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CYCAD BLUE BUTTERFLY *CHILADES PANDAVA PANDAVA* HORSFIELD, 1829 (LEPIDOPTERA : LYCAENIDAE) INFESTATION ON *CYCAS REVOLUTA* IN BENGALURU

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A survey was undertaken in Bengaluru on cycad blue butterfly, *Chilades pandava pandava* (Lepidoptera : Lycaenidae) infestation on the King sago palm, *Cycas revoluta* during June-August 2014. The survey-locations included residential places, parks, botanical gardens, Institutes and nurseries. Number of cycads, height and extent of damage by larvae of the butterflies was recorded and scaled (0-100%) at each location. The extent of damage was minimal to severe in the newly emerging fronds. Mean percent infestation considering all species of cycads was 16.4 ± 27.4 (*Cycas revoluta* comprised 18.8 ± 28.75, while other cycas species comprised 2.8 ± 10.25). Hence, necessary management measures including monitoring the spread and neem based botanical sprays can be envisaged to check the damage caused by the butterfly.

Key words : *Chilades pandava pandava, Cycas revoluta,* Bengaluru

INTRODUCTION

Cycads are the most ancient seed plants still living today, with fossils that date to the late Carboniferous period some 300–325 million years ago (Donaldson, 2003). Cycads in India are represented by one genus *Cycas* which comprises nine species and one variety. *Cycas annaikalensis*, *Cycas circinalis*, *Cycas beddomei*, *Cycas indica*, *Cycas nathorstii*, *Cycas pectinata*, *Cycas swamyi*, *Cycas sphaerica*, *Cycas zeylanica* and *Cycas circinalis var. orixensis*. Local people have also selectively removed cycads for a number of other purposes in the past (*e.g.* as pig food, as a source of starch for liquor production, for food in famine times, and for traditional medicines) (Hill *et al.*, 2003). The King sago palm, *C. revoluta* are commercially cultivated and grown in gardens and city parks.

Oriental plains Cupid, *Chilades pandava pandava* Horsfield, 1829 (Lepidoptera: Lycaenidae) is a specialist insect native to southern Asia and one of the invasive arthropod herbivores causing greatest threats to cycad conservation both *in situ* and *ex situ*. *Ch.p.pandava* is a voracious feeder of soft, expanding Cycas tissue. *C. pandava* is a specialist insect native to southern Asia and one of the Invasive arthropod herbivores causing greatest threats to cycad conservation both in situ and ex situ. Four subspecies of this cycad specialist *Chilades pandava lanka* (Sri Lanka), *Ch p. peripatria* occurs exclusively in Taiwan, *Ch p. vapanda* occurs in the Philippines and *Ch p. pandava* is found in mainland China and Southeast Asia. As a result of cycad cultivation *C. pandava* has spread either by migration or by accidental introduction to many of the warmer parts of the world. In 2000 it was discovered in Mauritius, 2500 miles from its native habitat, and rapidly became a pest of cultivated cycads. The cycad blue, *C. pandava,* was recorded from Egypt for the first time. According to molecular analysis, the species appears to have originated from South China or Northern Indochina, and was probably introduced with ornamental *Cycas plants* (Fric *et al.*, 2014). Eighty five species

showed susceptibility (Marler *et al.*, 2012). Butterfly caterpillar damage was present in 40% to 60% of the trees from mid-2010 until early 2013 on *C. micronesica* in *Guam* (Marler *et al.*, 2013). In India, Raju (2009) recorded *C. pandava* on red-listed *Cycas sphaerica* and *C. beddomei*. *C. p. pandava* is thus emerging as a greatest threat to cycads as it damages tender fronds making it an unusually formidable pest. So, a survey was undertaken in Bengaluru on *C. p. pandava* infestation on the King sago palm, *Cycas revoluta* during June-August 2014.

MATERIALS AND METHODS

The survey to record *C. pandava* infestation on the *C. revoluta* was undertaken during June-August 2014 in Bengaluru. The survey locations included residential places (4), parks/ botanical gardens (3), Institutes (5), Hospitals (2), Road avenues (2), Defense centers (2) and prominent monumental buildings (3). Number of cycads and extent of damage by larvae of the butterflies was recorded and scaled (0-100%) at each location. Co-occuring pests, predators and ants tending to the larvae were also recorded.

RESULTS AND DISCUSSION

Damage symptoms incurred due to scrapping by the larval feeding caused browning and drying of tender fronds, leading to fading and falling of emerging fronds and infested plants lost ornamental value compared to healthy trees (Figs. 3 & 4).

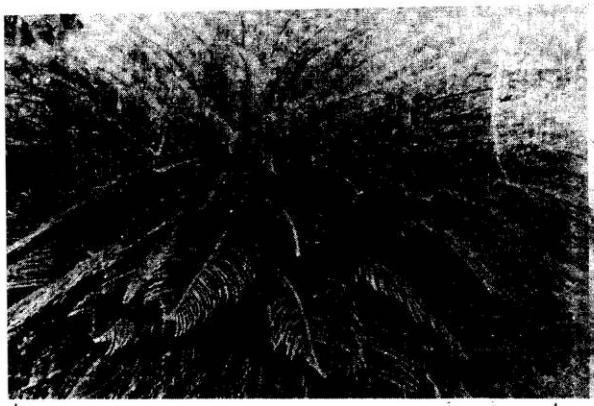

Fig. 1 : Feeding damage by butterfly larvae

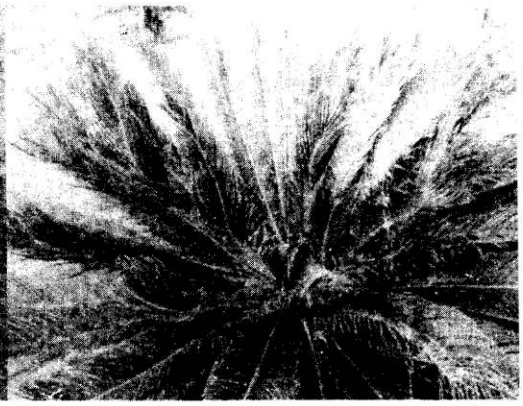

Fig. 2 : Undamaged cycas tree

The extent of damage was minimal to severe in the newly emerging fronds. A total of 11 adults spotted in 2 sites *viz.*, Indian Institute of Horticultural Research (IIHR) and Lalbagh and 50 larvae in 2 locations, IIHR and St. Joseph's College, Bengaluru. Mean percent infestation considering all species of cycads was 16.4 ± 27.4 (*Cycas revoluta* comprised 18.8 ± 28.75, while other cycas species comprised 2.8 ± 10.25). The extent of damage in *C. rebvoluta* was proportionately higher compared to other cycad species (Fig. and Table I). Myrmecophilous associations with ant species, *Camponotus campestris* was observed in locations with the larva (Fig. 4). *C. p. pandava* exhibits seasonal polyphenism and is detailed by Tiple *et al.* (2009) and Kunte & Tiple (2009). The wet season form is shown in Fig. 5. *C. p. pandava* is reported to exhibit melanism, variants

with 2-, 3- and 4-spots on the underside of the hind wing. During the present observations the four spotted variants were recorded at IIHR (Fig, 6).

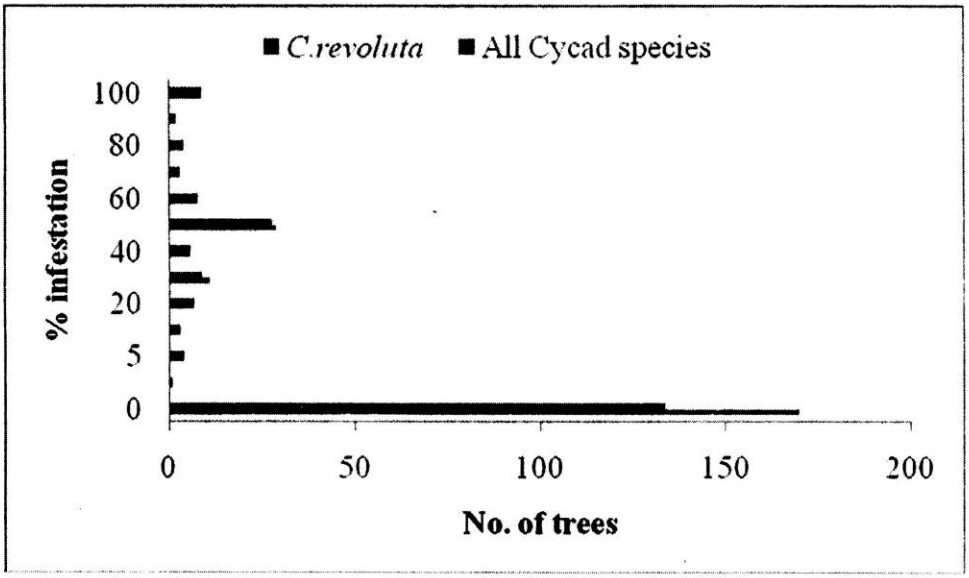

Fig. 3: Infestation of cycad butterfly on cycads.

Table I: Comparison of infestation of *C. p .pandava* on cycad species.

Infestation (%)	All species	*C. revoluta*
0	66.14786	61.46789
50	11.28405	12.84404
100	3.501946	4.12844

Fig. 4 : Ants attending to *C. p. pandava* larvae on *C. circinalis*

Fig. 5 : Wet season form

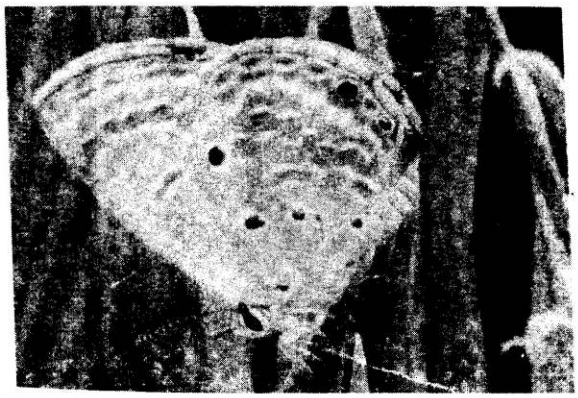

Fig. 6 : Four spotted variant

Although microsite variation throughout the garden and disparity in age and size of the trees are potentially confounding factors, on the contrary trees of different age groups were found infested in few cases during the present observations. Leaf damage by the butterfly is highly heterogeneous among closely planted cycas plants. According to observations made by Wu *et al.* (2010), horticultural plantings of *C. revoluta* in Taiwan lead to irruptions of the native *C. pandava* increasing the threats to the endemic, endangered *C. taitungensis* populations. *C. revoluta* was found highly susceptible species (Marler *et al.*, 2012) and damages aesthetic appeal and facilitating spread to natural habitats.

The focus of the present study was on *C. pandava*, but in the real world, a cycad plant is attacked by multiple herbivores (Marler, 2013). Even during the present survey numerous trees infested with pink wax scale, *Ceroplastes rubens* was observed. Additionally a range of co-occurring fauna, the common Madras snail, *Cryptozona bistrialis*, spiders, praying mantis and bugs were noticed. Identifying natural enemies needs to be undertaken. Hence, information pertaining to the life history patterns, host range and habitat associations of butterflies is essential prior to designing the garden. In case of severe incidence cultural practices including cutting and destruction of damaged parts, using mesh nets in nurseries may be undertaken. Neem based botanical sprays can be undertaken to check severe infestation. Management decisions on understanding how the butterfly relates to its native host Cycas species in natural habitats and how it relates as a pest to novel Cycas host species in horticultural ecosystems needs attention

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