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NP Trivedi
Department of Entomology, B. A. College of Agriculture, Anand Agricultural University, Anand, Gujarat, India

DB Sisodiya
Department of Entomology, B. A. College of Agriculture, Anand Agricultural University, Anand, Gujarat, India

MD Aniyaliya
Department of Entomology, B. A. College of Agriculture, Anand Agricultural University, Anand, Gujarat, India

Corresponding Author:
NP Trivedi
Department of Entomology, B. A. College of Agriculture, Anand Agricultural University, Anand, Gujarat, India

Impact of pollination frequency of *Apis dorsata* Fabricius on cucumber fruits

NP Trivedi, DB Sisodiya and MD Aniyaliya

Abstract
The present study was conducted to evaluate the impact of pollination frequency of giant honey bee, *Apis dorsata* Fabricius on qualitative as well as quantitative parameters of cucumber fruits. The results show that various parameters viz., total number of fruits; circumference, length and weight of fruits as well as fruit yield measured higher in open pollinated and the plots managed with five visits by *A. dorsata.* All these parameters found to escalate proportionately with increase in number of visits by *A. dorsata*. The minimum per cent of malformed fruits were bore in open as well as five times pollinated plots.

Keywords: Foraging rate, pollination effect, malformed fruits, fruit length, circumference, weight and yield

1. Introduction
Crop production entirely depends on pollination which lead to fertilization. Pollination generally of two types viz., self-pollination and cross pollination. For fruit and seed production, 35% of the world's food crops depend on animal pollinators which constitutes about 80% of total cross pollination (Anon., 2022a) [1]. Bees contribute around 80% of cross pollination resulting in increasing crop yield (Ramaswamy, 2016) [11]. There are many economically important crop plants viz., maize, mustard, pearl millet, castor, sugarcane, niger, alfalfa, sunflower, safflower, sugarbeet, cabbage, radish, spinach, onion, garlic, clover, coconut, date palm, oilpalm, carrot, coriander, sweet potato, tea, coffee, cocoa, turnip, squash, apple, pear, peach, plum, mango, papaya, banana, fig, grapes, pineapple, cashew, strawberries, almond, cassava, taro, rubber, cucurbitaceous crops *etc* which require cross pollination (Anon., 2022b) [2].

In India, many major and minor cucurbits are being grown which share about 5.6 per cent of the total vegetable production (Rai *et al.*, 2008) [10]. As per 3rd advance estimate of the year 2020-21, total 19.72 and 1.71 crore metric tonne of vegetables produced from 109.66 and 6.64 lakh ha land in India and Gujarat, respectively (Anon., 2022c) [3]. Cucumber (*Cucumis sativus* L.) is a very important vegetable crop in the family cucurbitaceae. Flowers of cucumber remain open only for one day and during that time they must be pollinated by pollinators otherwise they will abort and drop from the vine (McGregor, 1976) [8]. If pollination occurs adequately, then the fruits will be uniform with even maturity otherwise it results in production of misshapen, small and malformed fruits which fetch very low market price (Thakur and Rana, 2008) [16].

There is variety of insect-pollinators viz., honey bees, social bees, solitary bees, wasps, butterflies, flies and a few beetles have been recorded pollinating cucumber in open field condition. The quality as well as quantity of fruits entirely depend on pollination frequency of pollinators. The present study exhibits impact of pollination frequency of giant honey bee, *Apis dorsata* Fabricius on fruit growth and development. The results confirm the significance of pollinators in qualitative and quantitative fruit production in cucumber.

2. Material and Methods
The impact of pollination frequency of giant honey bee, *A. dorsata* on cucumber fruits (var. Gujarat cucumber 1) was evaluated in terms of quality (length, circumference and malformed fruits) and quantity (total number of fruits per plant and weight of fruits). A field experiment was carried out at Entomology Farm, B. A. College of Agriculture, Anand Agricultural University, Anand by adopting all standard agronomical practices except plant protection measures during summer, 2020 and 2021. The treatments consisted bagging of female flowers after different numbers of visits *i.e.*, one, two, three, four, five visits as well as open pollination made by *A. dorsata* with three replications.

The unopened female flower buds (likely to open next day morning) were bagged in the evening; and after number of visit(s) confirmed by *A. dorsata* as per treatments bagged again in the morning. The observations on number of fruits per plot; healthy and malformed fruits per plot; length (cm), size (cm) and weight (g) of fruit as well as fruit yield (kg/ ha) were made at each picking (weekly interval) starting from fruit setting till termination of the crop. The data viz., total number of fruits, per cent malformed fruits, length, circumference and weight of fruits and fruit yield recorded were subjected to ANOVA following arcsine transformation only in case of per cent malformed fruits.

3. Results and Discussion

3.1 Total Fruits

The data presented in Table 1 on pooled over periods showed that a good number of fruits formed in the plots governed with open pollination (14.18 fruits/ plot) during summer, 2020 which was statistically proportionate with the plots managed with bagging after five visits (13.63 fruits/ plot). The plots regulated with bagging after four visits assumed 12.60 fruits/ plot followed by the bagging after three visits (9.45 fruits/ plot), two visits (8.42 fruits/ plot) and one visit (5.69 fruits/ plot).

The data presented in Table 2 on pooled over periods indicated that the maximum number of fruits set in the plots governed with open pollination (16.09 fruits/ plot) during summer, 2021 which was statistically at par with the plots managed with bagging after five visits (15.36 fruits/ plot). The plots regulated with bagging after four visits assumed 14.42 fruits/ plot followed by bagging after three visits (11.00 fruits/ plot), two visits (9.69 fruits/ plot) and one visit (7.66 fruits/ plot) of which single visited plots showed the lowest number of fruits among all the bagging treatments.

The data presented in Table 3 on pooled over periods and years exhibited the highest number of fruits set in the plots kept with open pollination (15.13 fruits/ plot) which was found statistically at par with the plots managed with bagging after five pollination (14.50 fruits/ plot). Although, the latter was also recognized significantly proportionate with the plots administered with bagging after four visits (13.51 fruits/ plot). The plots regulated with bagging after three visits assumed 10.22 fruits/ plot followed by bagging after two visits (9.06 fruits/ plot) and one visit (6.68 fruits/ plot) which was the minimum among all the bagging treatments.

Overall, the higher number of fruits bore in open pollinated plots and the plots administered with bagging after five visits by *A. dorsata* while, the lowest fruits were counted from single visited plots. Number of fruits set increased correspondingly with increase in number of visits to female flower. Absolutely no any fruits were formed where female flower bud was covered with bag and did not allow to open at all.

The conclusions published by Sarwar *et al*. (2008) [12] are thoroughly comparable and in support to the current study; who registered the higher fruits per plants in the plots with free visits of pollinators than the plots caged with only *A. mellifera* as well as the plots caged without any bees. Solange (2008) [15] reinforced the statement by recognizing the higher number of fruits in open field condition relative to caged condition (without any pollinators). Thus, the present investigation on number of fruit setting is in agreement with the earlier investigations.

3.2 Malformed Fruits

The data presented in Table 4 on pooled over periods exhibited that the minimum per cent of malformed fruits were recorded from the plots kept with open pollination (1.92%) during summer, 2020 which was significantly at par with the plots managed with bagging after five visits (2.28%). The plots regulated with bagging after four visits registered 4.98 per cent of malformed fruits. The plots governed with bagging after three visits recorded 13.08 per cent of malformed fruits and it was statistically proportionate with the plots managed with bagging after two visits (13.25%). Among all the bagging treatments, the maximum per cent of malformed fruits were registered from the plots regulated with bagging after one visit (18.75%).

The data (Table 5) on pooled over periods exhibited that all the evaluated bagging treatments were significantly different from each other during summer, 2021. The lowest per cent of malformed fruits were observed from the plots kept with open pollination (2.63%) followed by the plots managed with bagging after five visits (5.21%), four visits (11.32%), three visits (29.28%), two visits (42.90%) and the highest per cent of malformed fruits were registered from single visited plots (66.58%).

The data presented in Table 6 on pooled over periods and years exhibited that the plots kept with open pollination (2.69%) recorded the least per cent of malformed fruits which was statistically at par with the plots managed with bagging after five visits (5.25%). The plots regulated with bagging after four visits recorded 12.46 per cent of malformed fruits followed by the three visits (31.71%) which was significantly at par with two visits (43.32%). Among all the evaluated bagging treatments, the maximum per cent of malformed fruits were registered from the plots managed with single visit (70.02%).

From the above results, the least per cent of malformed fruits were observed in open pollinated plots and the plots kept with bagging after five visits by *A. dorsata* whereas, the highest per cent of malformed fruits were recorded from plots which were allowed only single visit. Percentage of malformed fruits were escalated proportionately with decrease in number of visits to female flower.

According to Solange (2008) [15], open pollinated plots had lower number of malformed fruits as compared to confined condition (without any pollinators). Similarly, Hossain *et al.* (2018) [6] also acknowledged lower malformed fruits in open pollinated plots (20.25%) while, higher in the caged plots *i.e.*, without honey bees (24.35%). These investigations are perfectly sustenance to the immediate research work.

Thakur and Rana (2008) [16] confirmed that the higher malformed fruits produced in open pollinated plots followed by hand pollinated and honey bee pollinated plots. This incongruous result probably due to dissimilitude in experimental area and weather parameters which may had affected negatively the abundance of pollinators in open field condition and culminated in higher per cent of malformed fruits. Moreover, possibly insecticide application in or nearby field might have also affected the pollination by insects which resulted in higher number of fruit malformation in open pollinated condition. In another prospect, exceptionally higher efficiency of hand as well as caged bee pollination may had resulted in extensively lowering down the malformed fruits (%) production.

3.3 Length of Fruits

The data (Table 7) on pooled over periods showed that the plots kept with open pollination (25.27 cm) exhibited the highest length of fruits during summer, 2020 which was significantly at par with the plots managed with bagging after five visits (24.94 cm) and four visits (24.59 cm). The plots regulated with bagging after three visits exhibited 18.80 cm length of fruits which was also found statistically at par with the plots administered with bagging after two visits (18.53 cm). Among all the bagging treatments, the lowest length of fruits was registered in the plots administered with bagging after one visit (16.48 cm).

The data (Table 8) on pooled over periods showed that the plots administered with open pollination (25.93 cm) measured the maximum length of fruits during summer, 2021 which was statistically at par with the plots managed with bagging after five visits (25.66 cm) and four visits (25.30 cm). The plots regulated with bagging after three visits exhibited 19.02 cm length of fruits which was found significantly proportionate with the plots kept with bagging after two visits (18.80 cm). Among all the bagging treatments, the lowest length of fruits was registered in the plots administered with single visit (16.72 cm).

The data (Table 9) on pooled over periods showed that the plots kept with open pollination (25.60 cm) were measured with the maximum length of fruits which was statistically proportionate with the plots managed with bagging after five visits (25.30 cm) as well as four visits (24.95 cm). The plots regulated with bagging after three visits exhibited 18.91 cm of fruit length which was also found significantly at par with the plots governed with bagging after two visits (18.67 cm). Among all the bagging treatments, the lowest fruit length was measured in the plots administered with only single visit (16.60 cm).

Aforesaid results concluded that open pollination, pollination with five visits and four visits by *A. dorsata* ascertained the higher fruit length while, single visit produced the shortest fruits in cucumber. The selected variety (GCU 1) perhaps could be the reason here that open pollination along with five as well as four visits resulted in higher fruit length. The association of fruit length and number of visits were proportionate with each other as the surge in fruit length was observed with increase in the number of visits by *A. dorsata*.

Perfectly kindred assessments were also described by several researchers. As per Hanh (2008) [5], the higher fruit length was observed in open + hand pollinated plots (13.82 cm) as compared to self-pollinated (caged) plots (4.97 cm). Satheesha (2010) [13] recorded significantly higher fruit length in plants pollinated with six bee visits (36.87 cm) followed by four visits (29.30 cm), two visits (16.40 cm) and one visit (14.80 cm). Further, she also found significantly higher fruit length in open pollinated plots (38.28 cm) as well as in the caged plots pollinated with *A. cerana* (36.60 cm). By the same token, the higher fruit length in open pollinated plot (26.50 cm) while, the lower fruit length in caged condition (without honey bees) plots (21.80 cm) was also mentioned by Hossain *et al*. (2018) [6]. Thus, the above-mentioned outcomes are in utter affirmation of the existing investigation.

However, Cervancia and Bergonia (1991) [4] conceded the higher fruit length in bee pollinated plots (207 mm) followed by open pollinated plots (183 mm) and non-pollinated plots (119 mm). Likewise, the highest fruit length was also noted by Khaja (2010) [7] in plots pollinated with 10 visits (28.35 cm) while, the lowest length measured when pollinated by two visits (19.17 cm) by *A. cerana*. Analogous results were also achieved for *A. florea* (30.66 cm length with 10 visits and 22.42 cm length with two visits) and *T. iridipennis* (20.56 cm length with 10 visits and 17.26 cm length with three visits). Additionally, open pollination (33.46 cm) brought the highest fruit length followed by caged pollination with *A. cerana* (30.66 cm fruit length), caged pollination with *A. florea* (28.35 cm fruit length) and caged pollination with *T. iridipennis* (20.56 cm fruit length). These investigations are imperfectly (partially) subsistence to the immediate research work might be due to variations in species of honey bee studied. On top of that, *A. dorsata* cannot be studied in captivity hence, it was studied in open field condition in the current research work. The comparison revealed that only five visits of *A. dorsata* are enough for better fruit development while, that increased to 10 visits for *A. cerana* might be due to bigger size of *A. dorsata* as well as its more time spending nature for each visit.

Though, a few works are not in agreement with the present findings. Thakur and Rana (2008) [16] registered the lowest fruit length in open pollinated plots (25.70 cm) followed by hand pollinated (26.50 cm) and honey bee pollinated (28.80 cm) plots. Sarwar *et al*. (2008) [12] did not find any significant difference in fruit length among open pollinated plots, caged plots with *A. mellifera* and caged plots (without pollinators). These irreconcilable results might be due to inequality in experimental locations and weather parameters which may had affected negatively the abundance of pollinators in open field condition which reflected on fruit length. In another prospect, exceptionally higher efficiency of hand as well as caged bee pollination may had resulted in relatively lowering down the fruit length in open field condition.

3.4 Circumference of Fruits

The pooled over periods data (Table 10) showed that the plots kept with open pollination (14.78 cm) were recorded with the maximum circumference of fruits during summer, 2020 which was significantly at par with the plots managed with bagging after five visits (14.32 cm) as well as four visits (13.88 cm). Among all the bagging treatments, the minimum circumference of fruits was registered in the plots regulated with bagging after one visit (8.63 cm) which was found statistically at par with the plots managed with bagging after two visits (8.99 cm) and three visits (9.39 cm).

The data (Table 11) on pooled over periods conceded that open pollinated plots (16.10 cm) were measured with the maximum circumference of fruits during summer, 2021 which was significantly at par with the plots administered with bagging after five visits (15.67 cm). The plots kept with bagging after four visits were recorded with 14.78 cm circumference. The plots regulated with bagging after three visits were registered with 10.49 cm circumference which was found statistically proportionate with bagging after two visits (10.15 cm). Among all the bagging treatments, the plots governed with single visit of *A. dorsata* were recorded with the lowest (7.69 cm) fruit circumference.

The pooled over periods and years data exhibited that the plots allowed to be open pollinated (15.44 cm) were measured with the maximum circumference of fruits (Table 12) which was statistically at par with the plots administered with bagging after five visits (15.00 cm) followed by the plots kept with bagging after four visits (14.33 cm). The plots regulated with bagging after three visits exhibited 9.94 cm of fruit circumference which was conceded to be significantly at par with bagging after two visits (9.57 cm). Among all the bagging treatments, the plots administered with bagging after one visit (8.16 cm) were recorded with the lowest circumference of fruits.

From the finding on fruit circumference, it can be culminated that open pollinated plots and the plots maintained with five visits by *A. dorsata* were identified with the higher circumference of fruits while, single visit resulted with the lowest fruit circumference. The circumference of fruits was found to be increased positively with increment in number of visits to female flower.

In support to the current investigation, Hanh (2008) [5] reckoned the higher fruit diameter in open + hand pollinated plots (3.78 cm) as compared to self-pollinated (caged) plots (0.71 cm). Concurrently, Hossain *et al.* (2018) [6] also registered the higher fruit diameter in open pollinated plots (26.80 cm) while, the lower (23.90 cm) in caged (without honey bees) plots. These assessments are corroboratively supporting the current research work.

However, Cervancia and Bergonia (1991) [4] registered the higher fruit diameter in *A. cerana* pollinated plots (176 mm) followed by open pollinated plots (126 mm) and non-pollinated plots (123 mm). Sarwar *et al*. (2008) [12] narrated that the circumference of fruits from plots caged with honey bees and open pollinated plots did not significantly different but from the caged plots (without pollinators). Thakur and Rana (2008) [16] also revealed the highest fruit diameter in honey bee pollinated plots (29.90 cm) followed by open pollinated (27.40 cm) and hand pollinated (26.90 cm) plots. This past research work is completely paradoxical to the existing work that might be due to discrepancy in species of honey bee studied, experimental sites and abiotic factors which may had decreased the abundance of pollinators in open field condition. In another probability, exceptionally higher efficiency of caged bee pollination may had resulted in extensive increase of fruit circumference in open field.

3.5 Weight of Fruits

The data presented in Table 13 on pooled over periods showed that the plots regulated with open pollination (2.09 kg) were registered with the highest weight of fruits during summer, 2020 which was statistically proportionate with the plots managed with bagging after five visits (2.02 kg). Although, it was found significantly at par with the plots kept with bagging after four visits (1.93 kg). The plots regulated with bagging after three visits were recorded with 1.43 kg fruit weight which was significantly at par with the plots administered with bagging after two visits (1.34 kg). The plots governed with bagging after one visit (1.16 kg) were registered with the least weight of fruits among all the bagging treatments.

The data (Table 14) on pooled over periods exhibited that the plots regulated with open pollination (2.08 kg) were registered with the maximum fruit weight during summer, 2021 which was statistically at par with the plots managed with bagging after five visits (2.00 kg). Although, it was found significantly proportionate with the plots kept with bagging after four visits (1.91 kg). Three times visited plots were recorded with 1.46 kg weight of fruits which was found at par with the plots administered with bagging after two visits (1.39 kg). The minimum fruit weight was measured in the plots kept with single visit (1.21 kg).

The pooled over periods and years data (Table 15) exhibited that the plots kept with open pollination (2.08 kg) were registered with the highest weight of fruits which was statistically at par with the plots managed with bagging after five visits (2.01 kg). The plots regulated with bagging after four visits were recorded with 1.92 kg fruit weight followed by three times visited plots (1.45 kg), two visits (1.36 kg) and one visit (1.19 kg).

Erstwhile outcomes confirmed that open pollinated plots and the plots managed with five visits by *A. dorsata* were estimated with the maximum fruit weight while, the lowest fruit weight was proclaimed in plots with only single visit. The weight of fruits was observed to be escalated along with increase in number of visits of *A. dorsata* to female flower.

The cited results of some empiricists also substantiated the existing findings since Hanh (2008) [5] found the higher fruit weight in open + hand pollinated plots (159.62 g) as compared to self-pollinated (caged) plots (21.10 g). Satheesha (2010) [13] also recorded significantly higher fruit weight in plots pollinated with six bee visits (2637.25 g) followed by four visits (993.0 g), two visits (431.75 g) and one visit (254.25 g). Contemporaneously, significantly the higher fruit weight was recorded in open pollinated plots (1821.0 g) as well as in caged pollination with *A. cerana* (1774.75 g) while, significantly lower fruit weight achieved in hand pollinated plots (1523.75 g). Verma (2017) conceded open pollination as superior exhibiting the higher (278.02 g) fruit weight than without (caged) pollination (263.54 g). Likewise, Hossain *et al.* (2018) [6] also registered the higher fruit weight in open pollinated plots (977.87 g) while, the lower (770.51 g) in caged (without honey bees) plots. The above-described investigations are in close proximity to this research work.

However, Cervancia and Bergonia (1991) [4] revealed the higher fruit weight in bee pollinated plots (0.87 kg) followed by open pollinated plots (0.60 kg) and non-pollinated plots (0.36 kg). Identically, Prakasha (2002) [9] also found the highest fruit weight with 20 bee visits (1210 g) followed by 15 bee visits (1110 g), 10 bee visits (1010 g), five bee visits (930 g), two bee visits (670 g) and the lowest in one visit (440 g). Khaja (2010) [7] recorded the highest fruit weight in the plots pollinated by 10 visits (1517.75 g) by *A. cerana* while, the lowest in two visits (208.19 g). Similar results were also achieved for *A. florea* (852.90 g weight with 10 visits, 112.42 g weight with two visits) as well as *T. iridipennis* (784.59 g weight with 10 visits, 81.49 g weight with three visits). The highest (1619.09 g) fruit weight was recorded in open pollination condition followed by caged pollination by *A. cerana* (1510.68 g fruit weight), caged pollination by *A. florea* (853.10 g fruit weight) and caged pollination by *T. iridipennis* (784.59 g fruit weight). These reviews are incompletely supportive to the immediate research work; might be due to variations in species of honey bee studied. The difference in size of bee pollinators selected could also be the cause of dissimilarity in number of visits in past studies and current study.

Though, Sarwar *et al*. (2008) [12] revealed non-significant difference in plots caged with honey bees as well as in open pollinated plots but it was significantly different from caged (without pollinators) plots. Thakur and Rana (2008) [16] noted the higher fruit weight from honey bee pollinated plots (1184.50 g) followed by hand pollinated (990.20 g) and open pollinated (982.60 g) plots. This research work is completely oppugnant to the present work might be due to discrepancy in species of honey bee studied, study sites and abiotic factors which may had decreased the abundance of pollinators in open field condition. In another probability, exceptionally higher efficiency of caged bee pollination may had resulted in extensive increase of fruit weight in open field condition.

3.6 Yield

The plots regulated with open pollination (25203 kg/ ha) were recorded with the highest fruit yield (Table 16) during summer, 2020 which was statistically at par with the plots managed with bagging after five visits (25061 kg/ ha) and four visits (24528 kg/ ha). The plots kept with bagging after three visits were registered with 20639 kg/ ha fruit yield which was followed by the plots administered with bagging after two visits (17100 kg/ ha) and single visit (12431 kg/ ha) which was the lowest among all the bagging treatments.

The highest fruit yield was registered from the plots governed with open pollination (27053 kg/ ha) during summer, 2021 which was at par with the plots regulated with bagging after five visits (26228 kg/ ha) and four visits (25600 kg/ ha). The plots administered with bagging after three visits were recorded with 21230 kg/ ha fruit yield which was followed by the plots managed with bagging after two visits (17700 kg/ ha) and only single visited plots (13986 kg/ ha) fruit yield among all the bagging treatments (Table 16).

The data presented in Table 16 on pooled over years exhibited that the open pollinated plots (26128 kg/ ha) were measured with the maximum fruit yield which was found statistically at par with the plots managed with bagging after five visits (25644 kg/ ha) as well as four visits (25064 kg/ ha). The plots regulated with bagging after three visits were registered with 20935 kg/ ha fruit yield followed by the plots administered with bagging after two visits (17400 kg/ ha) and one visit (13208 kg/ ha) which was the minimum among all the bagging treatments.

Regarding fruit yield; open pollination, pollination with five as well as four visits by *A. dorsata* exhibited the higher fruit yield while, the lowest was registered in plots with single visit. The fruit yield seemed to increase proportionately with increase in visits by *A. dorsata* to female flower.

The statements made by a few researchers are in abutment with the existing outcomes. Sarwar *et al*. (2008) [12] recorded the higher yield in open pollinated plots than caged plots with honeybees as well as caged plots without bees. Shah *et al.* (2015) [14] reported the highest fruit yield in open pollinated plots. These past results are in accordance with the present investigations.

Table 1: Effect of bagging and pollination frequency of *A. dorsata* on fruit setting in cucumber (Summer, 2020)

Tr. No.	Treatments	Total no. of fruits/ plot at indicated weeks after initiation of fruiting											Pooled over periods
		1	2	3	4	5	6	7	8	9	10	11	
T_1	Bagging after one visit	2.00	4.33	11.00	9.66	5.66	5.66	6.33	8.66	7.00	1.33	1.00	5.69
T_2	Bagging after two visits	3.33	4.66	11.66	11.66	10.00	12.00	13.33	12.00	9.00	3.33	1.66	8.42
T_3	Bagging after three visits	3.33	5.33	12.00	14.66	12.33	13.33	14.33	14.00	9.33	3.33	2.00	9.45
T_4	Bagging after four visits	4.00	7.00	15.00	19.00	16.33	19.00	19.33	18.00	12.00	5.66	3.33	12.60
T_5	Bagging after five visits	5.00	7.00	15.66	20.33	17.00	20.66	21.00	19.00	13.66	7.00	3.66	13.63
T_6	No bagging (open pollination)	5.00	8.00	16.00	21.33	17.33	21.00	21.66	19.33	14.33	8.00	4.00	14.18
S.Em±	Treatment (T)	0.47	0.44	0.92	1.32	1.12	1.38	1.31	1.08	0.84	0.39	0.25	0.28
Period (P)		-	-	-	-	-	-	-	-	-	-	-	0.38
T x P		-	-	-	-	-	-	-	-	-	-	-	0.93
CD at 5%		1.47	1.39	2.90	4.17	3.54	4.33	4.12	3.40	2.65	1.22	0.79	0.78
CV (%)		21.43	12.67	11.79	14.22	14.84	15.61	14.16	12.33	13.37	14.12	16.64	15.25

Note: Significant parameters and their interactions: P and T x P

Table 2: Effect of bagging and pollination frequency of *A. dorsata* on fruit setting in cucumber (Summer, 2021)

Tr. No.	Treatments	Total no. of fruits/ plot at indicated weeks after initiation of fruiting											Pooled over periods
		1	2	3	4	5	6	7	8	9	10	11	
T_1	Bagging after one visit	2.33	5.00	11.00	11.33	11.66	11.33	11.33	8.66	7.33	3.00	1.33	7.66
T_2	Bagging after two visits	3.66	5.33	12.33	12.66	13.00	12.66	15.66	14.00	9.66	5.33	2.33	9.69
T_3	Bagging after three visits	3.00	5.66	12.66	13.66	14.00	17.00	17.33	15.00	13.66	6.00	3.00	11.00
T_4	Bagging after four visits	4.33	7.66	16.00	19.33	18.66	21.66	22.00	19.00	17.33	8.33	4.33	14.42
T_5	Bagging after five visits	4.66	8.33	16.33	20.33	21.33	23.00	22.66	20.00	17.66	9.00	5.66	15.36
T_6	No bagging (open pollination)	5.33	8.66	17.66	21.66	22.33	23.00	24.00	20.66	19.33	8.66	5.66	16.09
S.Em±	Treatment (T)	0.31	0.51	0.94	1.22	1.24	1.21	1.32	1.26	0.96	0.59	0.33	0.28
Period (P)		-	-	-	-	-	-	-	-	-	-	-	0.38
T x P		-	-	-	-	-	-	-	-	-	-	-	0.94
CD at 5%		0.97	1.61	2.95	3.84	3.91	3.82	4.16	3.98	3.02	1.86	1.03	0.79
CV (%)		13.82	13.10	11.32	12.80	12.78	11.61	12.14	13.49	11.74	15.28	15.25	13.28

Note: Significant parameters and their interactions: P and T x P

Table 3: Effect of bagging and pollination frequency of *A. dorsata* on fruit setting in cucumber (Pooled: 2020 and 2021)

Tr. No.	Treatments	Total no. of fruits/ plot at indicated weeks after initiation of fruiting											Pooled over periods and years
		1	2	3	4	5	6	7	8	9	10	11	
T_1	Bagging after one visit	2.16	4.66	11.00	10.50	8.66	8.50	8.83	8.66	7.16	2.16	1.16	6.68
T_2	Bagging after two visits	3.50	5.00	12.00	12.16	11.50	12.33	14.50	13.00	9.33	4.33	2.00	9.06
T_3	Bagging after three visits	3.16	5.50	12.33	14.16	13.16	15.16	15.83	14.50	11.50	4.66	2.50	10.22
T_4	Bagging after four visits	4.16	7.33	15.50	19.16	17.50	20.33	20.66	18.50	14.66	7.00	3.83	13.51
T_5	Bagging after five visits	4.83	7.66	16.00	20.33	19.16	21.83	21.83	19.50	15.66	8.00	4.66	14.50
T_6	No bagging (open pollination)	5.16	8.33	16.83	20.50	19.83	22.00	22.83	20.00	16.83	8.33	4.83	15.13
S.Em±	Treatment (T)	0.26	0.31	0.60	0.83	0.83	0.90	0.87	0.75	1.10	0.35	0.31	0.31
	Period (P)	-	-	-	-	-	-	-	-	-	-	-	5.29
	Year (Y)	0.16	0.19	0.38	0.52	0.48	0.53	0.53	0.48	0.36	0.20	0.11	0.11
	T x P	-	-	-	-	-	-	-	-	-	-	-	1.60
	T x Y	0.39	0.47	0.93	1.27	1.18	1.29	1.31	1.17	0.90	0.50	0.29	0.28
	P x Y	-	-	-	-	-	-	-	-	-	-	-	0.38
	T x P x Y	-	-	-	-	-	-	-	-	-	-	-	0.94
	CD at 5%	0.76	0.90	1.75	2.41	2.43	2.63	2.53	2.20	3.98	1.04	1.12	1.15
	CV (%)	17.92	12.93	11.55	13.52	13.70	13.46	13.07	12.97	12.48	15.11	15.96	14.25

Note: Significant parameters and their interactions: T x Y, P x Y and T x P x Y

Table 4: Effect of bagging and pollination frequency of *A. dorsata* on fruit malformation in cucumber (Summer, 2020)

Tr. No.	Treatments	Malformed fruits (%)/ plot at indicated weeks after initiation of fruiting											Pooled over periods
		1	2	3	4	5	6	7	8	9	10	11	
T_1	Bagging after one visit	44.98 (49.97)	48.05 (55.31)	52.76 (63.38)	56.45 (69.46)	53.39 (64.43)	58.53 (72.75)	56.46 (69.47)	54.28 (65.91)	58.23 (72.28)	74.97 (93.28)	89.96 (100.00)	25.66 (18.75)
T_2	Bagging after two visits	38.49 (38.74)	44.98 (49.97)	33.55 (30.54)	40.73 (42.58)	35.17 (33.18)	32.95 (29.58)	34.72 (32.44)	38.69 (39.08)	39.58 (40.60)	56.46 (69.47)	59.97 (74.95)	21.35 (13.25)
T_3	Bagging after three visits	33.49 (30.45)	41.13 (43.27)	40.14 (41.56)	36.44 (35.28)	25.95 (19.15)	26.68 (20.16)	30.60 (25.91)	30.50 (25.76)	32.12 (28.27)	51.47 (61.20)	44.98 (49.97)	21.20 (13.08)
T_4	Bagging after four visits	19.11 (10.72)	22.20 (14.28)	26.24 (19.55)	15.16 (6.84)	16.48 (8.05)	16.98 (8.53)	18.88 (10.47)	18.90 (10.49)	26.00 (19.22)	24.91 (17.74)	33.49 (30.45)	12.89 (4.98)
T_5	Bagging after five visits	0.81 (0.02)	14.57 (6.33)	16.65 (8.21)	14.59 (6.35)	14.07 (5.91)	14.45 (6.23)	12.65 (4.80)	15.08 (6.77)	17.85 (9.40)	15.19 (6.87)	10.53 (3.34)	8.69 (2.28)
T_6	No bagging (open pollination)	0.81 (0.02)	7.02 (1.49)	14.53 (6.29)	12.54 (4.71)	9.36 (2.65)	8.57 (2.22)	8.67 (2.27)	13.16 (5.18)	15.35 (7.01)	14.15 (5.98)	0.81 (0.02)	7.97 (1.92)
S.Em±	Treatment (T)	4.00	4.84	2.47	2.26	1.86	2.57	1.99	2.11	2.37	7.78	7.56	0.76
	Period (P)	-	-	-	-	-	-	-	-	-	-	-	1.03
	T x P	-	-	-	-	-	-	-	-	-	-	-	2.53
	CD at 5%	12.61	15.26	7.78	7.11	5.84	8.08	6.26	6.64	7.47	24.51	23.82	2.12
	CV (%)	30.22	28.28	13.96	13.33	12.49	16.86	12.74	12.84	13.03	34.09	32.77	26.98

Notes: 1. Figures in parentheses are retransformed values and those outsides are arcsine transformed values.
2. Significant parameters and their interactions: P and T x P

Table 5: Effect of bagging and pollination frequency of *A. dorsata* on fruit malformation in cucumber (Summer, 2021)

Tr. No.	Treatments	Malformed fruits (%)/ plot at indicated weeks after initiation of fruiting											Pooled over periods
		1	2	3	4	5	6	7	8	9	10	11	
T_1	Bagging after one visit	41.73 (44.31)	46.90 (53.31)	51.28 (60.87)	54.35 (66.03)	51.99 (62.08)	53.69 (64.94)	51.57 (61.37)	58.53 (72.75)	61.79 (77.66)	54.71 (66.62)	74.97 (93.28)	54.68 (66.58)
T_2	Bagging after two visits	38.23 (38.29)	41.73 (44.31)	44.36 (48.88)	35.74 (34.12)	44.35 (48.87)	40.83 (42.75)	31.62 (27.49)	36.75 (35.80)	41.99 (44.76)	52.83 (63.50)	41.73 (44.31)	40.92 (42.90)
T_3	Bagging after three visits	35.24 (33.29)	36.91 (36.07)	30.74 (26.13)	29.87 (24.80)	32.38 (28.68)	29.08 (23.62)	30.22 (25.33)	31.08 (26.65)	27.89 (21.88)	41.73 (44.31)	35.24 (33.29)	32.76 (29.28)
T_4	Bagging after four visits	28.84 (23.27)	24.29 (16.92)	16.52 (8.09)	14.96 (6.66)	13.44 (5.40)	19.08 (10.69)	14.01 (5.86)	15.15 (6.83)	17.98 (9.53)	23.16 (15.47)	28.84 (23.27)	19.66 (11.32)
T_5	Bagging after five visits	0.81 (0.02)	13.65 (5.57)	14.32 (6.12)	12.84 (4.94)	12.57 (4.74)	12.05 (4.36)	13.79 (5.68)	13.05 (5.10)	13.78 (5.67)	13.31 (5.30)	24.91 (17.74)	13.19 (5.21)
T_6	No bagging (open pollination)	0.81 (0.02)	7.43 (1.67)	13.78 (5.67)	12.44 (4.64)	8.50 (2.18)	8.30 (2.08)	8.04 (1.96)	8.50 (2.18)	13.18 (5.20)	13.24 (5.25)	8.56 (2.22)	9.34 (2.63)
S.Em±	Treatment (T)	3.49	4.37	2.75	3.72	2.31	2.33	2.85	2.87	1.92	4.09	6.72	1.12
	Period (P)	-	-	-	-	-	-	-	-	-	-	-	1.52
	T x P	-	-	-	-	-	-	-	-	-	-	-	3.73
	CD at 5%	11.01	13.77	8.67	11.72	7.28	7.35	8.96	9.05	6.03	12.89	21.16	3.12
	CV (%)	24.93	26.57	16.72	24.12	14.72	14.87	19.81	18.31	11.27	21.36	32.58	22.74

Notes: 1. Figures in parentheses are retransformed values and those outsides are arcsine transformed values.
2. Significant parameters and their interactions: P and T x P

Table 6: Effect of bagging and pollination frequency of *A. dorsata* on fruit malformation in cucumber (Pooled: 2020 and 2021)

Tr. No.	Treatments	Malformed fruits (%)/ plot at indicated weeks after initiation of fruiting											Pooled over periods and years
		1	2	3	4	5	6	7	8	9	10	11	
T_1	Bagging after one visit	43.36 (47.14)	47.48 (54.32)	52.02 (62.13)	55.40 (67.76)	52.69 (63.26)	56.11 (68.91)	54.02 (65.48)	56.41 (69.39)	60.10 (75.15)	64.84 (81.92)	82.46 (98.28)	56.80 (70.02)
T_2	Bagging after two visits	38.36 (38.51)	43.36 (47.14)	38.96 (39.54)	38.24 (38.31)	39.76 (40.91)	36.89 (36.03)	33.17 (29.93)	37.72 (37.43)	40.79 (42.68)	54.65 (66.53)	50.85 (60.14)	41.16 (43.32)
T_3	Bagging after three visits	34.37 (31.87)	39.02 (39.64)	35.44 (33.62)	33.16 (29.92)	29.16 (23.74)	27.88 (21.87)	30.41 (25.62)	30.79 (26.20)	30.10 (25.15)	46.60 (52.79)	40.11 (41.51)	34.27 (31.71)
T_4	Bagging after four visits	23.98 (16.52)	23.24 (15.57)	21.38 (13.29)	15.06 (6.75)	14.96 (6.66)	18.03 (9.58)	16.45 (8.02)	17.03 (8.58)	21.99 (14.02)	24.03 (16.58)	31.16 (26.77)	20.67 (12.46)
T_5	Bagging after five visits	0.81 (0.02)	14.11 (5.94)	15.49 (7.13)	13.71 (5.62)	13.32 (5.31)	13.25 (5.25)	13.22 (5.23)	14.06 (5.90)	15.81 (7.42)	14.25 (6.06)	17.72 (9.26)	13.25 (5.25)
T_6	No bagging (open pollination)	0.81 (0.02)	7.23 (1.58)	14.15 (5.98)	12.49 (4.68)	8.93 (2.41)	8.43 (2.15)	8.36 (2.11)	10.83 (3.53)	14.26 (6.07)	13.70 (5.61)	4.69 (0.67)	9.44 (2.69)
S.Em±	Treatment (T)	2.57	2.96	3.74	2.03	2.52	1.83	1.65	1.75	2.19	4.27	5.36	1.94
	Period (P)	-	-	-	-	-	-	-	-	-	-	-	3.00
	Year (Y)	1.53	1.88	1.06	1.25	0.85	1.00	1.00	1.02	0.88	2.53	2.92	0.48
	T x P	-	-	-	-	-	-	-	-	-	-	-	3.83
	T x Y	3.75	4.61	2.61	3.07	2.09	2.45	2.45	2.52	2.15	6.21	7.15	1.18
	P x Y	-	-	-	-	-	-	-	-	-	-	-	1.61
	T x P x Y	-	-	-	-	-	-	-	-	-	-	-	3.94
	CD at 5%	7.50	8.63	13.53	5.92	9.11	5.35	4.81	5.10	7.91	12.45	15.62	7.04
	CV (%)	27.56	27.48	15.31	19.02	13.72	15.87	16.39	15.70	12.25	29.62	32.73	23.34

Notes: 1. Figures in parentheses are retransformed values and those outsides are arcsine transformed values.
2. Significant parameters and their interactions: Y, T x Y, P x Y and T x P x Y

Table 7: Effect of bagging and pollination frequency of *A. dorsata* on length of fruits in cucumber (Summer, 2020)

Tr. No.	Treatments	Length (cm) of fruit at indicated weeks after initiation of fruiting											Pooled over periods
		1	2	3	4	5	6	7	8	9	10	11	
T_1	Bagging after one visit	12.38	12.48	12.34	12.68	14.65	18.36	20.55	20.27	19.88	19.14	18.52	16.48
T_2	Bagging after two visits	15.43	15.98	16.39	16.99	17.61	18.92	21.32	21.77	20.62	19.88	18.95	18.53
T_3	Bagging after three visits	15.58	16.09	16.47	17.21	18.18	19.42	21.84	22.16	20.95	20.03	18.86	18.80
T_4	Bagging after four visits	19.81	20.25	20.97	22.05	24.14	26.27	27.83	28.40	27.74	26.69	26.36	24.59
T_5	Bagging after five visits	20.03	20.55	21.25	22.32	24.70	26.61	28.48	28.84	28.06	26.92	26.54	24.94
T_6	No bagging (open pollination)	20.37	20.83	21.43	22.66	25.45	27.13	28.78	29.02	28.26	27.33	26.85	25.27
SEm±	Treatment (T)	1.20	1.24	1.25	1.30	1.39	1.67	1.58	1.77	1.86	1.80	1.74	0.43
	Period (P)	-	-	-	-	-	-	-	-	-	-	-	0.59
	T x P	-	-	-	-	-	-	-	-	-	-	-	0.45
	CD at 5%	3.77	3.91	3.95	4.08	4.37	5.27	4.99	5.57	5.85	5.66	5.49	1.21
	CV (%)	12.01	12.14	11.97	11.82	11.56	12.72	11.06	12.22	13.27	13.34	13.31	11.73
Note:	Significant parameters and their interactions: P												

Note: Significant parameters and their interactions: P

Table 8: Effect of bagging and pollination frequency of *A. dorsata* on length of fruits in cucumber (Summer, 2021)

Tr. No.	Treatments	Length (cm) of fruit at indicated weeks after initiation of fruiting											Pooled over periods
		1	2	3	4	5	6	7	8	9	10	11	
T_1	Bagging after one visit	13.02	13.25	13.43	13.70	14.21	18.20	20.70	20.25	19.75	19.05	18.38	16.72
T_2	Bagging after two visits	15.98	16.88	17.10	17.54	17.84	18.96	21.27	22.07	20.37	19.81	19.02	18.80
T_3	Bagging after three visits	16.28	16.89	17.20	17.54	17.91	19.17	22.18	22.08	21.00	19.98	19.04	19.02
T_4	Bagging after four visits	21.03	22.59	23.01	23.28	24.05	26.49	28.13	28.56	27.89	26.85	26.46	25.30
T_5	Bagging after five visits	21.41	22.77	23.39	23.58	24.43	27.03	28.73	28.94	28.26	27.05	26.68	25.66
T_6	No bagging (open pollination)	21.60	23.08	23.63	23.85	24.78	27.51	29.01	29.21	28.48	27.23	26.90	25.93
S.Em±	Treatment (T)	1.37	1.75	1.66	1.67	1.52	1.55	1.69	1.81	1.84	1.74	1.61	0.47
	Period (P)	-	-	-	-	-	-	-	-	-	-	-	0.63
	T x P	-	-	-	-	-	-	-	-	-	-	-	1.56
	CD at 5%	4.30	5.51	5.21	5.25	4.79	4.89	5.33	5.71	5.78	5.47	5.06	1.30
	CV (%)	12.97	15.76	14.61	14.50	12.83	17.75	11.72	12.46	13.09	12.89	12.23	12.35
Note:	Significant parameters and their interactions: P												

Note: Significant parameters and their interactions: P

Table 9: Effect of bagging and pollination frequency of *A. dorsata* on length of fruits in cucumber (Pooled: 2020 and 2021)

Tr. No.	Treatments	Length (cm) of fruit at indicated weeks after initiation of fruiting											Pooled over periods and years
		1	2	3	4	5	6	7	8	9	10	11	
T_1	Bagging after one visit	12.70	12.86	12.89	13.19	14.43	18.28	20.63	20.26	19.81	19.09	18.45	16.60
T_2	Bagging after two visits	15.70	16.43	16.74	17.27	17.72	18.94	21.30	21.92	20.49	19.84	18.98	18.67
T_3	Bagging after three visits	15.93	16.49	16.84	17.38	18.04	19.29	22.01	22.12	20.97	20.01	18.95	18.91
T_4	Bagging after four visits	20.42	21.42	21.99	22.67	24.09	26.38	27.98	28.48	27.82	26.77	26.41	24.95
T_5	Bagging after five visits	20.72	21.66	22.32	22.95	24.56	26.82	28.61	28.89	28.16	26.98	26.61	25.30
T_6	No bagging (open pollination)	20.99	21.95	22.53	23.25	25.12	27.32	28.89	29.11	28.37	27.23	26.87	25.60
S.Em±	Treatment (T)	0.81	0.97	0.94	0.94	0.92	1.02	1.03	1.13	1.17	1.11	1.06	0.32
	Period (P)	-	-	-	-	-	-	-	-	-	-	-	1.15
	Year (Y)	0.52	0.62	0.60	0.61	0.59	0.65	0.66	0.73	0.75	0.72	0.68	0.18
	T x P	-	-	-	-	-	-	-	-	-	-	-	1.06
	T x Y	1.28	1.51	1.46	1.49	1.45	1.61	1.64	1.79	1.84	1.76	1.67	0.45
	P x Y	-	-	-	-	-	-	-	-	-	-	-	0.61
	T x P x Y	-	-	-	-	-	-	-	-	-	-	-	1.50
	CD at 5%	2.37	2.84	2.74	2.76	2.69	2.98	3.02	3.30	3.40	3.25	3.09	0.88
	CV (%)	12.53	14.23	13.47	13.29	12.20	12.24	11.40	12.34	13.18	13.12	12.78	12.02

Note: Significant parameters and their interactions: Y and P x Y

Table 10: Effect of bagging and pollination frequency of *A. dorsata* on circumference of fruits in cucumber (Summer, 2020)

Tr. No.	Treatments	Circumference (cm) of fruit at indicated weeks after initiation of fruiting											Pooled over periods
		1	2	3	4	5	6	7	8	9	10	11	
T_1	Bagging after one visit	8.09	8.16	8.69	9.18	8.95	9.74	9.45	9.01	8.27	7.88	7.57	8.63
T_2	Bagging after two visits	8.32	8.54	9.14	9.41	9.64	10.08	9.92	9.21	8.64	8.13	7.82	8.99
T_3	Bagging after three visits	9.07	9.33	9.63	9.85	9.65	10.28	10.36	9.42	9.05	8.69	8.03	9.39
T_4	Bagging after four visits	13.10	13.43	13.97	14.29	14.55	13.75	14.60	13.76	13.32	13.72	14.27	13.88
T_5	Bagging after five visits	13.49	13.72	14.52	14.73	14.88	14.12	14.97	14.48	13.89	14.06	14.71	14.32
T_6	No bagging (open pollination)	14.00	14.59	15.19	15.06	15.29	14.53	15.30	14.85	14.23	14.53	15.05	14.78
S.Em±	Treatment (T)	1.02	0.92	1.25	1.28	1.34	1.04	1.3	1.29	1.16	1.26	1.24	0.36
	Period (P)	-	-	-	-	-	-	-	-	-	-	-	0.48
	T x P	-	-	-	-	-	-	-	-	-	-	-	1.19
	CD at 5%	3.22	2.90	3.93	4.01	4.21	3.29	4.25	4.07	3.65	3.96	3.90	0.99
	CV (%)	16.10	14.13	18.24	18.27	19.03	14.96	18.79	19.02	17.86	19.51	19.10	17.70

Note: Significant parameters and their interactions: Nil

Table 11: Effect of bagging and pollination frequency of *A. dorsata* on circumference of fruits in cucumber (Summer, 2021)

Tr. No.	Treatments	Circumference (cm) of fruit at indicated weeks after initiation of fruiting											Pooled over periods
		1	2	3	4	5	6	7	8	9	10	11	
T_1	Bagging after one visit	6.35	6.68	6.99	7.48	8.64	9.24	8.79	8.97	8.05	7.01	6.38	7.69
T_2	Bagging after two visits	9.32	10.04	9.81	10.27	10.71	11.19	10.49	10.74	10.17	9.78	9.15	10.15
T_3	Bagging after three visits	9.38	10.22	10.50	10.67	11.15	11.44	10.94	11.27	10.54	9.79	9.46	10.49
T_4	Bagging after four visits	13.21	13.81	14.18	14.49	15.46	15.98	15.49	16.00	14.60	14.93	14.46	14.78
T_5	Bagging after five visits	13.92	14.29	14.72	15.24	15.85	16.37	16.70	17.02	15.62	16.42	16.26	15.67
T_6	No bagging (open pollination)	14.33	14.70	14.93	15.68	16.29	16.77	16.91	17.30	16.40	16.85	16.90	16.10
S.Em±	Treatment (T)	1.04	0.98	0.95	1.00	1.04	1.07	1.04	1.12	1.07	1.02	1.04	0.29
	Period (P)	-	-	-	-	-	-	-	-	-	-	-	0.40
	T x P	-	-	-	-	-	-	-	-	-	-	-	0.98
	CD at 5%	3.28	3.08	2.99	3.15	3.28	3.38	3.28	3.54	3.37	3.21	3.27	0.82
	CV (%)	16.26	14.56	13.88	14.06	13.87	13.76	13.65	14.36	14.74	14.16	14.88	13.70

Note: Significant parameters and their interactions: P

Table 12: Effect of bagging and pollination frequency of *A. dorsata* on circumference of fruits in cucumber (Pooled: 2020 and 2021)

Tr. No.	Treatments	Circumference (cm) of fruit at indicated weeks after initiation of fruiting											Pooled over periods and years
		1	2	3	4	5	6	7	8	9	10	11	
T_1	Bagging after one visit	7.22	7.42	7.84	8.33	8.80	9.49	9.12	8.99	8.16	7.45	6.97	8.16
T_2	Bagging after two visits	8.82	9.29	9.48	9.84	10.17	10.64	10.21	9.97	9.41	8.95	8.49	9.57
T_3	Bagging after three visits	9.22	9.77	10.07	10.26	10.40	10.86	10.65	10.34	9.79	9.24	8.74	9.94
T_4	Bagging after four visits	13.15	13.62	14.08	14.39	15.01	14.87	15.04	14.88	13.96	14.33	14.36	14.33
T_5	Bagging after five visits	13.71	14.00	14.62	14.98	15.36	15.24	15.83	15.75	14.76	15.24	15.48	15.00
T_6	No bagging (open pollination)	14.17	14.64	15.06	15.37	15.79	15.65	16.10	16.08	15.31	15.69	15.97	15.44
S.Em±	Treatment (T)	0.68	0.64	0.73	0.75	0.77	0.71	0.78	0.79	0.72	0.77	0.76	0.23
	Period (P)	-	-	-	-	-	-	-	-	-	-	-	0.66
	Year (Y)	0.42	0.38	0.45	0.46	0.48	0.43	0.49	0.49	0.45	0.46	0.46	0.13
	T x P	-	-	-	-	-	-	-	-	-	-	-	0.76
	T x Y	1.03	0.95	1.11	1.14	1.19	1.05	1.20	1.21	1.11	1.14	1.14	0.32

P x Y	-	-	-	-	-	-	-	-	-	-	-	0.44
T x P x Y	-	-	-	-	-	-	-	-	-	-	-	1.08
CD at 5%	1.99	1.86	2.13	2.20	2.24	2.07	2.29	2.31	2.12	2.24	2.23	0.64
CV (%)	16.18	14.35	16.21	16.26	16.48	14.33	16.27	16.57	16.23	16.78	16.98	15.55

Note: Significant parameters and their interactions: Y and P x Y

Table 13: Effect of bagging and pollination frequency of *A. dorsata* on weight of fruits in cucumber (Summer, 2020)

Tr. No.	Treatments	Weight (kg) of fruit at indicated weeks after initiation of fruiting											Pooled over periods
		1	2	3	4	5	6	7	8	9	10	11	
T_1	Bagging after one visit	0.57	1.17	1.28	1.46	1.53	1.51	1.71	1.57	1.30	0.37	0.29	1.16
T_2	Bagging after two visits	0.75	1.21	1.35	1.50	1.58	1.68	1.78	1.62	1.42	1.13	0.69	1.34
T_3	Bagging after three visits	0.80	1.37	1.50	1.59	1.65	1.72	1.84	1.70	1.49	1.30	0.77	1.43
T_4	Bagging after four visits	1.13	1.91	1.95	2.06	2.23	2.16	2.41	2.33	1.94	1.81	1.29	1.93
T_5	Bagging after five visits	1.20	2.00	2.05	2.20	2.28	2.32	2.50	2.40	2.02	1.92	1.37	2.02
T_6	No bagging (open pollination)	1.22	2.04	2.06	2.25	2.37	2.39	2.59	2.49	2.11	2.01	1.49	2.09
S.Em±	Treatment (T)	0.10	0.15	0.17	0.17	0.18	0.15	0.20	0.19	0.16	0.15	0.11	0.04
	Period (P)	-	-	-	-	-	-	-	-	-	-	-	0.06
	T x P	-	-	-	-	-	-	-	-	-	-	-	0.15
	CD at 5%	0.32	0.46	0.52	0.54	0.56	0.48	0.62	0.59	0.49	0.47	0.34	0.13
	CV (%)	18.93	15.73	17.03	16.36	15.92	13.61	16.02	16.24	15.79	18.42	19.43	16.24

Note: Significant parameters and their interactions: P

Table 14: Effect of bagging and pollination frequency of *A. dorsata* on weight of fruits in cucumber (Summer, 2021)

Tr. No.	Treatments	Weight (kg) of fruit at indicated weeks after initiation of fruiting											Pooled over periods
		1	2	3	4	5	6	7	8	9	10	11	
T_1	Bagging after one visit	0.56	1.27	1.20	1.44	1.51	1.62	1.66	1.45	1.25	0.92	0.49	1.21
T_2	Bagging after two visits	0.73	1.39	1.42	1.50	1.60	1.68	1.72	1.52	1.46	1.36	0.88	1.39
T_3	Bagging after three visits	0.80	1.46	1.51	1.51	1.66	1.73	1.82	1.62	1.54	1.44	0.94	1.46
T_4	Bagging after four visits	1.13	1.83	1.85	1.93	2.23	2.21	2.31	2.18	2.03	1.94	1.34	1.91
T_5	Bagging after five visits	1.20	1.96	2.01	2.05	2.28	2.34	2.40	2.25	2.08	1.98	1.44	2.00
T_6	No bagging (open pollination)	1.23	2.06	2.13	2.16	2.38	2.42	2.46	2.30	2.14	2.07	1.50	2.08
S.Em±	Treatment (T)	0.11	0.15	0.14	0.13	0.17	0.17	0.17	0.15	0.14	0.14	0.11	0.04
	Period (P)	-	-	-	-	-	-	-	-	-	-	-	0.05
	T x P	-	-	-	-	-	-	-	-	-	-	-	0.14
	CD at 5%	0.33	0.46	0.45	0.41	0.52	0.54	0.53	0.48	0.44	0.44	0.35	0.12
	CV (%)	19.45	15.25	14.66	12.62	14.75	14.89	14.28	14.18	14.05	14.91	17.54	14.94

Note: Significant parameters and their interactions: P

Table 15: Effect of bagging and pollination frequency of *A. dorsata* on weight of fruits in cucumber (Pooled: 2020 and 2021)

Tr. No.	Treatments	Weight (kg) of fruit at indicated weeks after initiation of fruiting											Pooled over periods and years
		1	2	3	4	5	6	7	8	9	10	11	
T_1	Bagging after one visit	0.57	1.22	1.24	1.45	1.52	1.57	1.69	1.51	1.28	0.64	0.39	1.19
T_2	Bagging after two visits	0.74	1.30	1.38	1.50	1.59	1.68	1.75	1.57	1.44	1.25	0.78	1.36
T_3	Bagging after three visits	0.80	1.41	1.50	1.60	1.65	1.72	1.83	1.66	1.51	1.37	0.86	1.45
T_4	Bagging after four visits	1.13	1.87	1.90	1.99	2.23	2.19	2.36	2.26	1.98	1.88	1.32	1.92
T_5	Bagging after five visits	2.20	1.98	2.03	2.12	2.28	2.33	2.45	2.33	2.05	1.95	1.40	2.01
T_6	No bagging (open pollination)	2.23	2.05	2.09	2.20	2.37	2.40	2.52	2.40	2.12	2.04	1.49	2.08
S.Em±	Treatment (T)	0.06	0.09	0.10	0.09	0.10	0.10	0.11	0.11	0.09	0.10	0.07	0.03
	Period (P)	-	-	-	-	-	-	-	-	-	-	-	0.34
	Year (Y)	0.04	0.06	0.06	0.06	0.07	0.06	0.07	0.07	0.06	0.06	0.04	0.01
	T x P	-	-	-	-	-	-	-	-	-	-	-	0.10
	T x Y	0.10	0.14	0.15	0.15	0.17	0.16	0.18	0.17	0.15	0.14	0.11	0.04
	P x Y	-	-	-	-	-	-	-	-	-	-	-	0.06
	T x P x Y	-	-	-	-	-	-	-	-	-	-	-	0.15
	CD at 5%	0.19	0.27	0.29	0.28	0.31	0.30	0.34	0.32	0.27	0.29	0.21	0.08
	CV (%)	19.19	15.48	15.90	14.67	15.34	14.28	15.21	15.32	14.93	16.57	18.44	15.59

Note: Significant parameters and their interactions: Y and P x Y

Table 16: Impact of bagging and pollination frequency of *A. dorsata* on yield of cucumber (Pooled: 2020 and 2021)

Tr. No.	Treatments	Fruit yield (kg/ ha)		
		2020	2021	Pooled
T_1	Bagging after one visit	12431	13986	13208
T_2	Bagging after two visits	17100	17700	17400
T_3	Bagging after three visits	20639	21230	20935
T_4	Bagging after four visits	24528	25600	25064
T_5	Bagging after five visits	25061	26228	25644
T_6	No bagging (open pollination)	25203	27053	26128
S.Em±	Treatment (T)	1075	1077	690
Year (Y)		-	-	439
T x Y		-	-	1076
CD at 5%		3389	3392	2010
CV (%)		8.94	8.48	8.71

Note: Significant parameters and their interactions: Nil

4. Conclusions

The higher number of fruits were recorded from the plots kept with open pollination as well as from the plots managed with bagging after five visits by *A. dorsata* whereas, single visit plots exhibited the lowest number of fruits among all the bagging treatments. Absolutely no any fruits were formed where female flower buds were covered with bags and did not open at all. The ascending order of per cent malformed fruits recorded from all the bagging treatments was open pollination < the plots managed with bagging after five visits < four visits < three visits < two visits < single visit. The higher fruit length, circumference, weight and yield were noted in open pollinated plots as well as five visits plots whereas, the lowest were measured in single visit plots.

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