

## THE OCCURRENCE OF *CHILADES PANDAVA* INFESTED ZAMIA PALMS AND ITS CONTROL BY SOME BIOLOGICAL AND SAFE COMPOUNDS

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**ABSTRACT:** The current work aims to determine the monthly infestation of zamia palms by cycad blue butterfly, *Chilades pandava* for two successive years, as well as the effect of some biological and safe compounds on the reduction of infestation with butterfly. *Chilades pandava* infestation was estimated within two consecutive years by monthly recorded the numbers of infested zamia palms, at Abo-Ghaleb village, Giza governorate. The obtained results revealed that the highest infestation was recorded during May (14.67&15.33) and August (14.50&14.76), while the minimum infestation was recorded during January (2.6&3.67 palms) and February (4&4.67) at 2022 and 2023 years. The effect of some biological and safe compounds on infestation with *C. pandava* butterfly on zamia palms spraying three times at 30 days interval were arrangement according to reduction percentages as follow: Biomagic (60.40%), Ashok (59.52%), Palmetto gold (58.52%), KZ oil (56.97%), Captivprim (55.28%), Top Prefect (53.55%), Mixture of Top Perfect+ Folk oil (53.34%), Castrol oil (52.67%), Mixture of Ashok + Natural Oly fert (52.07%), Nano oil (51.97%), Protecto (47.50%) and Biover (47.30%). Accordingly, the present study could be help to set up the management program of cycad blue butterfly.

**Key words:** *Chilades pandava*, Zamia palms, infestation, control, safe compounds.

### INTRODUCTION

The Family Lycaenidae (Lepidoptera) had a worldwide distribution and include at numerous species in three subfamilies: Lycaeninae, Polyommatainae, and Theclinae (Lamas, 2004 and Silva *et al.* 2011). Despite its highly abundance, this family is relatively less well known (Pierce *et al.*, 2002) than other butterfly groups. However, the different studies on the lycaenids are rapidly development (Hall *et al.*, 2005, Vila and Eastwood, 2006 and Rodrigues *et al.*, 2010).

The cycad blue butterfly, *Chilades pandava* Horsfield (Lepidoptera: Lycaenidae) is invasive pest for ornamental palms, distributed in several regions planted with cycas and zamia palms. This species has spread and invaded many countries such as Spain (Schreiner and Nafus, 1997), Mauritius (Macdonald *et al.*, 2003), Sulawesi (Vane-Wright and de Jong, 2003), Southern Africa (Moore *et al.*, 2005), southern Asia on Guam (Wu, *et al.*, 2009), oriental region

in India to Philippines, Koran and Japan (Wu, *et al.*, 2010).

In Egypt, this pest was firstly recorded from private garden during September 2012 at Birqash district, Giza governorate (Fric, *et al.*, 2014) and it found infested cycas palms in Alexandria governorate and the North Coast (Abu-Shall, 2014) also, Batt *et al.*, (2016) mentioned that *C. pandava* infested Zamia palms at Abu-Sultan, Fayed, Ismailia governorate.

Under different climate conditions, *Chilades pandava* has ability to produce numerous generations yearly Kunte and Tiple (2009). Liu *et al.* (2003) recorded 2 peaks of *C. pandava* stages in May and October in some cycad gardens while; Wei QiYuan (2006) reported that blue butterfly has 5 generations/year on ornamental palms. Whereas, Batt *et al.*, (2019) found that the highest percentage of the infestation of *Chilades pandava* was recorded on Zamia palms at 1st week of May. The blue butterfly, *C. pandava* control based on Neem sprays was conducted by Naik *et al.* (2014). According to the previously studies, the present study aim to focus on the infestation of *Chilades*

*pandava* on *Zamia* palms and its control by some biological and safe compounds during 2022 and 2023.

## MATERIALS AND METHODS

Consecutive visits to ornamental palm nurseries revealed that *zamia* palms were infested by cycad blue butterfly where it cause heavy losses in palm trees as well as their economic income, therefore this work was conducted to determine the infestation degrees and to evaluate some bio and safe compounds on this dangerous pest.

### Monthly numbers of infested *zamia* palms

The annual infestation of cycad blue butterfly, *Chilades pandava* on *zamia* palms during the period from 1st January 2022 to the end of December 2023 in a private palm nursery at Abo-Ghaleb village, where the monthly numbers of infested palms were determined by counting every month the numbers of infested palms with dead heart for 3 blocks of cultivated *zamia* palms. Thirty random palm trees were monthly examined in each block.

### Effect of some vital compounds on infestation

The experiments on the effect of tested compounds (Table 1) *C. pandava* infected *zamia* palms were carried out by spraying the infestation palms for three times at one month interval using a handle sprayer 10 liter with continuous pressure. The reduction percentages of *zamia* palms infected with *C. pandava* for each compound was calculated according to Henderson and Tilton (1955) equation.

Experimental was divided into 39 blocks (3 blocks in length and 13 blocks in width); each block contained 10 *Zamia* palms as replicate. The twelve treatments were arranged in full randomized block design; each treatment was replicated three times. Control block was kept without compounds.

Further details about the trade name, active ingredient, concentration, and formulation and application rate are provided in Table (1).

### Statistical analysis

The obtained results were established for statistical analysis; the values were compared by T-Test, F-test and calculated least significant difference (LSD) by using SAS program computer (2003).

**Table (1): The tested compounds applied against *Chilades pandava* on *zamia* palms.**

Trade name	Active ingredient	Concentration	Application rate
Biomagic	<i>Metarhizium anisopliae</i>	1.15 % WP	300 ml / 100 liters
Biover	<i>Beauveria bassiana</i>	10 % WP (32,000 I.U./mg)	200g/100 liters
Protecto	<i>Bacillus thuringiensis</i> kurstaki	9.4% WP(32,000 I.U./mg)	75g/ 100 liters
Ashok	Azadirachtin	0.15 % EC	187.5 ml/100 liters
Top Perfect	Jjoba Oil	80 % EC	250 ml/100 liters
Nano oil	Aliphatic hydrocarbons + Plant oils	15% SC (10+5 )	250 ml /100 liters
KZ oil	Mineral Oil	95 % SC	1.5 L/100 liters
Palmetto gold	<i>Citronella</i> oil + Jasmine oil + Mineral oil	25 % + 5 % +5 % OD	600 ml/ 100 liters
Captivaprim	Capsicum Oleoresin 7.6% + garlic oil 23.4% + canola oil 55%	86 % SC	100 ml/100 liters
Castrol oil	Castor oil+ Palm oil+ Olen + Lanolen	100% EC	300 ml/ 100 liters
mixture of Ashok+ Natural Oly fert oil	Azadirachtin+ Paraffin oil	15 %+90 % EC	187.5 ml/ 100 liters+ 1.5 L /100 liters
mixture of Top Perfect + Folk oil	Jjoba oil + Mineral oil	80 %+85 % EC	250 ml/100L + 1000 ml / 100 L

WP = Wettable powder    SC= Suspension concentrate    EC= Emulsifiable    OD= Oil dispersion

## RESULTS AND DISCUSSION

Monthly numbers of infested palms with *Chilades pandava* along 2022 and 2023 year months at Abo-Ghaleb village, Giza governorate were counted and reported at Table (2).

Along 2022 year months , the highest mean numbers of infested zamia palms with *C. pandava* were recorded during May (14.67 palms) and August (14.50 palms), followed by September (13.67 palms) then April and July which recorded 12.50 palms for each month, while the infestation during June, March and October recorded 11.83,11.33 and 11.17 palms, respectively. The infestation was decreased during November (8.67 palms), December (5.0 palms), February (4.0 palms), while the

minimum infestation (2.6 palms) was recorded during January month.

Along 2023 year months, the highest mean number of infestation was 15.33 palms appeared during May, followed by 14.76 and 14.33palms during August and April, while the mean infested numbers during September, July and June recorded 13.67,13.33 and 13palms respectively, and equal mean numbers (10.67palms) were appeared during March and November, followed by 10.33 palms during October. The infested mean numbers of zamia palms at tested farm were very low during December, February and January recording 6.67, 4.67 and 3.67 palms, respectively.

**Table (2): Monthly numbers of infested zamia palms by cycad blue butterfly, *Chilades pandava* during 2022 and 2023 years at Abo-Ghaleb village, Giza governorate.**

Inspection month	Average numbers of infested palms by <i>C. pandava</i> per 30 palms	
	2022	2023
	Average ±SE	Average ±SE
January	2.67±0.67	3.67±0.67
February	4.00±0.58	4.67±0.33
March	11.33±1.17	10.67±1.76
April	12.50±1.26	14.33±1.20
May	14.67±0.73	15.33±2.03
June	11.83±1.30	13.00±2.08
July	12.50±0.29	13.33±2.96
August	14.50±0.29	14.67±0.33
September	13.67±2.73	13.67±2.73
October	11.17±1.20	10.33±1.67
November	8.67±1.76	10.67±1.20
December	5.00±0.58	6.67±0.33
<b>General average</b>	<b>10.21±1.20</b>	<b>10.92±1.14</b>
<b>T value</b>	<b>- 0.52NS</b>	
<b>Pr&gt;  t </b>	<b>0.604</b>	

SE = Standard Error

Pr= Probability

The obtained results are in harmony with those of Batt *et al.*, (2016) who reported that *C. pandava* larvae cause several damages in *Zamia* fronds leading to partial or entire death of infested palms, furthermore, Batt *et al.* (2019)

mentioned that the highly infestations with *C. pandava* for cycas and zamia palms were recorded during the period from middle of March to early September. Moreover, Wei Qi Yuan (2006) found that the adult emergences increased

in the middle of June and the larvae caused high damages on the foliage of *Cycas revoluta* at June-October. Also, Naik *et al.*, (2014) reported that the cycad blue butterfly, *C. pandava* highly infested the King sago palm, *Cycas revoluta* through the period June-August. They recorded that the infestation percent on all species of cycad palms was  $16.4 \pm 27.4$ , especially; it was reach to  $18.8 \pm 28.75$  on *Cyca srevoluta*. Additionally, Tiple *et al.*, (2009) observed that the population of *C. pandava* was highly occurrence on the dry seasons which it was related to relative humidity; therefore, this pest population was more summer season.

### Effect of some biological and safe compounds on zamia palm infestation with cycad blue butterfly, *C. pandava*

Results on the effect of tested vital compounds on reduction infestation with cycad blue butterfly, *C. pandava* after spray treatments

for three times on zamia palms are illustrated in Tables(3, 4&5).The number of infested palms after 30days from treatment (1<sup>st</sup> spray) Table (3) showed that Top Perfect recorded the highest reduction percentage (66.09%) followed by Mixture of Ashok + Natural Oly fert (65.33%), Captivaprim (64%), Ashok (61.57%) and Palmetto gold (60.38%), while Protecto recorded the least reduction percentage 45.40%.The data in Table (4) illustrated the effect of the tested compounds on the reduction infestation with cycad blue butterfly, *C. pandava* after 2<sup>nd</sup> spray, the obtained data revealed that the highest reduction percentage was recorded as 62.61% for mixture of Top Perfect + Folk oil, followed by Biomagic 58.79% reduction, then each of KZ oil and Palmetto gold were recorded 51.92% reduction, followed by the Protecto as 49.63%,while the least percentage was appeared for each of Biover and Captivaprim as 41.24% reduction.

**Table (3): Effect of spraying biological and safe compounds on zamia palms infested with *Chilades pandava* after the first spray.**

Treatments	Mean numbers of infested palms		Reduction percentages
	Before treatment	30 days after treatment	
Biomagic	8.00	7.00	54.50 ab
Biover	6.67	6.00	53.20ab
Protecto	6.67	7.00	45.40b
Ashok	7.67	5.67	61.57ab
Top Perfect	7.67	5.00	66.09a
Nano oil	6.67	5.67	55.80ab
KZ oil	6.00	5.33	53.78ab
Palmetto gold	7.00	5.33	60.38ab
Captivaprim	8.67	6.00	64.00ab
Castrol oil	7.00	5.67	57.90ab
Mixture of Ashok + Oly fert	7.00	4.67	65.33a
Mixture of Top Perfect + Folk oil	7.67	6.00	59.30ab
Control	4.33	8.33	—
<b>F value</b>			<b>0.87</b>
<b>LSD 5%</b>			<b>18.65</b>

values followed by different letter in column are significantly different at 5% level.

**Table (4): Effect of spraying biological and safe compounds on zamia palms infested with *Chilades pandava* after the second spray.**

Treatments	Mean numbers of infested palms		Reduction percentages
	Before treatment	30 days after treatment	
Biomagic	7.00	3.00	58.79ab
Biover	6.00	3.67	41.24c
Protecto	7.00	3.67	49.63abc
Ashok	5.67	3.00	49.10abc
Top Perfect	5.00	2.67	48.72abc
Nano oil	5.67	3.33	43.44bc
KZ oil	5.33	2.67	51.92abc
Palmetto gold	5.33	2.67	51.92abc
Captivaprim	6.00	3.67	41.24c
Castrol oil	5.67	3.33	43.44bc
Mixture of Ashok + Oly fert	4.67	2.67	45.05bc
Mixture of Top Perfect + Folk oil	6.00	2.33	62.61a
Control	8.33	8.67	-
<b>F value</b>			<b>1.29</b>
<b>LSD 5%</b>			<b>17.283</b>

values followed by different letter in column are significantly different at 5% level.

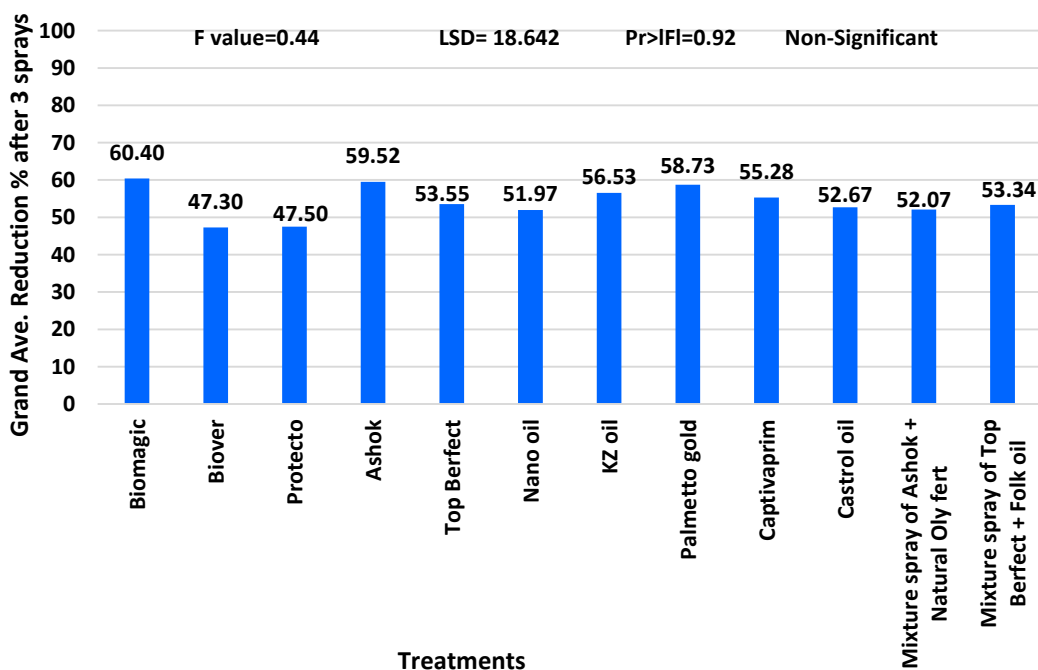
**Table (5): Effect of spraying biological and safe compounds on zamia palms infested with *Chilades pandava* after the third spray.**

Treatments	Mean numbers of infested palms		Reduction percentages
	Before treatment	30 days after treatment	
Biomagic	3.00	1.00	67.90a
Biover	3.67	1.33	47.47bc
Protecto	3.67	1.33	47.47bc
Ashok	3.00	0.67	67.90a
Top Perfect	2.67	1.00	45.83bc
Nano oil	3.33	1.00	56.67 ab
KZ oil	2.67	0.67	63.89a
Palmetto gold	2.67	0.67	63.89a
Captivaprim	3.67	1.00	60.61ab
Castrol oil	3.33	1.00	56.67ab
Mixture of Ashok + Oly fert	2.67	1.00	45.83bc
Mixture of Top Perfect + Folk oil	2.33	1.00	38.10c
Control	8.67	9.00	-
<b>F value</b>			<b>3.44</b>
<b>LSD 5%</b>			<b>15.693</b>

values followed by different letter in column are significantly different at 5% level.

As for the reduction of infestation with *C. pandava* by tested compounds was also differed after the 3<sup>rd</sup> spray, the obtained results in Table (5) indicated that highest reduction percentage was recorded for Biomagic and Ashok 67.90%, followed by 63.89% reduction for KZ oil and Palmetto gold, then 60.61% reduction for Captivaprim, while, the mixture of Top Perfect + Folk oil recorded the least reduction percentage 38.10% .Generally, the obtained results revealed

that highly significant differences in reduction percentages in the infested palm trees by *C. pandava* between tested compounds during three sprays where values recorded 0.87, 1.29 and 3.44 of each 1<sup>st</sup>,2<sup>nd</sup> and 3<sup>rd</sup> spray, while LSD 5% values were 18.649, 17.283 and 15.639, respectively. The grand average of reduction with cycad blue butterfly *C. pandava* by vital compounds after 3sprays (3months) are clarified in Figure (1).



**Figure (1): Average values of reduction percentages of cycad blue butterfly, *Chilades pandava* infested zamia palms after the three sprays of tested agents.**

The tested compounds could be arranged according to their reduction percentages against *C. pandava* as follows: Biomagic (60.40%), Ashok (59.52%), Palmetto gold (58.52%), KZ oil (56.97%), Captivaprim (55.28%), Top Perfect (53.55), Mixture of Top Perfect + Folk oil (53.34%) Castrol oil (52.67%), Mixture of Ashok + Natural Oly fert (52.07%), Nano oil (51.97%), Protecto (47.50%) and Biover (47.30%).

The obtained results are in agreement with those conducted by Batt *et al.*, 2019, who found that the reduction percentages of *C. pandava*

were recorded as 69.88 and 61.30% for fipronil 80% WG and sulfur 70% SC after 3 consecutive applications throughout 3 months on infested cycas palms naturally infested with *C. pandava*. In addition, Moore (2012) reported that the weekly using of microbial insecticide application containing *Bacillus thuringiensis* kurstaki killed the feeding caterpillars but it is not harm other organisms, so that, It is not necessary to foliar on the whole palm. To seek more effective biocontrol management, Hai-yan *et al.*, (2015) evaluated the biological pesticides: matrine, *B. thuringiensis*, Abamectin and Mineral oil to

control *C. pandava* larvae and found that these biological agents had an evident control effect, so, it may be suggest to control this pest.

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## دراسة تواجد أبو دقيق السيكاس *Chilades pandava* الذي يصيب نخيل الزاميا ومكافحته ببعض المركبات الحيوية والأمنة

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### الملخص العربي

تم إجراء تجربة حقلية لمدة عامين متتاليين ٢٠٢٢-٢٠٢٣ لدراسة التذبذب العددي لحشرة أبو دقيق السيكاس الزرقاء علي نخيل الزاميا في قرية ابو غالب محافظة الجيزة ومكافحتها بواسطة بعض المركبات الحيوية الأمنة. وقد أظهرت النتائج أن أعلى متوسط لأعداد النخيل المصاب بالآفة تم تسجيله أثناء شهر مايو بمتوسط ١٤,٦٧ و ١٥,٣٣ نخلة، يليه خلال شهر اغسطس بمتوسط ١٤,٥ و ١٤,٧٦ نخلة، بينما سجلت النتائج أقل متوسط خلال شهر يناير بمتوسط ٢,٦ و ٣,٦٧ نخلة وخلال شهر فبراير بمتوسط ٤,٠٠ و ٤,٦٧ نخلة، وذلك خلال موسمي الدراسة ٢٠٢٢ و ٢٠٢٣ على التوالي.

وكذلك تناولت الدراسة تأثير بعض المركبات الحيوية الأمنة على الإصابة بحشرة أبو دقيق السيكاس علي نباتات الزاميا. حيث أوضحت النتائج أن المعاملة بمركب توب برفكت أعطى أعلى نسبة خفض لأعداد النباتات المصابة بمتوسط ٦٦,٩٪ يليه خليط مركب أشوك مع الزيت الطبيعي أولي فيرت بمتوسط ٦٥,٣٣٪، في حين سجلت المعاملة بمركب بروتكتو أقل نسبة خفض لأعداد النباتات المصابة بمتوسط ٤٥,٤٠٪ بعد الرشة الأولى. بينما كانت المعاملة بخليط توب برفكت مع زيت الفولك الأعلى في نسبة خفض أعداد النباتات المصابة بمتوسط ٦٢,٦١٪ يتبعه المعاملة بمركب بيوماجيك بمتوسط ٨٥,٧٩٪ بعد الرشة الثانية، بينما كان مركب بيوفار وكابتيفابرايم الأقل في نسبة الخفض بمتوسط ٤١,٢٤٪ لكل منهما بعد الرشة الثانية على التوالي. أما بعد الرشة الثالثة فقد سجلت المعاملة بمركب بيوماجيك والأشوك أعلى نسبة خفض لأعداد النباتات المصابة بمتوسط ٦٧,٩٠٪ لكل منهما بينما أعطت المعاملة بخليط توب برفكت مع زيت الفولك أقل نسبة خفض بمتوسط ٣٨,١٠٪. وقد أوضحت النتائج أن ترتيب المركبات الحيوية المختبرة وفقا لفاعلية خفض أعداد النباتات المصابة بعد ثلاث رشات متتالية كالآتي: بيوماجيك (٦٠,٤٠٪)، أشوك (٥٩,٥٢٪)، بالميتوجولد (٥٨,٥٢٪)، زيت كفر الزيات (٥٦,٩٧٪)، كابتيفابرايم (٥٥,٢٨٪)، توب برفكت (٥٣,٥٥٪)، خليط توب برفكت مع زيت الفولك (٥٣,٣٤٪)، زيت كاسترول (٥٢,٦٧٪)، خليط أشوك مع الزيت الطبيعي أولي فيرت (٥٢,٠٧٪)، زيت النانو (٥١,٩٧٪)، بروتكتو (٤٧,٥٠٪) وبيوفار (٤٧,٣٠٪). وتأتي هذه الدراسة في ظل انتشار الآفة في كثير من المشاتل والحدايق وإصابتها لنخيل الزاميا وتسببها في خسائر فادحة مع عدم توافر برامج مكافحة لهذه الآفة الهامة، وكذلك للحد من التأثيرات الضارة لاستخدام المبيدات الكيماوية.