Red Weaver Ant (Oecophylla smaragdina) as a Potential Non-Timber Forest Product: Production, Consumption and Economic Opportunities in Bastar, Central India

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Abstract:
The red weaver ant (Oecophylla smaragdina) is an important edible insect traditionally utilized by tribal communities for food, medicine and income generation in different parts of India. The present study was conducted in the Bastar region of Chhattisgarh to document the economic value, consumption pattern, host tree association and market potential of red weaver ants as a non-timber forest product. Field investigations were carried out in four tribal villages-Darbha, Chitapur, Kadma and Neganar-during February to May 2023 using household surveys, personal interviews and market observations. Data were collected from 24 households actively involved in red ant collection and trade. Results revealed that an average weekly collection of 96.5 kg of red weaver ants generated a total income of Rs. 18,900, highlighting their role as a significant supplementary livelihood source. A substantial proportion of the harvest was marketed, while regular household consumption reflected their importance in traditional diets. Host tree-wise analysis showed that red weaver ants were predominantly associated with sal (Shorea robusta), mango (Mangifera indica), jamun (Syzygium cumini) and kusum (Schleichera oleosa) trees, indicating strong ecological linkages with forest and agroforestry species. Market surveys confirmed consistent local demand and favorable prices, demonstrating the commercial potential of red weaver ants. The study concludes that Oecophylla smaragdina plays a multifunctional role in supporting tribal livelihoods, food security and ecological sustainability and emphasizes the need for sustainable harvesting and value-addition strategies.

Key words: Red weaver ant; Oecophylla smaragdina; Entomophagy; Tribal livelihoods; Non-timber forest products; Bastar region; Traditional knowledge

Introduction

Edible insects have long formed an integral component of traditional food systems and ethnomedicinal practices among indigenous and tribal communities across the world. Entomophagy is increasingly recognized for its potential contribution to food security, nutrition and sustainable livelihoods, particularly in tropical regions where insect diversity and availability are high (DeFoliart, 1999; van Huis et al. 2013). Insects are rich sources of protein, essential amino acids, fatty acids, vitamins and minerals and require significantly lower inputs of land, water and feed compared to conventional livestock, making them an environmentally sustainable food resource (Rastogi, 2011; van Huis, 2014). In India, the consumption of insects is deeply embedded in the cultural traditions of many tribal societies, especially in the northeastern, central and eastern regions (Chakravorty, 2014; Chakravorty et al. 2016).

Among edible insects, the red weaver ant Oecophylla smaragdina (Fabricius) (Hymenoptera: Formicidae) holds a unique position due to its wide geographical distribution, ecological importance and diverse traditional uses. The species is widely distributed across South and Southeast Asia and Australia and is well known for its arboreal nest-building behavior, in which worker ants weave living leaves using larval silk (Way & Khoo, 1992; Peng & Christian, 2004). Beyond its ecological role, O. smaragdina is traditionally consumed as food and used as medicine by several tribal communities in India, including those in Odisha, Assam, Arunachal Pradesh, Chhattisgarh and Tamil Nadu (Oudhia, 2002; Langthasa et al. 2017; Jena et al. 2020). Nutritional studies have reported high crude protein content and favorable proximate composition in O. smaragdina, highlighting its potential as a nutrient-dense food source (Chakravorty et al. 2016; Borgohain et al. 2014).

In addition to its dietary value, O. smaragdina is widely used in traditional medicine for the treatment of ailments such as fever, common cold, jaundice, enteric disorders and cough. Ethno-entomological studies from different regions of India have documented the use of whole ants, brood, or extracts in traditional healing practices, often attributed to the presence of formic acid and other bioactive compounds (Mahawar & Jaroli, 2008; Khelkar et al. 2015; Jena et al. 2020). Recent biochemical and antimicrobial investigations have further suggested the therapeutic potential of weaver ants, though systematic clinical validation remains limited (Zhang, 2017; Bhagavathula et al. 2017). These traditional claims underscore the need for scientific documentation and validation of indigenous knowledge systems.

The Bastar region of Chhattisgarh is characterized by dense forests, rich biodiversity and a high concentration of tribal

populations who maintain close linkages with forest resources. Red weaver ants, locally known as Chapda or Cheeti Chapda, are commonly harvested from host trees such as sal (Shorea robusta), mango (Mangifera indica), jamun (Syzygium cumini) and kusum (Schleichera oleosa). In Bastar, red ant chutney is not only a culturally significant food item but also an important source of supplementary income through local market sales (Roy & Rao, 1957; Oudhia, 2002). Despite its cultural, nutritional and economic importance, systematic studies focusing on the economic contribution, consumption pattern, host tree association and market potential of O. smaragdina in the Bastar region remain limited.

Therefore, the present study was undertaken to document the traditional utilization of red weaver ants in Bastar district of Chhattisgarh, with specific emphasis on their economic value, consumption patterns, ecological association with host tree species and market potential. By integrating ethnobiological knowledge with quantitative field data, the study aims to highlight the role of Oecophylla smaragdina as a sustainable non-timber forest product and to provide baseline information for future research, conservation planning and livelihood-based development initiatives.

2. Methodology

The present study was conducted in the Bastar region of Chhattisgarh, India, with special reference to four tribal villages-Darbha, Chitapur, Kadma and Neganar-during the period February to May 2023. The study area lies within the tropical moist and dry deciduous forest zone, characterized by rich biodiversity and dominance of sal (Shorea robusta), mango (Mangifera indica), jamun (Syzygium cumini) and kusum (Schleichera oleosa) trees, which serve as major host species for red weaver ants (Oecophylla smaragdina). A reconnaissance survey was carried out to identify active red ant nesting sites and to understand local harvesting practices followed by tribal communities.

Primary data were collected through household surveys, personal interviews and field observations using a semi-structured questionnaire. A total of 24 households involved in red ant collection and trade were purposively selected across the four villages. Information related to quantity of red ants collected, household consumption, marketed surplus, selling price and income generation was recorded. Market surveys were conducted in local weekly markets to assess demand, pricing and trade volume of red weaver ants. Host tree species supporting ant nests were identified and basic tree parameters such as height and diameter were recorded to understand host tree–ant associations.

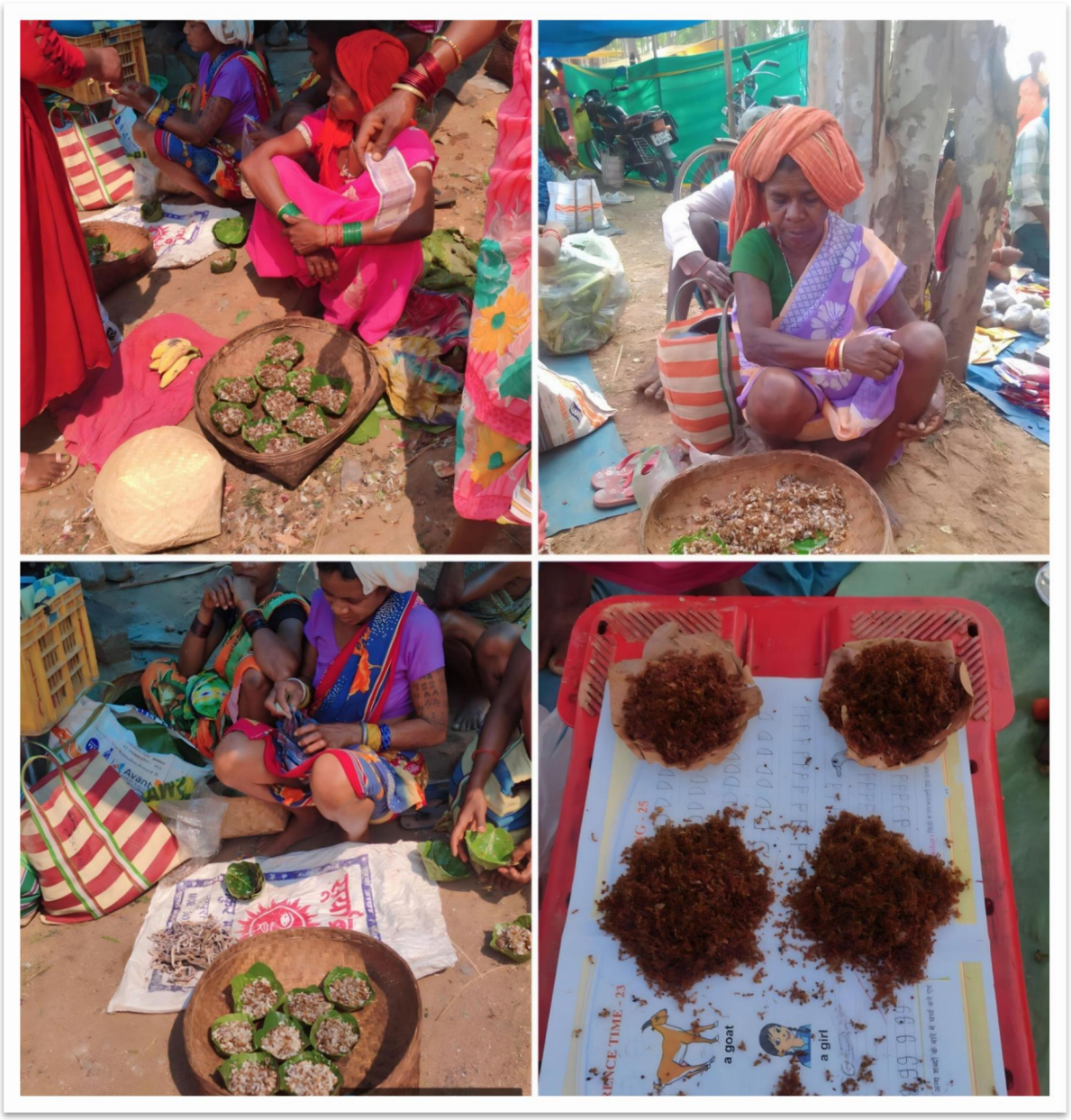
Collected data were compiled and analyzed using descriptive statistical methods. Village-wise averages for income, consumption and marketed quantity were calculated and results were presented in tabular form. Host tree-wise production data were summarized to assess ecological dependence of red weaver ants on forest and agroforestry species. The methodology emphasized participatory approaches and non-destructive observations to respect traditional practices and ensure sustainability of red weaver ant populations in the study area.

3. Result

3.1 Income Generation From Red Weaver Ant Collection

The results indicate that the collection and sale of red weaver ants (Oecophylla smaragdina) constitute an important supplementary livelihood activity for tribal households in the Bastar region (Table 1). A total of 24 households across four villages collectively harvested 96.5 kg of red ants per week, generating a total weekly income of Rs. 18,900. Among the villages studied, Darbha recorded the highest average weekly household income (Rs. 887.50), followed by Chitapur (Rs. 860.00), Kadma (Rs. 683.30) and Neganar (Rs. 680.00).

The variation in income among villages may be attributed to differences in availability of host trees, collection intensity and proximity to local markets. Villages with higher forest cover and better market access, such as Darbha and Chitapur, exhibited higher income levels. These findings demonstrate that red weaver ant collection serves as a low-investment, forest-based income source, particularly during the lean agricultural season, thereby contributing to livelihood resilience among tribal communities.



RED ANTS LOCAL MARKET SURVEY
Fig. 1 Red ant sell local market

3.2 Consumption pattern of red weaver ants

The consumption pattern of red weaver ants reflects a dual role as both a subsistence food and a market commodity (Table 2). Of the total weekly collection (96.0 kg), 27.0 kg was consumed domestically, while 69.0 kg was sold in local markets. Average household consumption ranged from 0.90 kg/week in Neganar to 1.50 kg/week in Chitapur, indicating regular dietary incorporation of red ants in tribal households.

The higher proportion of marketed quantity compared to domestic consumption highlights the increasing commercialization of red weaver ants. However, continued household consumption suggests that traditional dietary practices remain strong. The use of red ants in the form of chutney and traditional remedies provides nutritional and perceived medicinal benefits, reinforcing their importance in local food systems. This balance between consumption and sale underscores the role of red weaver ants in enhancing both food security and household income.

RED ANTS CHUTNY MAKINGPROCESS

Fig. 2.Chutney

3.3 Host tree-wise production of red weaver ants

Host tree-wise production data reveal that red weaver ants are closely associated with specific forest and agroforestry tree species (Table 3). The highest production was recorded from Shorea robusta and Syzygium cumini (30 kg each), followed by Mangifera indica and Schleichera oleosa (25 kg each). Collectively, twelve host tree species supported a total red ant production of 220 kg during the study period.

These results indicate that red weaver ants exhibit strong host preference, particularly for perennial, broad-leaved tree species that provide suitable nesting sites and food resources. Mango, sal, jamun and kusum trees are commonly retained by farmers and forest dwellers, facilitating sustainable ant harvesting without deliberate cultivation. The ecological association between red weaver ants and host trees highlights their compatibility with agroforestry systems and underscores the importance of conserving host tree diversity for sustaining red ant populations.

3.4 Market potential of red weaver ant trade

Market analysis revealed a substantial demand for red weaver ants in local weekly markets of Bastar district (Table 4).

Ten surveyed households sold a total of 64 kg of red ants, with an average sale of 6.4 kg per household. The selling price ranged from Rs. 10–20 per 30–50 g, resulting in an average income of Rs. 1,240 per household during the study period.

The consistent market demand and favorable prices indicate that red weaver ants have significant commercial potential as a non-timber forest product. The trade not only provides immediate cash income but also promotes the utilization of indigenous knowledge systems. Given their ecological role and cultural acceptance, red weaver ants could be further promoted through value addition, hygienic processing and regulated harvesting to enhance income while ensuring sustainability.

3.4 Overall interpretation

Overall, the results demonstrate that red weaver ants (Oecophylla smaragdina) play a multifunctional role in the Bastar region by supporting tribal livelihoods, contributing to household nutrition and maintaining ecological linkages with forest and agroforestry species. The integration of traditional knowledge with sustainable market practices could further strengthen the socio-economic benefits derived from this unique biological resource.

Table 1. Village-wise income generation from red weaver ant (Oecophylla smaragdina) collection in Bastar district

Village	No. of households	Total collection (kg/week)	Total income (Rs/week)	Average income per household (Rs/week)
Darbha	8	37.0	7,100	887.50
Chitapur	5	21.5	4,300	860.00
Kadma	6	21.0	4,100	683.30
Neganar	5	17.0	3,400	680.00
Total / Mean	24	96.5	18,900	777.70

Table 2. Consumption pattern of red weaver ant (Oecophylla smaragdina) among tribal households

Village	Total collection (kg/week)	Domestic consumption (kg/week)	Marketed quantity (kg/week)	Average household consumption (kg/week)
Darbha	37.0	10.0	27.0	1.25
Chitapur	21.0	6.0	15.0	1.50
Kadma	21.0	6.5	14.5	1.08
Neganar	17.0	4.5	12.5	0.90
Total / Mean	96.0	27.0	69.0	1.18

Table 3. Host tree-wise production of red weaver ant (Oecophylla smaragdina) in the study area (2023)

S. No.	Host tree species	Height (m)	Diameter (cm)	Red ant production (kg)
1	Shorea robusta	35	100–200	30
2	Mangifera indica	25	100–500	25
3	Syzygium cumini	30	60–90	30
4	Anacardium occidentale	20	10–20	20
5	Schleichera oleosa	30	100–200	25
6	Psidium guajava	20	20–30	15
7	Artocarpus heterophyllus	25	30–80	10
8	Madhuca indica	20	80	15
9	Buchanania lanzan	25	50	10
10	Tectona grandis	30	91–150	15
11	Pterocarpus marsupium	30	10	10
12	Tamarindus indica	30	100–200	5
Total				220

Table 4. Market potential and income from red weaver ant trade in local markets of Bastar district

Parameter	Value
Total households surveyed	10
Total quantity sold (kg)	64
Average quantity sold per household (kg)	6.4
Selling price	Rs. 10–20 per 30–50 g
Total income generated (Rs)	12,400
Average income per household (Rs)	1,240

4. Discussion

The findings of this study demonstrate that the red weaver ant (Oecophylla smaragdina) contributes significantly to tribal livelihoods and traditional food systems in Bastar, corroborating patterns observed in other parts of India. O. smaragdina is known to be consumed as a source of nutrition and used in traditional medicine among tribal populations in Odisha, where Jena, Das and Sahu (2020) documented its dietary and therapeutic roles for ailments such as fever, common cold and jaundice and its commercialization in local markets.

Nutritional studies further support the relevance of this species in tribal diets. Chakravorty, Ghosh, Jung and Meyer-Rochow (2016) reported that O. smaragdina exhibits a high protein content and favorable proximate composition, indicating its potential to contribute to macronutrient intake. Similarly, Doloi and Basumatari (2024) found crude protein to be the dominant nutrient in the proximate analysis of weaver ants consumed by tribes in Assam. (These nutritional profiles align with the observed consumption patterns in our study, where tribal households integrate weaver ant harvest into their regular diet (Table 2).

Regarding ecological associations, Rajagopal et al. (2019) documented the nesting of O. smaragdina on a variety of host plants, particularly Mangifera indica, with broad plant species support reflecting host preference patterns similar to those observed in Bastar. This supports the current study's findings of diverse host tree usage (Table 3), indicating that the availability of host trees in forest and agroforestry landscapes is a key factor in sustaining ant populations available for harvest.

Beyond nutritional and ecological aspects, O. smaragdina also serves as a multi-utility resource. Langthasa, Teron and Tamuli (2017) reported the cultural and economic significance of weaver ants among ethnic tribes in Assam, including its role in food, medicine and rituals, reinforcing the multifaceted value of this species across tribal contexts.

Furthermore, research by Nayak (2025) highlights the broader ethnobiological role of weaver ants in combating malnutrition and treating ailments across tribal India, noting that indigenous communities consume O. smaragdina for immune support and as a digestive stimulant. The income generation patterns observed in this study (Table 1 and Table 4) thus reflect both subsistence and commercial value, affirming the role of O. smaragdina as an important non-timber forest product.

Overall, the integration of traditional knowledge and nutritional science underscores the importance of O. smaragdina in tribal ecosystems. Future research should investigate biochemical properties and sustainable harvesting protocols to ensure both conservation and livelihood benefits.

5. Conclusion

The present study concludes that the red weaver ant (Oecophylla smaragdina) plays a significant role in supporting the livelihoods and food systems of tribal communities in the Bastar region of Chhattisgarh. The results demonstrate that red ant collection and trade provide a reliable supplementary source of income, with noticeable variation among villages depending on resource availability and market access. At the household level, red weaver ants contribute not only to cash income but also to regular dietary consumption, reflecting their continued importance in traditional food practices and local food security.

Furthermore, the strong association of red weaver ants with specific forest and agroforestry tree species highlights their ecological relevance and compatibility with existing land-use systems. The sustained market demand and stable prices indicate clear potential for red weaver ants as a non-timber forest product. Promoting sustainable harvesting, conservation of host trees and improved market linkages can enhance economic benefits while safeguarding ecological balance. Overall, the study emphasizes the value of integrating traditional knowledge with sustainable livelihood and conservation strategies in tribal regions.

6. Acknowledgement

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7. Conflict of Study

The author declares that there is no conflict of interest associated with this study.

8. FUTURE SUGGESTIONS FOR THIS STUDY

Nutritional and biochemical analysis:Detailed studies should be conducted to analyze the nutritional composition, bioactive compounds and medicinal properties of red weaver ants (Oecophylla smaragdina) collected from different seasons and host tree species.

Clinical validation of medicinal uses:Scientific and clinical investigations are needed to validate traditional medicinal claims related to the treatment of fever, jaundice, cough and digestive disorders.

Sustainable harvesting practices:Guidelines for sustainable and non-destructive harvesting should be developed to ensure long-term conservation of red weaver ant populations and their nesting habitats.

Ecological monitoring:Long-term studies should be undertaken to monitor population dynamics of red weaver ants and their association with host tree species under varying harvesting pressures.

Agroforestry integration:Red weaver ants should be explored as a component of agroforestry and forest management systems due to their compatibility with host trees and ecological benefits.

Value addition and processing:Standardized processing methods, hygienic handling and value-added products such as packaged chutney or dried ant brood should be developed to improve marketability.

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