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# Height preference for nest building by *Crematogaster subnuda* Mayer, 1879 in Aarey Colony near Sanjay Gandhi National Park, Mumbai, Maharashtra, India

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**Abstract**
Aarey colony is forested area, acts as buffer for the Sanjay Gandhi National Park, Mumbai. It has nursery, gardens, lakes, recreation spots. It also harbors 32 cattle farms, animal husbandry centers. Study of height preference for nest by *Crematogaster subnuda* Mayer, 1879 was carried out between January 2016 to May 2016. Total 196 nests were observed. 27.5% nests were found between heights of 11 to 15 feet. Only 4 % nests were seen upto 5 feet and 3.57 % between 31 to 35 feet above the ground. There were 2 % nests between 41 to 45 feet and 0.5 % between 46 to 50 feet. The average height of the nests was 19.6 feet above the ground.

**Keywords:** *Crematogaster*, nest height preference, Aarey colony, Sanjay Gandhi National Park, Mumbai

## 1. Introduction
Aarey colony established in 1949, covers an area of 16sq.km., situated on western boundary of Sanjay Gandhi National Park, Mumbai. Being forested, the colony acts as a buffer zone for the national park.

There is some resident population of leopard *Panthera pardus* in the colony. The leopard activity is fairly common in the area because of cattle farms, poultry farms and human settlements. Among invertebrates, insects are most abundant and diverse organisms on Earth. As most of the insects are highly mobile, their presence in an ecosystem may be temporary, which limits their use to detect environmental changes (Khot *et al.* 2012) [9]. On other hand, Ants being more local than other insects and can be efficiently used as bioindicator (Andersen, 2002; Stephens and Wagner, 2006; Underwood and Fisher, 2006, Majer *et al.*, 2007, Gomez C and S. Abril. (2011) [14, 17, 10, 13].

Nest plays an important role in ant's lifespan. Ants use nests to rare and protect their offspring also they use this nest to store food resources. They live in a colony consisting of 4 different castes: queen, Reproductive females, males and workers (Holldobler and Wilson 1990). The architecture and designed of nests vary across species. According to Narendra Ajay and Sunil Kumar M. (2006) [12] ant build nest in soil, in leaf litter, in concrete structures, in plants, in rotting logs and dead wood. Some species like *Crematogaster*, *Oecophylla* build their nest in the tree canopy or on branches and species like *Tetraponera rufonigra*, *Tapinoma melanocephalum* build their nest inside tree trunk while species like *Pheidole watsoni*, *Tetramorium walshi* build their nests under the ground. Amarsinghe (2010) carried out ant nest study in Sri Lanka. Watanasit, S. and Janatarit, S. (2006) studied nests of *Crematogaster rogenhoferi* Mayer, 1879 in Thailand. This study was carried out to study mainly the architecture of the nest. However they noted that the nests were located between 248 cm to 469 cm (n=15) above the ground i.e. 8.13 feet to 15.39 feet.

According to Narendra Ajay and Sunil Kumar M (2006) [12] *Crematogaster subnuda* Mayer, 1879 build carton nest by chewing leaves and regurgitating them along with a mixture of abdominal and salivary gland secretions, they also use leaves and twigs to construct such nests.

## 2. Materials and Methods
The study area was visited between January 2016 and May 2016. The GPS location of 196 nests was recorded. The height of the nest from the ground was determined by approximation. The height of the nest was segregated in different groups like A,B,C,D,E,F,G,H,I and J as follows - A (1 to 5 feet), B (6 to 10 feet), C ( 11 to 15 feet), D ( 16 to 20 feet), E ( 21 to 25 feet), F (26 to 30 feet), G (31 to 35 feet), H (36 to 40 feet), I (41 to 45 feet), J (46 to 50 feet). One nest was recorded fallen on the ground.

## 3. Results and Discussions
Total 196 nests were recorded for their height above the ground. Table 1. Shows the GPS coordinates and the height category as described in materials and methods.

**Table 1:** GPS coordinates and the height of the nests of *Crematogaster subnuda* Mayer, 1879 from Aarey Colony, Mumbai. [ Category details: A (1 to 5 feet), B (6 to 10 feet), C ( 11 to 15 feet), D ( 16 to 20 feet), E ( 21 to 25 feet), F (26 to 30 feet), G (31 to 35 feet), H (36 to 40 feet), I (41 to 45 feet), J (46 to 50 feet)]

| No. | GPS Coordinates | Height | | No. | GPS Coordinates | Height |
|---|---|---|---|---|---|---|
| 1 | N 19 09.298 E 072 51.594 | A | | 100 | N 19 09.646 E 072 51.764 | F |
| 2 | N 19 09.302 E 072 51.595 | F | | 101 | N 19 09.633 E 072 51.757 | B |
| 3 | N 19 09.313 E 072 51.627 | G | | 102 | N 19 09.642 E 072 51.744 | C |
| 4 | N 19 09.321 E 072 51.632 | J | | 103 | N 19 09.639 E 072 51.735 | D |
| 5 | N 19 09.341 E 072 51.674 | I | | 104 | N 19 09.639 E 072 51.734 | C |
| 6 | N 19 09.422 E 072 51.891 | I | | 105 | N 19 09.632 E 072 51.744 | B |
| 7 | N 19 09.297 E 072 51.959 | E | | 106 | N 19 09.631 E 072 51.744 | B |
| 8 | N 19 09.271 E 072 51.968 | F | | 107 | N 19 09.631 E 072 51.752 | B |
| 9 | N 19 09.138 E 072 51.081 | A | | 108 | N 19 09.631 E 072 51.753 | C |
| 10 | N 19 08.733 E 072 52.514 | D | | 109 | N 19 09.625 E 072 51.771 | C |
| 11 | N 19 08.729 E 072 52.524 | D | | 110 | N 19 09.625 E 072 51.775 | C |
| 12 | N 19 08.726 E 072 52.528 | F | | 111 | N 19 09.625 E 072 51.780 | C |
| 13 | N 19 08.638 E 072 52.494 | E | | 112 | N 19 09.628 E 072 51.792 | C |
| 14 | N 19 08.634 E 072 52.493 | E | | 113 | N 19 09.629 E 072 51.805 | D |
| 15 | N 19 09.297 E 072 51.624 | A | | 114 | N 19 09.629 E 072 51.821 | D |
| 17 | N 19 09.005 E 072 52.138 | D | | 115 | N 19 09.629 E 072 51.826 | E |
| 18 | N 19 08.974 E 072 52.134 | D | | 116 | N 19 09.626 E 072 51.823 | F |
| 19 | N 19 09.013 E 072 52.135 | C | | 117 | N 19 09.613 E 072 51.805 | F |
| 20 | N 19 09.017 E 072 52.134 | B | | 118 | N 19 09.611 E 072 51.799 | C |
| 21 | N 19 09.018 E 072 52.135 | C | | 119 | N 19 09.589 E 072 51.787 | I |
| 22 | N 19 09.018 E 072 52.113 | C | | 120 | N 19 09.601 E 072 51.799 | G |
| 23 | N 19 09.041 E 072 52.118 | B | | 121 | N 19 09.601 E 072 51.802 | F |
| 24 | N 19 09.035 E 072 52.129 | B | | 122 | N 19 09.601 E 072 51.813 | F |
| 25 | N 19 09.028 E 072 52.135 | C | | 123 | N 19 09.612 E 072 51.726 | D |
| 26 | N 19 09.043 E 072 52.135 | B | | 124 | N 19 09.620 E 072 51.730 | B |
| 27 | N 19 09.034 E 072 52.176 | C | | 125 | N 19 09.662 E 072 51.72 | B |
| 28 | N 19 09.034 E 072 52.188 | B | | 126 | N 19 09.711 E 072 52.526 | C |
| 29 | N 19 09.031 E 072 52.255 | B | | 127 | N 19 08.711 E 072 52.530 | C |
| 30 | N 19 09.088 E 072 52.131 | B | | 128 | N 19 08.703 E 072 52.530 | D |
| 31 | N 19 09.105 E 072 52.128 | D | | 129 | N 19 08.699 E 072 52.520 | E |
| 32 | N 19 09.105 E 072 52.128 | B | | 130 | N 19 08.694 E 072 52.523 | F |
| 33 | N 19 09.106 E 072 52.128 | B | | 131 | N 19 08.685 E 072 52.510 | D |
| 34 | N 19 09.118 E 072 52.120 | D | | 132 | N 19 08.679 E 072 52.508 | D |
| 35 | N 19 09.094 E 072 52.119 | B | | 133 | N 19 08.675 E 072 52.505 | D |
| 36 | N 19 09.910 E 072 51.694 | D | | 134 | N 19 08.675 E 072 52.499 | D |
| 37 | N 19 09.915 E 072 51.694 | E | | 135 | N 19 08.622 E 072 52.497 | D |
| 38 | N 19 09.941 E 072 51.680 | D | | 136 | N 19 08.658 E 072 52.497 | C |
| 39 | N 19 09.940 E 072 51.676 | E | | 137 | N 19 08.655 E 072 52.494 | C |
| 40 | N 19 09.939 E 072 51.675 | E | | 138 | N 19 08.653 E 072 52.486 | B |
| 41 | N 19 09.940 E 072 51.675 | D | | 139 | N 19 08.662 E 072 52.488 | B |
| 42 | N 19 09.946 E 072 51.645 | I | | 140 | N 19 08.670 E 072 52.490 | B |
| 43 | N 19 09.121 E 072 51.634 | D | | 141 | N 19 08.666 E 072 52.486 | C |
| 44 | N 19 09.920 E 072 51.637 | D | | 142 | N 19 08.659 E 072 52.480 | C |
| 45 | N 19 09.920 E 072 51.639 | A | | 143 | N 19 08.654 E 072 52.485 | C |
| 46 | N 19 09.920 E 072 51.644 | D | | 144 | N 19 08.648 E 072 52.491 | B |
| 47 | N 19 09.922 E 072 51.648 | C | | 145 | N 19 08.655 E 072 52.493 | C |
| 48 | N 19 09.908 E 072 51.669 | C | | 146 | N 19 08.641 E 072 52.484 | C |
| 49 | N 19 09.677 E 072 51.835 | C | | 147 | N 19 08.632 E 072 52.480 | A |
| 50 | N 19 09.667 E 072 51.824 | B | | 148 | N 19 08.633 E 072 52.467 | C |
| 51 | N 19 09.673 E 072 51.816 | B | | 149 | N 19 08.631 E 072 52.466 | B |
| 52 | N 19 09.676 E 072 51.809 | C | | 150 | N 19 08.630 E 072 52.466 | B |
| 53 | N 19 09.667 E 072 51.800 | C | | 151 | N 19 08.634 E 072 52.461 | D |
| 54 | N 19 09.668 E 072 51.806 | G | | 152 | N 19 08.637 E 072 52.462 | C |
| 55 | N 19 09.666 E 072 51.795 | F | | 153 | N 19 08.637 E 072 52.462 | C |
| 56 | N 19 09.678 E 072 51.779 | B | | 154 | N 19 08.649 E 072 52.453 | C |
| 57 | N 19 09.679 E 072 51.773 | A | | 155 | N 19 08.649 E 072 52.450 | B |
| 58 | N 19 09.685 E 072 51.776 | B | | 156 | N 19 08.651 E 072 52.445 | D |
| 59 | N 19 09.691 E 072 51.775 | C | | 157 | N 19 08.657 E 072 52.450 | B |
| 60 | N 19 09.692 E 072 51.772 | D | | 158 | N 19 08.657 E 072 52.450 | D |
| 61 | N 19 09.698 E 072 51.766 | C | | 159 | N 19 08.661 E 072 52.453 | C |
| 62 | N 19 09.698 E 072 51.768 | C | | 160 | N 19 08.666 E 072 52.457 | E |
| 63 | N 19 09.693 E 072 51.782 | D | | 161 | N 19 08.669 E 072 52.457 | B |
| 64 | N 19 09.684 E 072 51.803 | G | | 162 | N 19 08.685 E 072 52.484 | C |

| | | | | | | |
|---|---|---|---|---|---|---|
| 65 | N 19 09.682 E 072 51.806 | D | | 163 | N 19 08.685 E 072 52.484 | D |
| 66 | N 19 09.684 E 072 51.810 | G | | 164 | N 19 08.685 E 072 52.484 | D |
| 67 | N 19 09.682 E 072 51.822 | G | | 165 | N 19 08.692 E 072 52.483 | A |
| 68 | N 19 09.496 E 072 52.347 | B | | 166 | N 19 08.698 E 072 52.492 | D |
| 69 | N 19 09.483 E 072 52.358 | C | | 167 | N 19 08.702 E 072 52.492 | D |
| 70 | N 19 09.301 E 072 51.592 | B | | 168 | N 19 08.709 E 072 52.490 | C |
| 71 | N 19 09.675 E 072 51.726 | B | | 169 | N 19 08.708 E 072 52.499 | B |
| 72 | N 19 09.674 E 072 51.716 | B | | 170 | N 19 08.710 E 072 52.502 | B |
| 73 | N 19 09.671 E 072 51.725 | C | | 171 | N 19 08.709 E 072 52.503 | A |
| 74 | N 19 09.674 E 072 51.731 | B | | 172 | N 19 08.717 E 072 52.500 | B |
| 75 | N 19 09.657 E 072 51.762 | C | | 173 | N 19 09.202 E 072 52.290 | B |
| 76 | N 19 09.653 E 072 51.770 | B | | 174 | N 19 09.207 E 072 52.290 | E |
| 77 | N 19 09.662 E 072 51.783 | D | | 175 | N 19 09.186 E 072 52.316 | E |
| 78 | N 19 09.659 E 072 51.789 | B | | 176 | N 19 09.185 E 072 52.316 | E |
| 79 | N 19 09.660 E 072 51.790 | C | | 177 | N 19 09.176 E 072 52.315 | E |
| 80 | N 19 09.652 E 072 51.773 | B | | 178 | N 19 09.114 E 072 52.277 | E |
| 81 | N 19 09.648 E 072 51.777 | G | | 179 | N 19 09.114 E 072 52.269 | D |
| 82 | N 19 09.639 E 072 51.795 | B | | 180 | N 19 09.113 E 072 52.266 | E |
| 83 | N 19 09.638 E 072 51.816 | B | | 181 | N 19 09.110 E 072 52.252 | B |
| 84 | N 19 09.639 E 072 51.824 | C | | 182 | N 19 09.104 E 072 52.529 | E |
| 85 | N 19 09.634 E 072 51.836 | D | | 183 | N 19 09.096 E 72 52.264 | E |
| 86 | N 19 09.636 E 072 51.825 | B | | 184 | N 19 09.080 E 072 52.270 | C |
| 87 | N 19 09.631 E 072 51.823 | B | | 185 | N 19 09.073 E 072 52.267 | C |
| 88 | N 19 09.624 E 072 51.824 | E | | 186 | N 19 09.073 E 072 52.267 | C |
| 89 | N 19 09.625 E 072 51.826 | F | | 187 | N 19 09.021 E 072 52.386 | D |
| 90 | N 19 09.625 E 072 51.811 | C | | 188 | N 19 09.028 E 072 52.386 | C |
| 91 | N 19 09.633 E 072 51.799 | C | | 189 | N 19 09.061 E 072 52.300 | B |
| 92 | N 19 09.627 E 072 51.794 | C | | 190 | N 19 09.055 E 072 52.304 | D |
| 93 | N 19 09.627 E 072 51.790 | C | | 191 | N 19 09.038 E 072 52.311 | D |
| 94 | N 19 09.625 E 072 51.781 | C | | 192 | N 19 09.039 E 072 52.307 | C |
| 95 | N 19 09.625 E 072 51.776 | C | | 193 | N 19 09.032 E 072 52.314 | F |
| 96 | N 19 09.626 E 072 51.771 | B | | 194 | N 19 08.989 E 072 52.322 | F |
| 97 | N 19 09.634 E 072 51.763 | F | | 195 | N 19 09.016 E 072 52.377 | E |
| 98 | N 19 09.637 E 072 51.765 | C | | 196 | N 19 09.060 E 072 52.342 | E |
| 99 | N 19 09.642 E 072 51.765 | F | | | | |

**Table 2:** Category wise distribution of the *Crematogaster subnuda* Mayer, 1879 nests

| Sr. No. | Category | Height above ground (in feet) | Number of nests(n) | % |
|---|---|---|---|---|
| 1 | A | 1 to 5 | 8 | 4.08 |
| 2 | B | 6 to 10 | 48 | 24.49 |
| 3 | C | 11 to 15 | 54 | 27.55 |
| 4 | D | 16 to 20 | 38 | 19.39 |
| 5 | E | 21 to 25 | 20 | 10.20 |
| 6 | F | 26 to 30 | 16 | 8.16 |
| 7 | G | 31 to 35 | 7 | 3.57 |
| 8 | H | 36 to 40 | 0 | 0.00 |
| 9 | I | 41 to 45 | 4 | 2.04 |
| 10 | J | 46 to 50 | 1 | 0.51 |
| | Total | | 196 | 100 |

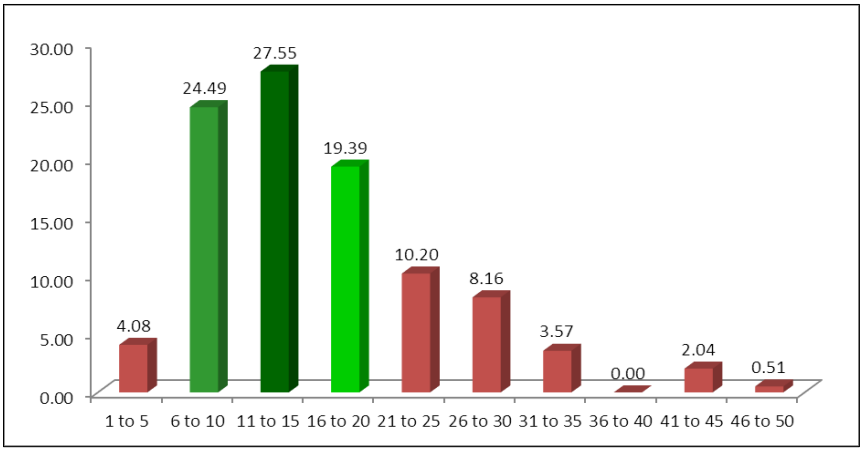


**Fig 1:** Height wise distribution of nests (the green height categories are the preferred ones) of *Crematogaster subnuda* Mayer, 1879

The preferred height of the nests above the ground was found to be between 6 to 20 feet above ground level with more preference for 11 to 15 feet (Fig. 1). The average height of the nest was 19.6 feet above the ground.
Following were the plants utilized by the ants to build the nest.

**Shrubs and younger trees**: *Carissa caranda, Tectona grandis, Terminalia tomentosa, Wrightia tinctoria, Holerrhina antidyssentrica*

**Medium to large trees**: *Terminalia catappa, Terminalia tomentosa, Madhuca indica, Bombax ceiba, Acacia auriculoformis* (Exotic invasive)

Following are some of the remarks on the findings.

1. The height of the nests could be decided by the species of the tree, girth and it shade. For trees with thinner bark, nests would be built higher.
2. Hardwood trees there are no branches at lower height to build a nest.
3. Nests higher up in trees might be vulnerable to temperature, wind, rains etc. There will be little canopy cover for protection.

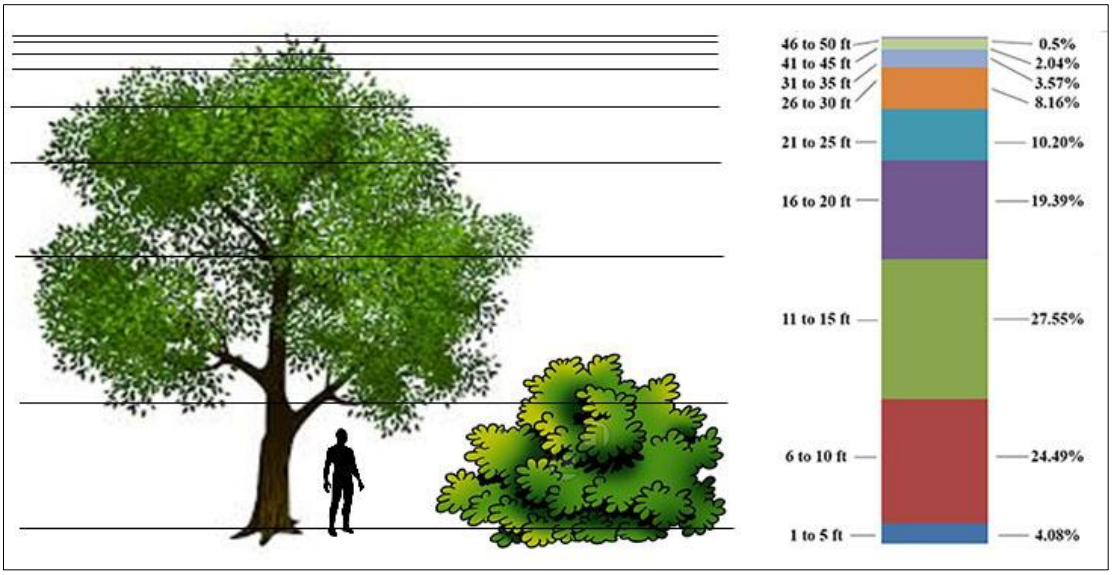


**Fig 2:** Height wise distribution of *Crematogaster subnuda* Mayer, 1879 (Category 'H' is not represented here because its value is 0)

**Fig 3:** *Crematogaster subnuda* (Mayer, 1879)

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