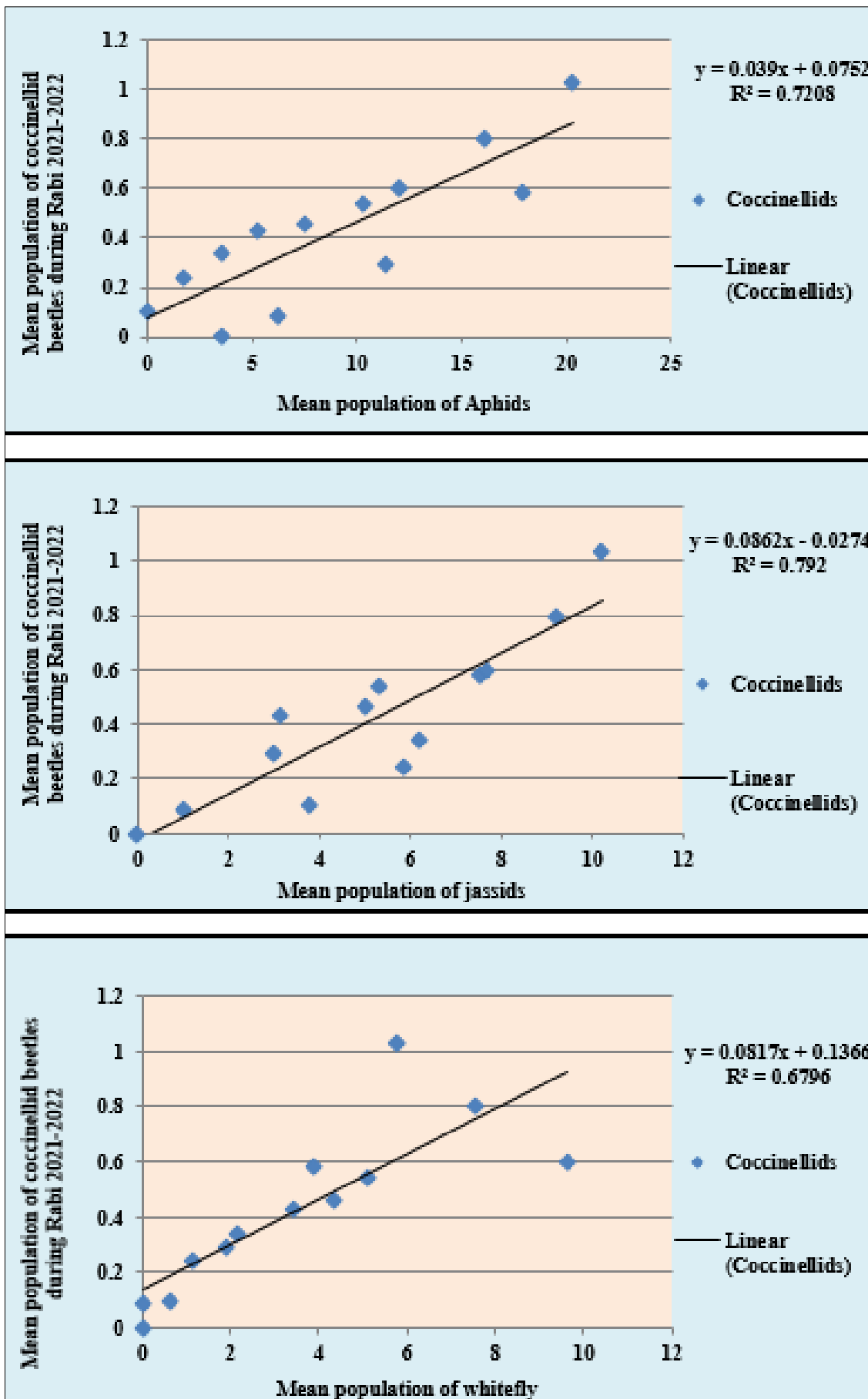


Fig 1: Regression equation between coccinellid beetles and sucking pests of okra during Rabi 2021-2022

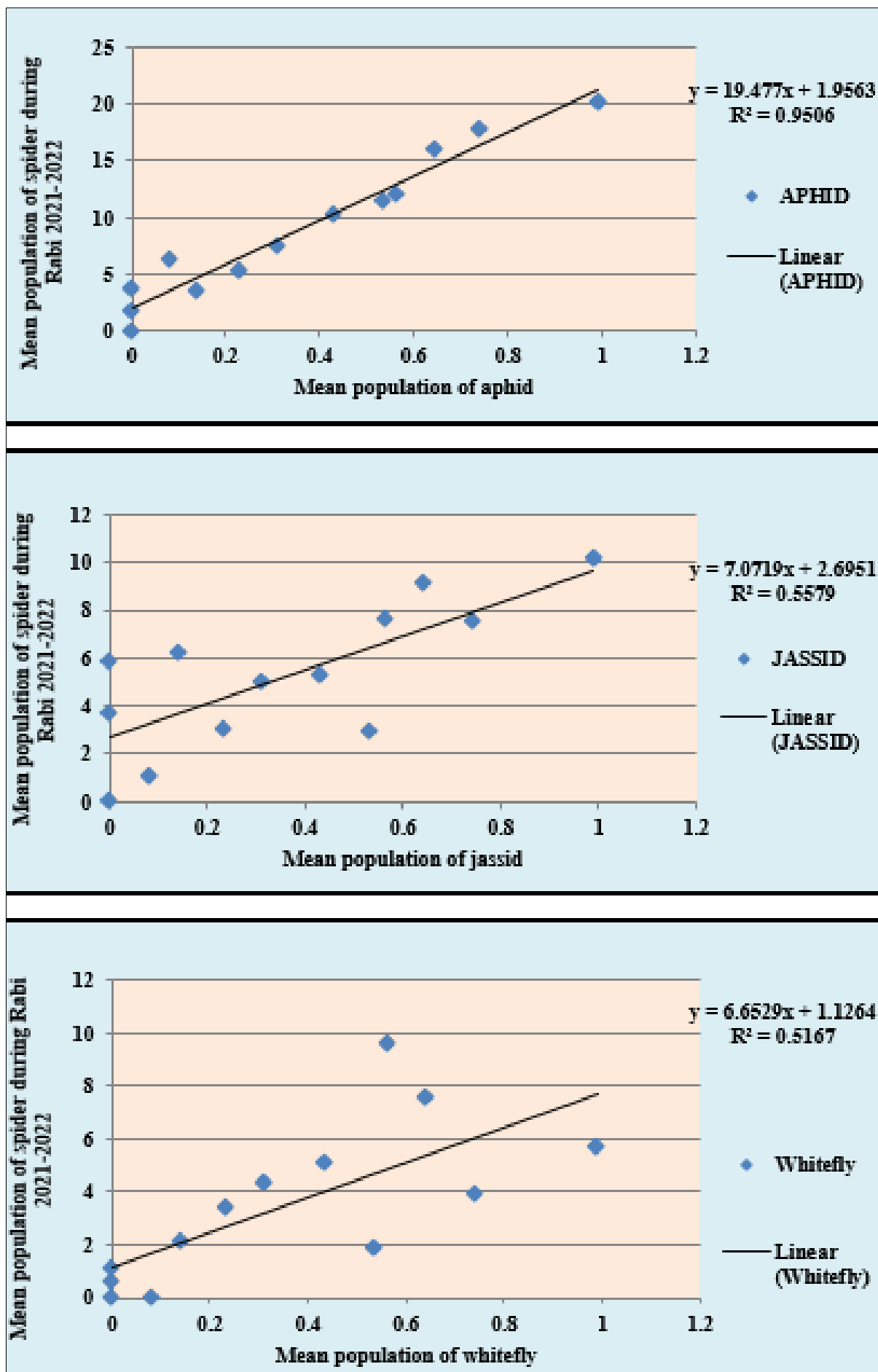


Fig 2: Regression equation between spiders and sucking pests of okra during Rabi 2021-2022

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