

# Management of red ants predating on eggs and hatchlings inside protected nests of olive ridley sea turtle along the coast of Maharashtra

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## Executive summary

Olive ridley turtles (ORT), listed as vulnerable by IUCN and Schedule I under Wildlife (Protection) Act, 1972, have become a mandatory species for conservation. With its declining population, the species needs to be protected from all plausible threats such as criminal activities (hunting, poaching, trafficking, etc), a sudden shift in weather patterns and predators. On the coastline of Wayangani (Sindhudurg district), Maharashtra repeated incidents of ant predation by the red army ant, *Dorylus orientalis* Westwood were reported since 2009. In 2017-18 and 2018-19 nesting season, it was observed that more than 75% nests were infested with ants, which resulted in extremely low hatching success. This study was thus undertaken, to identify the predatory ant species taxonomically, study its behavioural ecology concerning ORT and develop suitable eco-friendly control measures. After mapping the study site and conducting surveys with the local population, it was evident that agriculture is not practised as a major occupation in Wayangani. The plantation fields are located far from the hatcheries. Thus, contradictory to what most studies report, *D. orientalis* Westwood, is not a major pest in the study area. Since the species has a larger ecological role, preventive measures had to be developed rather than using elimination measures. Although neem powder could be suggested as a definite control measure, its dosage could not be standardised due to time constraint and COVID-19 lockdown in the country. This was the first study of its kind from India, which was targeted on red army ants preying on olive ridley turtle eggs and hatchlings, to help in further conservation of the species.

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## Acknowledgements

I would like to extend my gratitude and sincere thanks to my project supervisor Ms Sumedha Korgaonkar for her continuous guidance, encouragement and support throughout my project work. She has always brought the best out of me. I would like to thank the Mangrove and Marine Biodiversity Conservation Foundation of Maharashtra - Small Grants Programme for funding my project. I thank Executive Director & APCCF, Mangrove Cell, Maharashtra, Mr Virendra Tiwari and Deputy Director, Dr Manas Manjrekar for trusting my ideas, initiating the process and helping me in all the administration work.

I am thankful to Suhas Toraskar, Balabhau (Local conservationists, Wayangani) and other localites for their support in fieldwork and other inputs regarding local knowledge about olive ridley turtle conservation and *D. orientalis*. I thank Ms Ranjana Khobrekar for all the love and care during my stay at Wayangani.

My sincere thanks to the Department of Biodiversity, M.E.S. Abasaheb Garware College, Pune for providing the infrastructural and instrumentational facility for lab work. I also thank Dr Hemant Ghate for helping me out in taxonomic photography and Dr Himender Bharti (Punjabi University and Member IUCN) for guiding me in the identification of the ant specimens. I am grateful to my family and friends for their constant support and encouragement during the project.

I have used the Land Use / Land Cover information in my research work from Natural Resources Census Project of National Remote Sensing Centre (NRSC), ISRO, Hyderabad, India.

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Preprint of the work in [preprints.org](https://preprints.org)

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Plate 4: Control measures

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## Introduction

Olive ridley turtles have threatened species, classified as vulnerable under IUCN status and Schedule I under the Indian Wildlife Protection Act, 1972. This species is best known for 'Arribada' i.e., mass nesting. Rushikulya and Gahirmatha in Orissa coast are the sites in India where mass nesting is observed. Orissa coast of India is one of the three sites for mass nesting in the World. The rest of the 7000 km coast of India harbours solitary nesting population. The west coast of India has a solitary nesting population which lay eggs on sandy beaches about one foot deep. On the Indian coasts, the eggs of these turtles begin to hatch in about 45-65 days after they are laid. During this time, several predators such as jackals, birds, hyenas, fiddler crabs, and feral dogs are known to attack and destroy the developing embryos. Significant research has been conducted on one such predator of sea turtles, i.e. predatory ants on the coastlines of El Salvador Florida, etc. In India, there is a record of nests being destroyed by ants on the nesting sites of Karde beach of Ratnagiri district (Kelaskar et. al, 2016). Due to the lack of taxonomic identification of the predatory ants, further studies could not be undertaken. A similar attacking phenomenon was observed by local beach managers of Wayangani, Sindhudurg district since 2009. In 2019, out of seven ex-situ protected nests of olive ridley turtles, four were destroyed by ants.

The ants were taxonomically identified as *Dorylus orientalis* Westwood. Studying the behavioural ecology of *D. orientalis* Westwood concerning olive ridley turtle nests would prove beneficial in conservation management of these turtles. The primary objective of this study was to study feeding, foraging and predatory behaviour of this ant species during the nesting season of turtles and finding a solution to prevent them from nest predation.

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## Objectives

- i. To study the nesting ecology and predatory behaviour of ants predated on the protected nest of sea turtles.
- ii. To find a solution(non-toxic) for the prevention or eradication of ants from nesting beach as a means for conservation measure.

## Proposed vs Actual Activities

Sr. No.	Proposed activity	Proposed Timeline	Actual activity	Actual Timeline
1.	Ordering of digital thermo-hygrometer	Dec 2019	Ordering of digital thermo-hygrometer	Dec 2019
2.	Field Observations- Behavioural ecology of predatory ants	Dec 2019 – Jan 2020	Setting up bait traps to study behavioural ecology of predatory ants	Dec 2019 – March 2020 Further studies cancelled due to lockdown
Actual behavioural ecology could not be studied since it had to be discontinued because of sudden lockdown.			_____	
4.	Control solutions- Experimental setup to test eco-friendly solutions	Feb 2020 – April 2020	Neem powder used in hatcheries as an effective precautionary measure. (Done by Mr Suhas Toraskar throughout the nesting season)	Jan 2020 - April 2020 (until end of nesting season)
The experimental setup had to be aborted due to sudden lockdown.				
5.	Report submission	June 2020	Report submission	August 2020
6.	_____		Acceptance of preprint by preprints.org	August 2020

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## Study area: Wayangani

It is located in the Southern part of Sindhudurg district in coastal Maharashtra, about 4 km from Vengurla (15°52'19.50" N, 73°36'28.72" E ). The length of the entire beach is 1.94 km. It is surrounded by coconut plantations on the Northern side and *Casuarina* plantations on the Southern part. *Ipomea pes-caprae* borders the beach. The village consists of a total population of 1,199 people with a total of 303 settlements. The main occupation is fishing. No particular crops are cultivated as part of the main occupation. The beach is considered as an important site for ex-situ olive ridley turtle conservation.

## Methodology

1. Vegetation mapping was done in the mentioned study site. Accordingly, Land Use/ Land Cover map was prepared in QGIS.
2. A survey was undertaken with the local hatchery managers and other local villagers regarding the history of ant predation on protected eggs of olive ridley turtles to obtain information about the behaviour of the species through traditional knowledge and local observation.
3. The study area was divided into 3 blocks due to its heterogeneous vegetation conditions. (fig. 1, Appendix II plate 1). Bait traps were set up in each block, where freshly prepared groundnut oil from cold-pressed oil refinery was used as a bait.
4. Temperature readings were taken with HTC Digital Thermo-Hygrometer before the baits were placed and every time the baits were checked.
5. Neem powder (20kg in total. Obtained from gardening nurseries) was used as a precautionary measure for the ex-situ relocated nests.

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## Outcome of Study

**Table 1. Data obtained from bait traps**

Months	Temperature (°C)		Moisture (%)		Ants Obtained In Block								
	Min	Max	Min	Max	A			B			C		
					A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	B <sub>1</sub>	B <sub>2</sub>	B <sub>3</sub>	C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>
Dec	21.9	28.4	54	77	P	P	P	P,M	P		P		
Jan	28.1	28.2	58	70	P	P	P	P,M	P	P			P
Feb	20.4	25.2	64	72	P			P,M	P	P	P		P
March	23.2	27.5	52	67	P			P, M	P, M				P

P= *Paratrechina longicornis*, M= *Monomorium indicum*

*D. orientalis* Westwood (predatory ant) was not obtained until the baiting was done (till March 2020). Further studies had to be discontinued due to a sudden lockdown in the country.

### Precautionary biocontrol measures:

Neem powder worked as a successful precautionary measure. Unlike what most papers suggest, instead of harmful chemicals, neem powder prepared from the barks and leaves was used as a precautionary control measure. For 8 ex-situ hatcheries, a total of 20 kg of powder was used. One foot deep borders were dug around all ex-situ hatcheries and were filled with neem powder (Appendix II, plate 5). This method showed positive results with 0% infestation. All the protected nests were free from ant attack during their incubation period.

Both, the dosage of neem concentrate in water as well as the quantity of neem powder alone was to be tested on *D. orientalis* Westwood. This was to be done to check which out of the two, is more effective and at what dosage does it work most efficiently. But the experimental setup had to be aborted due to declaration of sudden lockdown in the country.



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## Discussion

Predatory ants collected during the pilot study in April 2019, were taxonomically identified as *Dorylus orientalis* Westwood and further studies were planned through this project to study its behavioural ecology. During the pilot study, it was observed that the ants showing activity inside the turtle nest when exposed to broad daylight vanished quickly into the sand probably due to low tolerance for bright light and that there was a possibility of a long tunnel under the sand leading towards their nest. Their infestation behaviour is therefore critical for conservation management due to inconspicuous activity on the surface. The QGIS map shows that the region does not have the type of crops on which these ants are found as a pest. The questionnaire suggests the historical presence of these ants in the region. Hence in absence of the host crop but the presence in the region for several years suggests an ecological role *D. orientalis* in the habitat. Thus we suggest that *D. orientalis* Westwood infestation should be prevented rather than exterminated with harmful chemicals like Phorate. There is also an increased risk of the chemical pesticides seeping in the sandy beaches and disrupting the embryonic developing of the incubating turtle eggs. The use of chemical pesticides like Phorate which has been used in the past for hatchery management should be discontinued. As a preventive measure, we applied the natural formicide, Neem powder commonly used in plant nurseries near the hatchery. Even though the action of neem powder against this species is not known. A trench at the depth of 1.5 feet was dug around the hatchery and neem powder was applied in layers during the project period. The method proved applicable as this year there was 0% infestation till the end of the incubation period in April 2020.

During baiting, *P. longicornis* and *M. indicum* were obtained in the baits which are not reported to attack the turtle nests in the study site or otherwise in other regions. *D. orientalis* Westwood, a known subterranean nomadic species is highly challenging to locate through baiting. Their presence in the bait was expected during their foraging period of March and April. *D. orientalis* Westwood was not obtained in the bait traps till mid-March. which suggest their absence on the beach. *D. orientalis* Westwood is an Asian species of army ants and is known to march long distance away from their permanent nest towards their foraging site in a short period. Though they were not found till the baiting activity their presence after mid-March cannot be ruled out.

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There is a fair chances of neem powder preventing turtle nest infestation of *D. orientalis* Westwood. After a consecutive 4-5 years of the ant infestation in the hatchery, 2019 – 2020 nesting year was completely free from infestation. This might be due to the effective preventive measures taken around the hatchery.

### **Limitations :**

The study had to be discontinued after 15<sup>th</sup> March due to the sudden lockdown, so the first objective of studying the behavioural ecology of *D. orientalis* Westwood could not be achieved.

### **Future scope of the project:**

1. Standardising the dosage of neem powder which could be used as an environment-friendly control measure against ant predation.
2. Locating the ant tunnels in the study site to fixate the location of ex-situ hatcheries on the beach.

### **Conclusion**

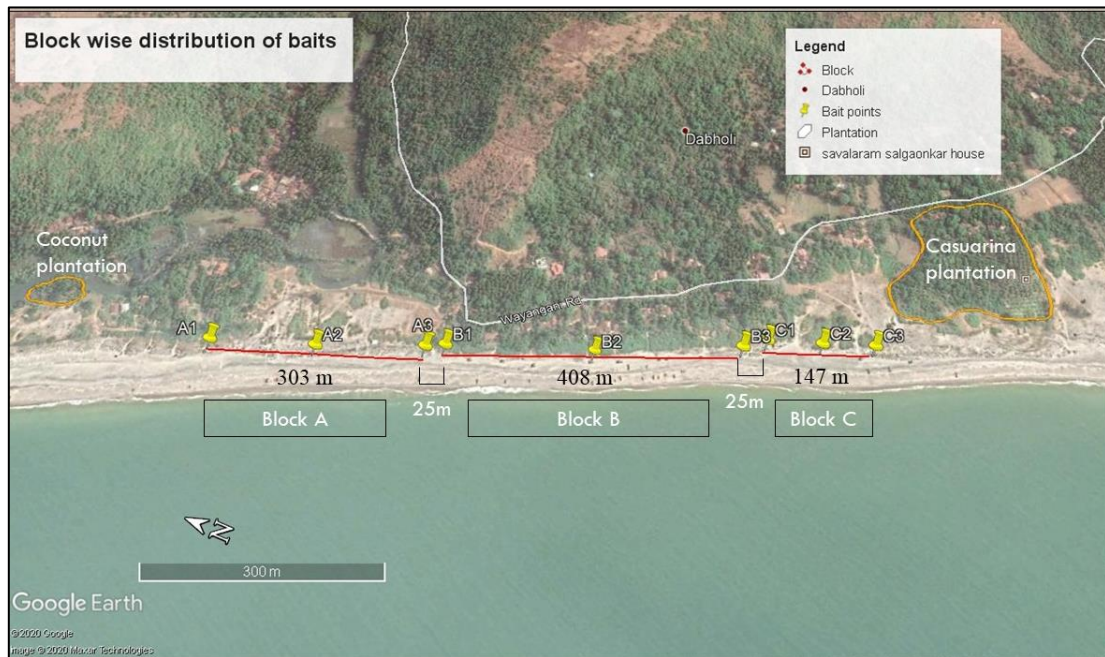
*Dorylus orientalis* Westwood is predatory in their behaviour. On the attack, the damage caused to the turtle nests is high and could prove to be expensive for conservation. In the turtle nesting site, they have a larger ecological role to play in the habitat than being an agricultural pest, thus chemical pesticides should not be used as an elimination measure. The suggested control measure, i.e. neem powder could be used as a precautionary measure after standardising the application dosage.

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## Appendix I



**Map 1. Study area prepared in Google earth pro.**

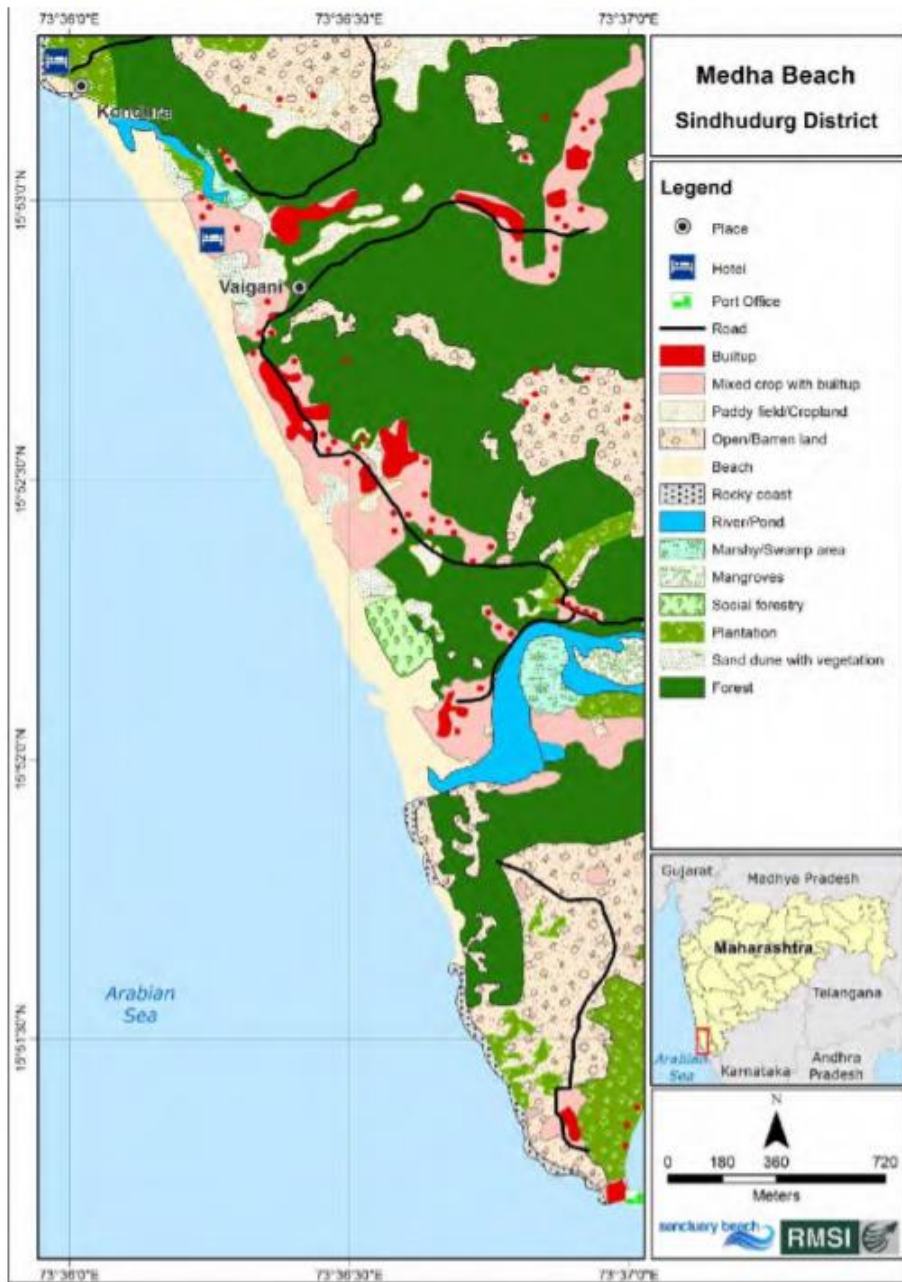


Figure 41: Medha Beach, Sindhudurg

Map 2. LULC of Wayangani village taken from RMSI survey report, 2017

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## Appendix II

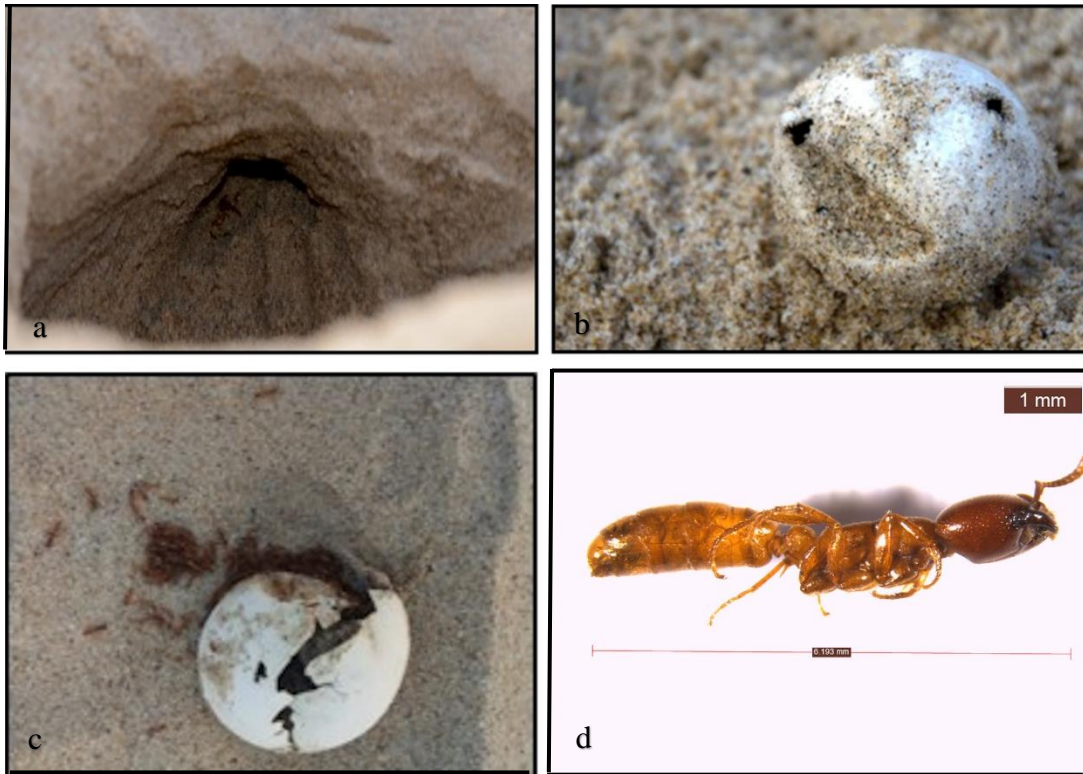


Plate 1- Images showing ant predation on olive ridley turtles protected nest in April 2019 a) ant tunnel dug in hatchery b) holes in the eggs due to ants c) attack of ants on egg d) identified ant *D. orientalis* Westwood



Plate 2- Images showing the division of study sites into blocks depending on the amount of vegetation a) Block A, least vegetation b) Block B, medium vegetation c) Block C, high vegetation.

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Plate 2- Images showing the setting of bait traps a) Setting of bait trap b) Oil bait in the trap c) Ants attracted to the bait trap.



Plate 5- Images showing control measures. a) Ex-situ hatchery b) Digging 1ft deep borders around hatchery c) Filling neem powder in borders as a control measure. d) neem powder (control measure).

## Appendix III



The screenshot shows the preprint page for the article "Predatory Ants: First Report on Direct Evidence of Predation by *Dorylus orientalis* Westwood, 1885 on Olive Ridley Eggs from India". The page includes a navigation bar with the Preprints logo, a search bar, and a "Submit preprint" button. The article title is prominently displayed, along with the authors' names: Sumedha Korgaonkar, Anuja Vartak, and Kuppasamy Sivakumar. A status box indicates that this version is not peer-reviewed. On the right side, there are statistics for Views (14), Downloads (3), and Comments (0). Below the title, there are buttons for "Get PDF", "Supplementary Files", "Cite", "Share", and "Bookmark". The abstract text is provided at the bottom of the page.

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### Predatory Ants: First Report on Direct Evidence of Predation by *Dorylus orientalis* Westwood, 1885 on Olive Ridley Eggs from India

Sumedha Korgaonkar, Anuja Vartak, Kuppasamy Sivakumar

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#### Abstract

Abstract: Predation of eggs and emerging hatchlings of olive ridley turtle (*Lepidochelys olivacea*) by wild animals and feral dogs are known. They reduce the hatching success rate considerably affecting the conservation management of this vulnerable species. Hatchery management is practised in India to overcome predation. Ant predation is a serious threat to turtle nest protected by ex situ or in situ erected hatchery. This article reports the first direct evidence of turtle eggs predation by *Dorylus orientalis* Westwood, 1835 commonly called red ants. Native to India, Oriental, Indo Australian and Palearctic regions they are notorious as an agricultural pest. Chlorpyrifos pesticides recommended for their control could become fatal for the developing embryos of turtles if applied near the hatchery. In the turtle nesting site of the west coast of India, *D. orientalis* has more of an ecological role than as a pest. Natural pesticide such as Neem powder (*Azadirachta indica*) shows promising results for preventing their infestation.

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