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Adverse Environmental Condition Causes Shifting of Behaviour of *Tetraponerasp* (Slender Ants) from Aggressive, Ecological Dominance to Resource Partitioning, Coexistence with Other Arthropods Pest of *Cocos nucifera* L. Plant

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Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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Short Research Article

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ABSTRACT

Slender ant belonging to the genus *Tetraponeraspis* ecologically dominant, aggressive species don't believe on resource partitioning and coexistence with other arthropod species in their natural habitat. With help of their peptide containing venom they can paralysed and deterred other species from their host plant.

After Amphan, a super-cyclone which strike on Gangetic plane, West Bengal, on 20th May, 2020 caused destruction of lots of plants due to high wind velocity (155km/hour). This adverse

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environmental condition causes food scarcity and lost of habitat of *Tetraponerasp* which resulted into changed their behaviour. It make them natural pest of *Cocos nucifera* by sharing their habitat with carpenter ants, pest beetle of coconut and causes huge damage of growing coconuts.

Keywords: Cocos nucifera; Tetraponera; dominance; Swietenia macrophylla; coexistence; resource partitioning.

1. INTRODUCTION

Cocos nucifera belonging to the family Arecaceae, is a monocotyledonous, erect or slightly curved plant without any branching. It is nearly about constant diameter, variable length stemmed palm tree with swollen base. At the top of stem was provided with crown of spirally arranged leaves. *C. nucifera* is a perennial tropical tree and the endocarp part of coconut is used for oil extraction and feeding purpose (Mialet-Serra et al., 2008). It also has lots of similarity with other large grasses species i.e. sugarcane on the basis of their structure and sucrose production (Komar, 2000).

According to Seni et al., (2019), there are seven arthropod pests were reported, which were affected on *C. nucifera* fruit, leaf and other part of plant.

*Oryctes*sp, Asiatic rhinoceros beetle is one of the major arthropod pest on *C. nucifera,* was biologically controlled by predatory efficacy of larger ant. (Staypley., 1973) *Tetraponera* ants preferably habitat on larger leaf bearing mahogany plant (*Swietenia macrophylla*) belonging to the family Meliaceae. This plant is predominantly distributed in India and other parts of Indian Peninsula.

Slender ants belonging to the genus *Tetraponera* are characterised by their arboreal nature and cylindrical structure. These ants are commonly found in warmer part of Africa, Asia and Australia. Due to its aggressive behaviour, they also protected its host plant from different invader i.e. mostly katydids or leaf beetles. They can establish their mutualism behaviour with host plant by taking food, shelter whereas they also provide protection to host plant (Young et al., 1996). They form their nests in cavities of dead or living wood and worker are more aggressive in nature.

According to Ward., (2001), burrows which were created by larvae of beetle (Crambycid) on *Santalum album* are some time occupied by *Tetraponera* sp. Dejean et al., (2008) reported that after perceiving vibrations caused by landing of other insects (adult leaf beetles, larger katydids) on host plant resulted into rush of *Tetraponera* around invader and finally prayed on them. Dejean et al., (2008) reported that several species of ants, other arthropods and *Tetraponeratessmanni* were competed for their resource provided by young *Vitex thyriflora* but finally *Tetraponera* become winner and protect host plant from invasion of others.

According to Barasse et al., (2019), the venom of *Tetraponera aethiops* is mixture of twelve peptides, out of which nine are mature peptides were sequenced and they are responsible for rapid paralysis of invader ants and other arthropod species.

2. MATERIALS AND METHODS

The study was conducted through five consecutive years i.e. from 2018 to 2022, at Debipur, west Bengal, India. In these experimental periods total numbers of coconuts were collected in every year were recorded properly and any type of damaged were tried to be identified properly.

At Debipur there are two plants were grown and matured side by side and age of this two plants are nearly about seventeen years. On 20th May, 2020, super cyclone Amphan, strike on Ganges Delta (West Bengal and Bangladesh) containing speed of 155 km/ h and it was one of the strongest tropical cyclone within recent period.

3. RESULTS AND DISCUSSION

As a result of this incidence *S. macrophylla* was broken by high wind velocity of Amphan. In previous two years nearly about 90% of coconuts were matured without any type of damage by slender ants but damaged by other pest population were recorded with insignificant percentage. Because this *C. nucifera* plant was regularly cleaned and the base of plant was always remain clean by regular application of weedicide and insecticides.

Table 1. Major arthropods pests of *C. nucifera* (According to Seni., 2019)

Sl.No	Common name of pest	Scientific name of pest	Respective Order of pest	Type of damage on host
1	Coconut black caterpillar	*Opisinaarenosella*	Lepidoptera	Mainly brunt like appearance of leaf and immature nuts shed heavily.
2	Rhinoceros beetle	*Oryctes rhinoceros*	Coleoptera	Penetrated into the centre of the crown and feeds on growing tissue.
3	Red palm weevil	*Rhynchophorusferrugineus*	Coleoptera	Feed large number of tissue within stem and brownish black fluid oozing out from stem.
4	Coconut eriophyid mite	*Aceriaguerreronis*	Acarina	They feed on side of the fruit meristem and release gummy exudation from surface of fruits.
5	Coconut scale	*Aspidiotus destructor*	Hemiptera	Yellow spot appear on leaf and finally turn into brown colour. Fruits become discoloured and felled prematurely.
6	Slug caterpillars	*Contheyla rotunda, Macroplectranararia, Latoialepida*	Lepidoptera	They damaged on buds, shoots of flower and growing fruits. They created lesion of leaf surface.
7	Termite	*Odontotermesobesus*	Isoptera	They mainly targeted on coconut seedling.

Table 2. Year wise production of coconuts and their damages by slender ants and other pest populations

Sl No	Year of study	Number of collected coconuts	Percent of damaged by *Tetraponerasp*	Percent of damaged by other pest populations
1.	2018	95	8.4%	0%
2.	2019	97	7.2%	0%
3.	2020 **(Amphan super cyclone)**	87	1.5%	65%
4.	2021	90	3.7%	27%
5.	2022	95	5.3%	6.3%

At the natural circumstances different pest of *C. nucifera* were recorded till now are tabulated with their common name and respective order they can belong.

After Amphan in 2020, it was also noticed that percentage of damage by *Tetraponera* sp was increased dramatically whereas damaged by other pest were decreased. But on 2020 damaged percentage by *Tetraponera sp* and other pest were reached nearly about equal.

When *S. macrophylla* was broken by high wind of Amphan, all slender ants were sheltered on it for their feeding and habitat purpose. In 2020, 65% of mature coconuts were damaged by attacked of *Tetraponera*.

It was also noticed that after Amphan, all affected coconuts have pore which were created by *Tetraponera*sp and when we broken shell of coconuts, we found different stages of damage, which are enlisted sequentially and damaged were caused by *Tetraponera*sp not by other pest.

a. In some cases total endosperm part was converted into black colour without any water, hollow part was filled with different life cycle stages of *Tetraponera sp*. In all cases ants create prominent hole on coconut to enter within shell.

b. In other instances, water of coconut was dried as well as majority white parts were fed by ants. According to my opinion, ants attacked on this coconut at late stage of its maturation.

c. In another type, the shell of coconut was shrunken and their fibrous, endosperm parts were completely damaged due to attacked by earlier stage of ant.

d. After 2022, *Tetraponera* sp damaged potentiality become lower because they can find their other natural host plant as well as natural pest of *C. nucifera* again show their damaging potentiality which were recorded previous to Amphan incidence.

Resource partitioning is the ecological concept, when two or more species are involve in sharing the same resources. From previous review work it was established that slender ants belonging to the genus *Tetraponera* is such ecologically dominant species that don't believed on resource partitioning. (Dejean et al., 2008).

Tetraponera with help of their peptides containing venom can paralyse and deterred another ant's species, leaf beetle from their habitat. Finally they can win such a competition and form a mutualism with host plant (Young et al. 1996). They took their food and shelter from it, whereas due to its aggressive behaviour they also prevent different damaging activities by other pest on that host plant.

One of the wide spread, diversified insect families in agro-ecosystem is ants (Rey et al. 2019). Lots of reports were already established that ants were acts a bio-control agent for agro-ecosystem and crop ecosystem (Morris et al. 2015). Ants get positive impact on other pest of crops as well as acts as bio control agents of different tropical crop trees (Thurman et al. 2019 and Offenberg 2015).

Some ants species put negative impact on coffee borer (Escobar-Ramírez et al. 2019).

According to (Barasse et al., 2019) et al. 2019, there are seven arthropod species which reported as pest on *C. nucifera* plant. But till now any previous report, was not established that *Tetraponera* was pest on *C. nucifera*. Coexistence of *Tetraponera* with other ants (carpenter ant) and beetle which are natural pest of *C. nucifera* was established by previous author.

In our observation lots of unusual things were documented and I also tried to report those unexpected circumstances are as follows:

After Amphan Super Cyclone, normal habitat of *Tetraponera* i.e. *S. macrophylus* plant was destroyed and they took their shelter on nearby *C. nucifera* plant to obtain their required food and shelter.

C. nucifera is not the usual host plant of *Tetraponera*, but at the adverse conditions they become facultative pest of *C. nucifera*. They created hole on growing coconut for their shelter and obtaining food. Finally they got their shelter within coconut for their breeding, keep their egg safely, obtaining food etc. As a result 60% of coconuts in 2020 were found as damaged condition with different growing stage of *Tetraponera* sp.

Tetraponera due to its aggressive behaviour can't share their habitat with other arthropods.

4. CONCLUSION

From this observation, we can conclude that at adverse conditions learn every creature try to how to change their behaviour to survive. They can use unusual resource as food; they can show resource partitioning and coexistence with those animals, those are normally paralysed or deterred by their peptide containing venom at natural situation.

Dominant species are disproportionately important species and their impact also influenced on other community members (Paine, 1969a; Dayton, 1976). Ecologically dominant species in community also exert competitive control on abundance and distribution of other species (Clements,1916; Weaver and Clements, 1938).

The opposite behaviour of dominancy in Ecology are resource partitioning and coexistence, in which nearer members of different species show sharing of food and shelter (Dayton, 1971).

A particular species always try to adjust them self with changing circumstances, and if they can able to do it, must become winner of Darwinian "Struggle for Existence" rather become extinct (Darwin, 1859).

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COMPETING INTERESTS

Author has declared that no competing interests exist.

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