

Immature stages of *Chilades pandava* (Lepidoptera:Lycaenidae), a new pest of *Cycas* spp. in Egypt

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ABSTRACT

Morphological studies of the egg, larva and pupa stage of the cycas blue butterfly, *Chilades pandava* (Lepidoptera: Lycaenidae), a new pest of cycas palm trees, was carried out using SEM photographs. The eggs are turban-shaped with flattened base and a depression at the top, which containing the micropyle surrounded with number of petals. They were 4, 8, 11 and 9 in the first, second, third and fourth rows, respectively. First instar larvae are light pink in colour about 1 mm. in length, second instar slightly darker, about 5 mm. in length, the third instar about 9 mm., while the last instar is about 15 mm. in length. Antenna composed of three segments (An1, An2 and An3) and bears sensory setae. The basal segment short and flat, the second cylindrical twice as long as the first. Prothorax has one pair of circular spiracles bordered with dark brown peritreme. The Abdomen consists of ten segments with a pair of lateral spiracles on each of the 1st to 8th segments except the last pair is oval in shape. The obtect pupa is quite smooth; fuscous, the dorsal aspect is darker than ventral one. It measures from 9 to 12 mm in length.

Key words: *Chilades pandava*, Immature stages, Cycastrees, Egypt

INTRODUCTION

Cycas spp. (Cycadophyta) are commercially valuable palms, cultivated and grown in gardens and city parks. They are used for the production of sago (starch flour), as well as an ornamental plant. Sago palms are evergreen plants, resembling miniature palms. Dark green, feathery leaves form a rosette coming out of a single point at the top of the trunk (Northrop *et al.*, 2010). Chang (1989) mentioned that the lycaenid butterfly pest, *Chilades pandava* Horsfield, is an important pest of cycas palm tree in Taiwan. This pest was found in Spain in 1996 feeding on *C. revoluta* (Schreiner and Nafus, 1997). Then it was recorded in Mauritius by Macdonald *et al.* (2003) and also in Sulawesi by Vane-Wright and De Jone (2003). Moore *et al.* (2005) mentioned that *C. pandava* is native to southern Asia invaded Guam. Wu *et al.* (2009) mentioned that *C. pandava* butterfly was recorded in Kinmen offshore of Fujial for the first time in 2007. Marler *et al.* (2012) recorded 85 hosts of this insect belonging to family Cycadaceae. Fric *et al.* (2014) mentioned that a group of blue butterflies were collected from a privet garden in Birqash, Giza, in the Nile Delta about 25 km NW of Cairo and from Al Qanatir, Qalyubia about 20 km north Cairo in 2012. This butterfly was identified as *C. pandava*, this new record not only for Egypt but also for continental Africa and the Mediterranean region.

Recently, during 2014, in Alexandria governorate and the North coast, *C. revolute*, *C. circinalis* and *C. rumphii* palm trees were observed that attacked with this lycaenid blue butterfly, its

larvae bore into young shoots making sever damage leading to the death of the palm tree.

This investigation aimed to describe the different immature stages of this insect. SEM photograph were presented.

MATERIALS AND METHODS

The specimens used in this study were collected from the infested cycad trees, *C. revolute*, in El-Chatby district (31°12'18.62"N, 29°55'8.86"E), in the arboretum of the Faculty of Agriculture, Alexandria University in June, 2014.

To prepare the immature stages for Scanning Electron Microscope (SEM) examination, they were dried in 95% alcohol for several days, and then mounted on copper stub by using double faced adhesive tape. The mounted specimens were coated with gold in a Joel JEC-1100E for 18 minutes to thickness of 12 nm. They were examined and photographed in JEOL (JSM-5300) scanning electron microscope at the Faculty of Science, Alexandria University.

RESULTS AND DISCUSSION

The damaged cycas plants with *Chilades pandava* Horsfield (Lepidoptera: Lycaenidae: Polyommatainae: Polyommataini) show wilt of top bud and can not longer grow. The larvae bore in young fronds making tunnels (Figure 1 A and B) and feed through the leaf or tunnel tissues and also in young stems. The Cycad new leaves appear to be dwarfed, pale green or yellowish colour (Figure 2 A). After the first or second molt they burrow into

the stalk causing severe damage to the plant leading to death of the tree (Figure 2 B).

Description of the immature stages:

Eggs: Gravid female of *C. pandava* lay eggs individually on the undersides of young leaves or attached to their edges. The eggs are turban-shaped with flattened base and a depression at the top, which containing the micropyle. It is pale green in colour initially but turns blackish just before hatching. It is about 0.43 mm. SEM examination of the egg shell showed its architecture pattern (egg decoration) which is depending on the arrangement of ovariol follicular imprints (Figure, 3A). The micopyler apparatus is located at the anterior pole of the egg. The micopyler pit is surrounded by a rosette of 3 - 4 rows of polygonal petals (4 – 6 sides). Number of petals were 4, 8, 11 and 9 in the first, second, third and fourth rows, respectively (Figure 3B). The rest of egg shell ridged imprints are hexagonal in shape, each one divided into 6 triangles with a protuberance on each angle, some of

them with fine pore (the aeropyle) which conducted ambient air to the oocyte (Figure 3C).

Larvae: The larvae are elongate (onisciform), slightly flattened especially in the last larval instar, with small, black, shining head capsule concealed in the thoracic segments. They have two distinct colours, either bright green or dark reddish purple. First instar larvae are light pink in colour about 1 mm in length, second instar slightly darker, about 5 mm. in length, the third instar about 9 mm., while the last instar is about 15 mm. in length (Figure 4 A, B, C & D). Dark longitudinal lines are extending through the body length. The dorsal line is the darker and wider one and surrounded by thin, irregular white lines. Addorsal, supraspiracular and the spiracular lines are slightly lighter and thinner than dorsal line. Supraventral and ventral lines are yellowish and whitish in colour, respectively. The larva is attended by ants which milk it to obtain a sugary fluid secreted from a gland on the dorsum of 7th abdominal segment.



Figure 1: A) the larva of *Chilades pandava* inside the tunnel B) green larva on the rolled young frond

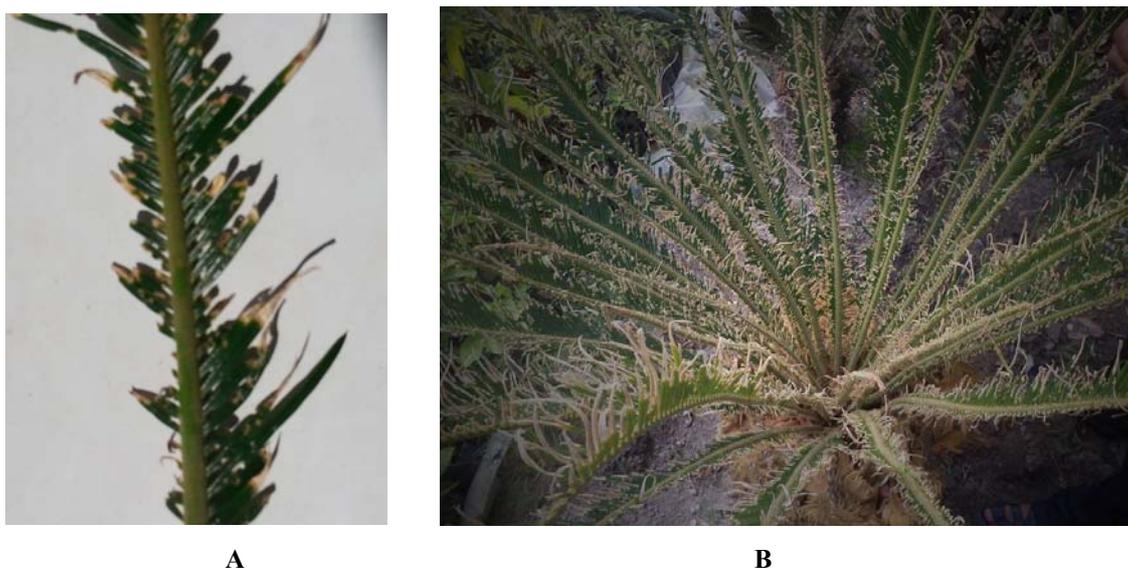
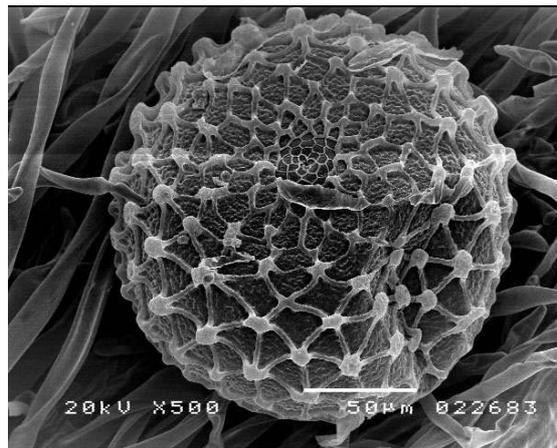
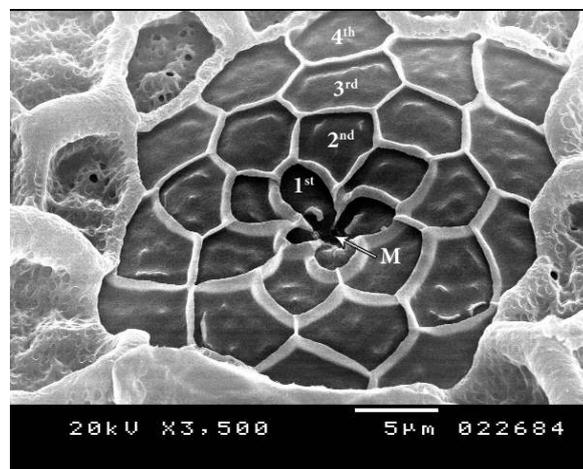


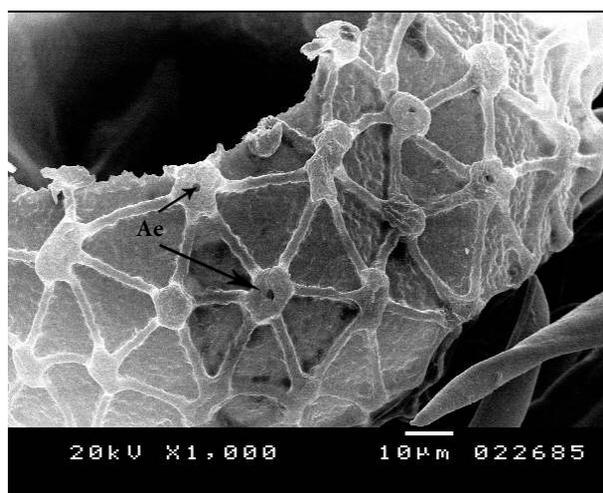
Figure 2: A) the dwarfed, pale green leaves B) severe damage caused by *Chilades pandava* butterfly



A



B



C

Figure 3: SEM photographs of *Chilades pandava* egg A) general appearance B) magnification of sculpture of micropyle C) sculpture of egg shell. Ae. aeropyle, M. micropyle, 1st, 2nd, 3rd and 4th rows of rosette petals.



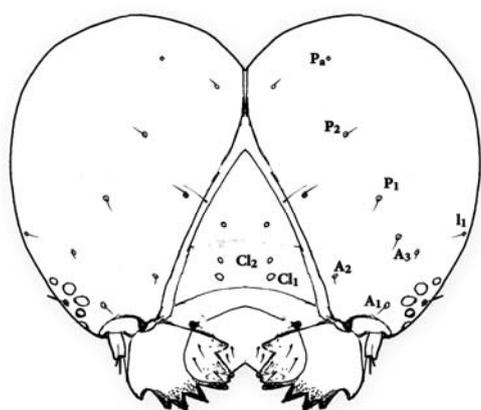
Figure 4: Larval instars of *C. pandava* A) first , B) second, C) third and D) fourth (4X).

Head capsule:

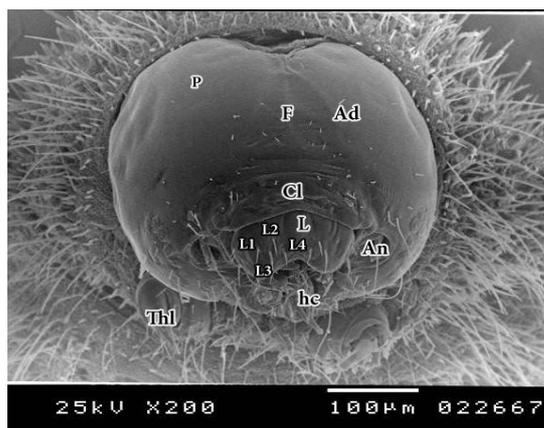
The head capsule of *C. pandava* larvae (Figure, 5) as all lepidopterous larvae composed of several sclerites (epicranium (E), frons (F), clypeus (Cl) and adfrontal sclerites (Ad)). It has also, an epicranial inverted Y shaped suture. Each sclerite with tactile, minute setae and punctures (Figure 6). Setae on the epicranium are distributed in groups, anterior group consists of three setae (A1, A2 and A3), posterior group of two (P1 and P2) and a lateral one. Three setae on ocellar group (O1, O2 and O3) (Figure, 6) and subocellar group (So1, So2 and So3) in addition to a genal seta (G1). Frons has one pair of tactile setae (F1) as well as the clypeus has one pair (Cl1 and Cl2). Each adfrontal sclerite has pair of tactile setae. Labrum is an oblong notched sclerite bearing four pairs of lateral tactile setae (L1, L2, L3 and L4).

Stemmata (lateral ocelli) as most lepidopterous larvae are six on each side of the head capsule, five of them arranged in semicircle and the last one on the center, each of them with polygonal sculptures (Figure, 6).

Antenna (Figure, 7) composed of three segments (An1, An2 and An3) and bears sensory setae. The basal segment is short and flat, the second cylindrical twice as long as the first. It bears a long trichoid sensillum (Tr), a stylonic sensillum (Ss), and a sensillum basiconica. Third segment is the smallest one and bears two sensilla basiconica (Sb). The mandibles of the biting mouth parts provided with seven sclerotized sharp pointed teeth. Maxillolabial hypopharyngeal complex with a smooth hypopharynx at its apex. The maxillae stipes carries a three segmented maxillary palp which has eight basiconic sensilla (Sb) at its apex (Figure, 8).



A



B

Figure 5: A) diagram showing chaetotaxy of head capsule B) SEM photograph showing the head capsule of *Chilades pandava* larvae, Ad., adfrontal sclerite; An., antennae; A1 –A3., anterior seta; Cl., clypeus; Cl1-Cl2 clypeal setae, F., frons; hc., maxilo-lapial- hypopharyngeal complex; L., labrum; L1, L2, L3 & L4., labral setae, P., partial; P1 – P2 posterior setae, Pa puncture and Thl., thoracic legs.

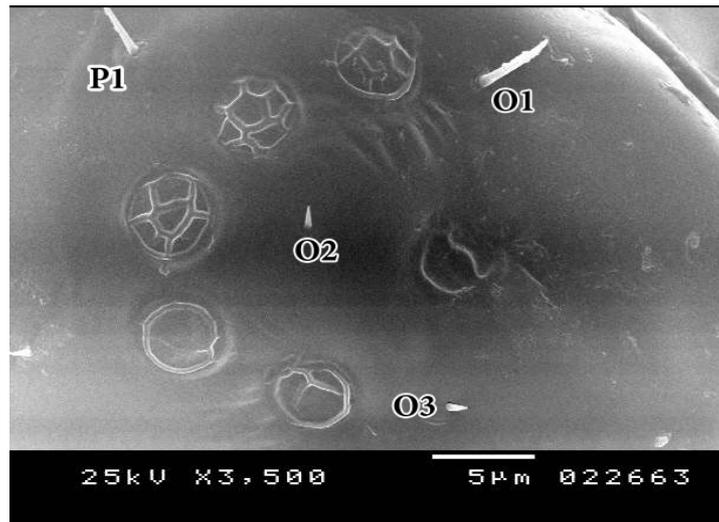


Figure 6: SEM photograph showing stemmata (lateral ocelli), O1, O2 and O3. ocellar group of setae and P1 lateral seta.

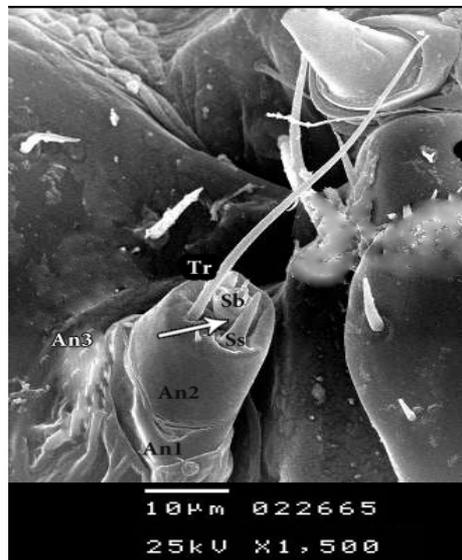


Figure 7: SEM photograph showing antennae of *Chilades pandava* full grown larvae, An1, An2 and An3., antennal segments; Sb., sensilla basiconica; Ss., sensilla styleconica and Tr., trichoid sensillum.

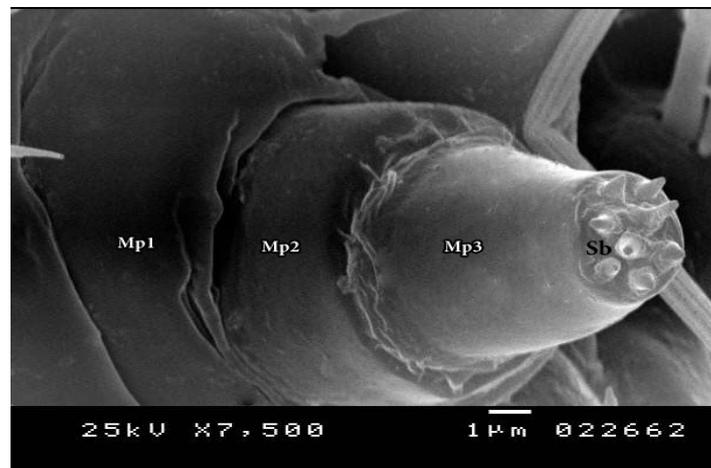


Figure 8: SEM photograph showing maxillary palp of *Chilades pandava* full grown larvae; Sb., sensilla basiconica.

The prementum carries spinneret (S) and labial palp (Lp). Each labial palps has short setae and one long trichoid sensillum. The spinneret (S) is cylindrical with circular opening at its apex (Figure, 9).

All body segments are densely covered with numerous minute setae (Figure, 10 A and B). Prothorax has one pair of circular spiracles bordered with dark brown peritreme and the thoracic shield is dark brown in colour.

The Abdomen consists of ten segments with a pair of lateral circular spiracles on each of the 1st to 8th segments. Spiracles more or less similar in shape except the last pair which is oval and larger. As most lepidopterous larvae, there is a pair of prolegs on the 3rd to the 6th and 10th abdominal segments. As most lycaenid larvae the proleg is a fleshy conical projection bearing on its distal margin crochets. The crochets (cr) are arranged in a mesoseries which is interrupted by a median fleshy lobe (Fl), they differ in the different instars of larvae (Braby ,2000). Crochets are uniordinal in the first instar (Figure, 11A), while the mature larvae have biordinal

crochets which well developed near the center and very small near the ends (Figure, 11B).

Pupae: Pupation takes place in the rolled leaf shelters or in tunnel created by the larva. The larva cleans and expands the tunnel prior to pupation, leaving only a thin layer of plant tissue for the butterfly to break through its emergence. The pre-pupa (Figure 12A) prepares for pupation by spinning a silk girdle (central girdle) and a silk pad to which it attaches itself via anal hooks. The obtect pupa is quite smooth; fuscous, the dorsal aspect is darker than ventral one. Depending on the colour form of the final instar larvae, the pupa can be dark yellowish green almost entirely, or yellowish to dark reddish brown with numerous black spots (Figure 12B). It measures from 9 to 12 mm in length. Pupa has eight pairs of spiracles, one on prothorax just in front of wing base, and on abdominal segments 2 to 8. The posterior segments of abdomen are flattened and bear prominent pointed tubercles, the distal segment bears hooks which fastening the pupae to the silk pad (Figure, 13).

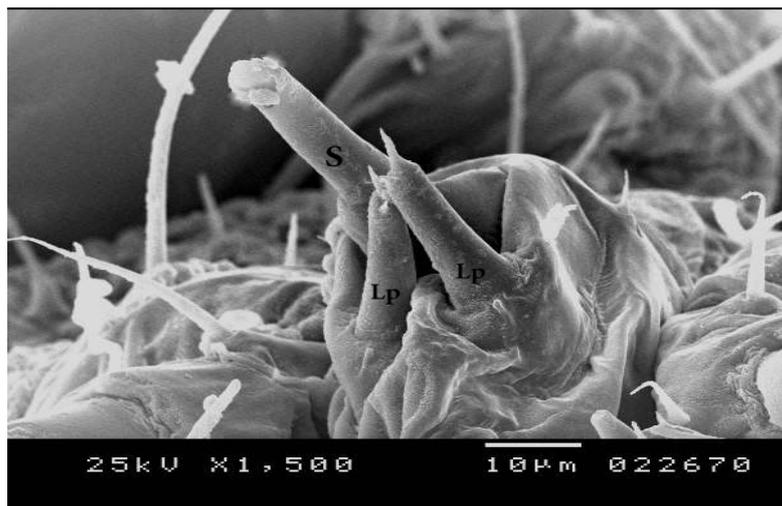


Figure 9: SEM photograph showing spinneret (S) and labial palp (Lp) of *Chilades pandava* full grown larvae,

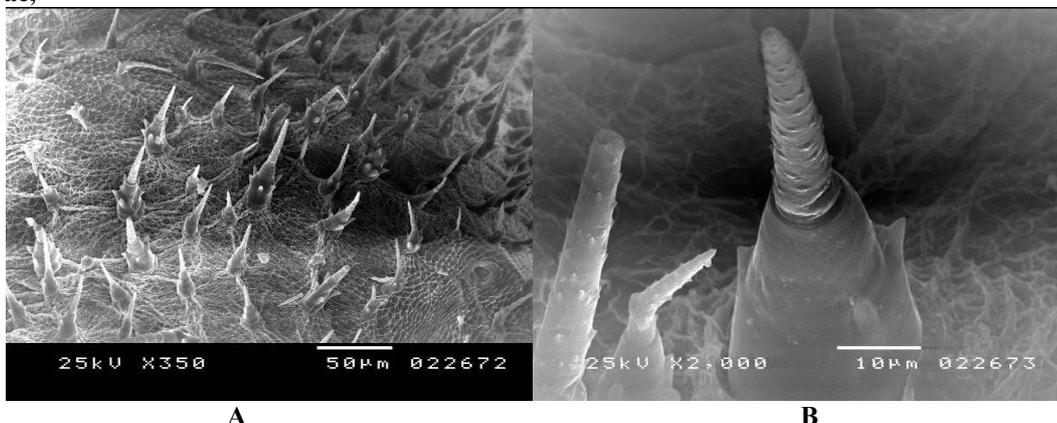


Figure 10: SEM photograph showing A) the very dense fine setae covering body B) magnification of one of the covering setae.

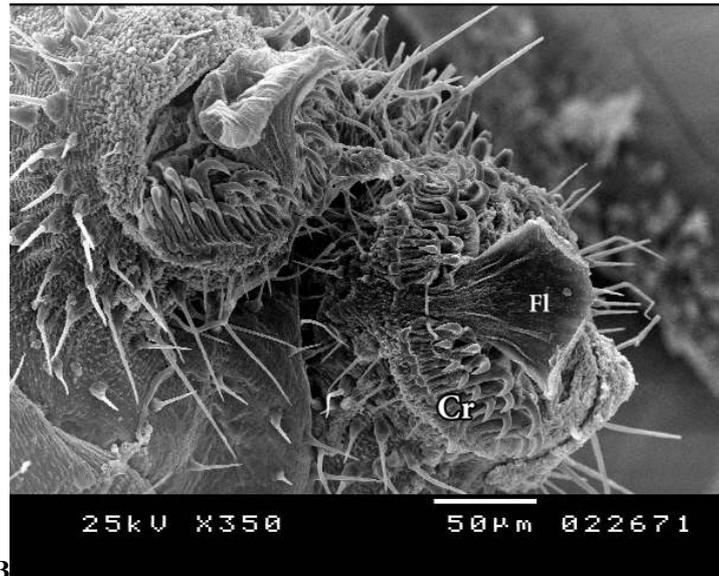


Figure 11: SEM photograph showing prolegs with crochets A) first larval instar B) mature larval instar. Cr., crochets; Fl., fleshy lobe.



Figure 12: showing A) prepupae B) ventral and dorsal side of *Chilades pandava* pupae. V. ventral side; D. dorsal side.

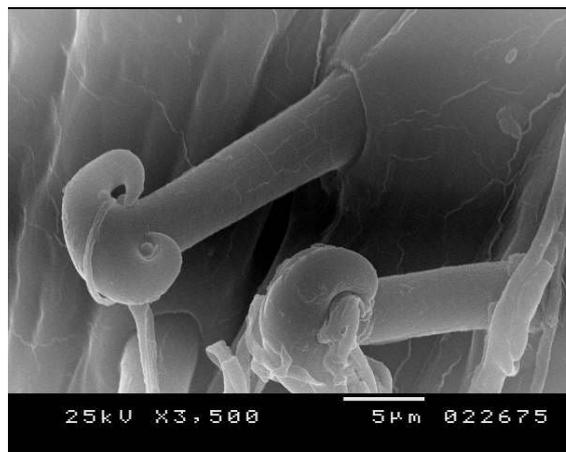


Figure 13: SEM photograph showing anal hooks in the ventral view of the posterior segments of abdomen of *C. panadava* pupae

REFERENCES

- Braby, M. F. (2000). Butterflies of Australia, Their identification, biology and distribution. Volum 1., CSIRO pp101.
- Chang, Y. C. (1989). Morphology, life history and damage of cycas blue butterfly *Chilades pandava* as well as pathogenicity of entomogenous fungus to its larva. Bull. of Taiwann For. Res. Inst. New Ser. **4(1)**: 43 – 50.
- Fric, Z.; R. Dickinson; G. Fetouh; T. B. Larsen; W. Schon and M. Wiemers (2014). First record of the cycas blue, *Chilades pandava*, in Egypt- a new invasive butterfly species in the Mediterranean region and on the African continent (Lepidoptera: Lycaenidae). African Entomology **22(2)**: 315 – 319.
- Macdonald, I.A.W.; J.K. Reaser; C. Bright, L.E. Neville; G.W. Howard; S.J. Murphy and G. Preston (2003). Invasive alien species in southern Africa: national reports & directory of resources. Global Invasive Species Programme, Cape Town, South Africa. Mauritius. <http://www.gisp.org/downloadpubs/SOUTHERN>.
- Marler, T. E.; A. J. Lindstrom. and L. I. Terry (2012). *Chilades panadava* damage among 85 cycas species in a common garden setting. Hort. Science **47(12)**: 1832 – 1836.
- Moore, A.; T. E. Marler; R., Miller and R., Muniappan (2005). Biological control of cycad aulacaspis scale on Guam. The Cycad Newsletter **28**: 6 – 8.
- Northrop, R. J.; M. G., Andreu; M. H. Friedman; M. McKenzie and H. V. Quintana (2010). *Cycas revoluta*, Sago Palm. University of Florida. <http://edis.ifas.ufl.edu/fr316>.
- Schreiner, I.H. & D.M. Nafus 1997. Butterflies of Micronesia. University of Guam Press. <http://www.micronesianinsects.com/PUB/ButterfliesOfMicronesia.pdf>
- Vane-Wright, R. I. and R. deJone (2003). The butterflies of Sulawesi: annotated checklist for a critical island fauna. Zool. Verh. Leiden. pp. 343.
- Wu, L.; L. C. David and H. Yu-Feng (2009). Tracing the origin of *Chilades panadava* (Lepidoptera, Lycaenidae) found at Kinmen island using mitochondrial COI and COII gene. BioFormos **44(2)**: 61 – 68.

Lycaenidae

*Chilades pandava**Chilades pandava* Horsfield