

A necessitatesustainment of *Semnopithecus hypoleucos* throughout summer to refrain from a challenging survival task in terms of food, water scarcity, and allied illness in the Hingoli district of Maharashtra, India

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ABSTRACT:

The Indian grey langur was studied for their survival during the summer season in Hingoli, Maharashtra, India; the 5 Km area of Kamla Nagar is near the agricultural land, and therefore, the *Semnopithecushypoleucos* (langurs) were visiting this area constantly in search of food, water and shelter etc. hence, the planned study was performed in the local area as well as in their habitat where langur specifically belong. The observations were captured with the photographic images with the help of a Canon HD camera, and the final comments were made. There is a reasonable possibility of infections and stress conditions in langur due to heat wave. The clicked picture observed and noted that the langurs were thirsty, hungry and under a stressed state with ill issues such as running nose, flu, and sour throat were the common symptoms. In 2022, the temperature reached upto 42 °C, in this region and therefore, such temperature creates problems for the survival of langurs. Consequently, this study focuses on the stress issues faced by the langur in the summer season of the year 2022 & the majors to be taken for their survival.

KEYWORDS: Indian grey langur, Heat wave, drum stick, water scarcity, viral infections

I. INTRODUCTION

The Indian grey langur (*Semnopithecus hypoleucos*) is one of the old species of the Indian subcontinent, also known as hanuman langurs^[1]. These langurs have special spiritual and historical importance in Indian Hindu religious culture. The vernacular name 'Hanuman' is the name of lord hanuman of the Hindu religion^[2]. It's a holy

festival of Dussehra celebrated in India. Remembering the lord Rama when he took revenge and killed the Ravana. It's the emblem of a victory of truth over lies and negativity. This spiritual importance of the langur species is having in India. There are many different species of langur present in India and worldwide. There was no data found where it seems that langurs are on the way to extinction or endangered species, so it is a good sign of species that adapted to the Indian environment. They breed and maintain the reproduction pool for new generations to be continued. As they are arboreal animals, the preferred habitat of langurs is forest and the mountain, hilly, and the area near temples of Indian god-goddess (Fig. 1. A)^[3]. These langurs are part of Indian animal diversity and are an important part of the ecological food chain. The langurs are herbivores and mostly feed on a vegetarian diet, including the leaves and fruits of different plants, almost 126 in number and the drum stick (*Moringa oleifera*) (Fig. 3. A)^[4]. They are also likely to taste artificial food. The Indian langurs are semi-social animals. They have emotions and feelings for their partners or the group members. They behave according to the situation, as they belong to the category of primates where human belongs: The species of highly evolved socio-animals^[5]. The socio nature of langurs allied them with humans. The langurs used to come to the human locality searching for food and water. Due to the spiritual connectivity of Indian people with the langurs, they are well protected and surviving in India to date. When the langur group entered the human locality, people used to offer them food and water. They eat almost all the vegetarian materials made in the

human kitchen. They eat biscuits, slices of bread, cooked rice, food made from flour, etc. The Indian grey langurs are familiar with humans; sometimes, they do funny moments, such as snatching the food and running away (Fig. 6. A) ^[6]. These are all likely conditions for the langurs in a good environment, but it is not the same. The climatic and seasonal variations may badly affect the survival conditions of the langur. Sometimes, it is more hazardous and deadly to the old and newly born babies of langurs. Generally, the extreme environmental force decides the fit one among all, and the remaining will be extinct ^[7]. It works on the basic principles of the evolutionary theory proposed by Charles Darwin, i.e., survival of the fittest ^[8]. In short, dog days from January to May, the extreme heat wave is experienced and recorded in the Indian subcontinent during the running year. i.e., in 2022, hot waves are not tremendously affecting animals' survival but may result in the death of wildlife ^[9]. This year the highest temperature was recorded in the village Bramhpuri Chandrapur district of the Vidarbha region of Maharashtra. The temperature inclined upto 45.1 °C was recorded, which is the highest ever in Maharashtra ^[10]. The Hingoli region where the survey study was performed was 373 Km from Bramhpuri (Google Map). The Hingoli district belongs to the Marathwada region of Maharashtra state, a semi-urban area. The highest temperature recorded was 40°C in May 2022 (Fig. 6. B). An extreme heat wave was observed this year in overall India as well. This seasonal change affects langur species (Fig. 2. A) ^[11]. Due to the high heat wave, almost 70 % of water sources were evaporated from the semi-urban area of Hingoli (Fig. 1. A a). The precipitation is the only source of water in this region. The major water source in the Hingoli sub-urban area is the river Kayadhu. The river basin length is almost 80.50 Km and 20 to 25 feet deep from ground level ^[12]. On rainy days, the river water almost touches the ground, even though 70 % of water flows out and only 30 % is the actual stagnant source. This water source is for drinking, agriculture, and industrial irrigation purposes ^[13]. The frequency of municipality drinking water is weekly once for 3 to 4 hr maximum. This is the condition in the rainy season, so that one can imagine the scenario in summer. This indicates the water scarcity in Hingoli semi-urban area. The intense sunlight changes the physiological properties of the water source. The surface water gets heated and evaporated very fast ^[14]. As a result, the remaining water source left becomes moderately alkaline, i.e., 100 to 250 mg/L ^[15] with increased salinity and mineral content, becoming toxic. Due to the high temperature of surface water,

the oxygen percentage of water reaches below the threshold level, and the reason behind this is that oxygen is a nonpolar gas. After heating, it gets evaporated very easily (Fig. 6. C) ^[16]. That is the reason behind using an aerator in the aquarium. On the other hand, the biota of aquatic water, including the bacteria, various microbes, fungi, and detritivore, increases their metabolic activity (Fig. 6. C) ^[17]. As a result, the water quality indices go below the purity level, rapidly decreasing the water quality. There is a concept of eutrophication in ecology, indicating life succession and environmental changes. Here, during the rainy season, a pond is naturally under eutrophic conditions (unless we use some herbicides) unless there is an interruption of man activity ^[18]. Therefore, all the water becomes eutrophic due to the traffic of grown algae, semi-merged plants, surface plants, highly growing bacteria, microbes, etc. One can not imagine the condition of such a wet pond with huge vegetation. The ecological succession is at its highest peak, and later on, as the season changes, such plants start to decay. The microbes now take their position similarly after a few months; the detritivore receives the job and metabolizes all the waste material available in the pond. The pond is again ready for new ecological succession ^[19]. The langurs are part of the terrestrial ecosystem. Hence, they also need water for drinking purposes, but such water is not good for drinking purposes; there is no special water source available for the forest animals, including the langurs (Fig. 1. A) ^[20]. They avoid this water from drinking. Hence, in summer, such a concentrated and hot water, langur species have to drink, and as a result, it may affect bacterial and viral infections and gastrointestinal disorders (Fig. 3. A) ^[21]. The most common infection in langur is viral flu with a running nose (Fig. 2. A, Fig. 4. A) ^[22]. In the running year, i.e., 2022, due to unexpected heat waves, the travel industry and tourist visits badly affected the Indian economy; alternatively, it hampers the langurs as they recedes in the tourist visiting places for food ^[23]. The Indian grey langur has been observed and studied in these extremely harsh dog days for their survival, and it's been a tough situation they are facing due to heat waves (Fig. 2. A b-d). Therefore, to protect them, certain special water sources should be created to avoid further exertion in summer and dwell in the human locality in search of water.

II. EXPERIMENTAL

Canon HD camera, Cell phone with selfie stick, Computer device, and Hard disc were purchased using Amazon.in and Graphpad prism 5 application software.

2.1 CHOOSING OF FIELD SURVEY AREA

The field was chosen for a survey after communicating with the local people of the Hingoli semi-urban area, and later on, the Kamla Nagar was chosen; this area was associated with the farms, agricultural land, and empty forest land of the Maharashtra government and Indian railways with low human population and where the langurs commonly observed by the localities. The total area covered was approximately 5 km in range. The survey was done in the natural habitat of langur and the human locality of Kamla Nagar, Hingoli.

2.2 IDENTIFICATION OF LANGUR SPECIES

The langur species were captured via Canon HD camera and sometimes with mobilestickss with selfie sticks. The field area was not densely crowded, but specific construction work was seen, and the top of which langurs were usually gathered ere gathered usually. As we do not want them to disturb, we usually kept a minimum distance of 20 to 30 feet. The images were captured and nicely stored in the computer device. The previous data and literature were analyzed and identified the langur species [24].

2.3 DURATION AND SUITABLE TIME FOR THE FIELD STUDY

As the summer was, we hence we planned the field study accordingly. After ccommunicating with localities and observing a few da ays, we decided to visit the Kamla Nagar, Hingoli area, between 8 - 10 AM and 4 - 6 PM daily. Our group conducted the field study from the middle of April to May last week of 2022 and collected the data, stored securely in a computer device (Fig. 2. A). We did not choose the afternoon duration as the langurs hid under the tree to protect them from sunlight and heat shock and were not found in the human locality and not found in other places.

2.4 REALTIME OBSERVATIONS OF THE HUMAN LOCALITE AREA AND NATURAL HABITAT

To predict and evaluate the exact situation and the reasons, we have visited the natural home of langurs where they are trying to protenaturalhemselves from hot summer. In the afternoon sessions for a fortnight, we saw the actual habit of natural langurs and nearby water bodies. We clicked the picture of their habitat and water source from where the langur used to drink water (Fig. 1. A a-b) [25].

2.4.1. AVAILABLE FOOD RESOURCE AND WATER QUALITY CHECK

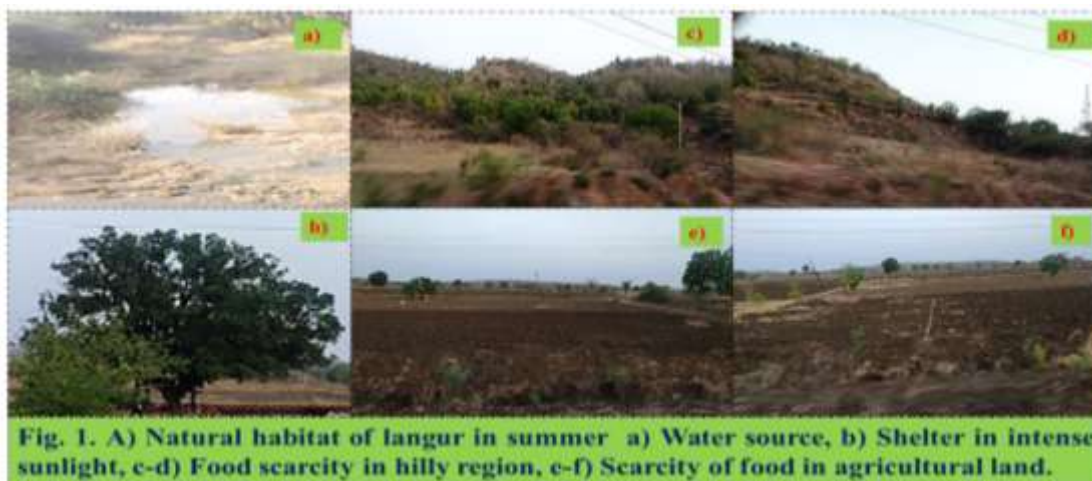
As the part of field study, we, too,k the pictures of nearby food resources from where langur get their food material, and later on, the water sample were collected from the water resource and analyzed the following parameters visually: TDS, microbial, and insect fauna, plankton, molluscans, carbonated content, turbidity, etc. with visual observations (Fig. 2. A a-b) [26].

2.5 CRITICALLY ILL OBSERVATIONS IN LANGURS PHYSIOLOGY

This study was based on the data collected and observed visual symptoms with the naked eye during s durisummermes. The toxicity of water may lead to various viral infections. The captured images and naked eye observations can not deny the possibility of viral infections (Fig 2. A b-e) [27].

2.6 ANALYSIS OF THE COLLECTED DATA AND STATISTICAL INTERPRETATION

All the collected data were sorted out day-wise nicely. In the next step, with the help of GraphPad prism 5 software, the graph was plotted, and the results were interpreted statistically for temperature changes, Physico-chemical and biological factors (Fig. 6. B, C) [28].



III. RESULTS AND DISCUSSIONS

3.1 IDENTIFICATION OF LANGUR SPECIES:

The captured images were firstly analyzed for a previously published database. It was found that the langurs located in Kamla Nagar belong to the genus- *Semnopithecus* and species- *hypoleucos*. These are also called the hanuman langurs. There were 3 pairs observed maximum time, including 3 males and 3 females. In the case of langurs, the male langurs are larger in size and appearance than female langurs. They were bearing brown-coloured hairy coats all over the body with a reddish tinge coating at the hair's surface. Except for the palm, legs, and face, all the parts were covered with hair. These three portions of the body are highly black, with the front surrounded by a hairy brown coat. The tail of both the sexes was 3-4 times longer than their body with white hairy tips.

3.2 DURATION AND SUITABLE TIME FOR THE FIELD STUDY

The survey was done for almost one and half months. The study was conducted in the morning session 8 to 10 AM and from 4 to 6 PM daily in the evening. It was visually observed that langurs were most probably found in the Kamla

Nagar area in the evening time. They used to gather on the top floor of an under-construction building, and sometimes they used to come to nearby houses and climb on trees. Their visit was occasional with the gap of 3 - 4 days, most probably in the evening. Based on these observations, the time-dependent graph was plotted. In the survey of 45 days, the langurs visited the Kamla Nagar place 15 times, out of which 11 visits were during the evening session, and the remaining 04 were in the morning session. From the total collective visits 10 times, it was observed that the langurs were in thirst of water and hungry for food. Therefore, these 10 visits are not only for wandering in the human locality but also for searching for food and water. The observations were pictured and analyzed critically.

3.3 REALTIME OBSERVATIONS OF THE HUMAN LOCALITE AREA AND NATURAL HABITAT

It was usually gathered in nearby houses where they found greenery and water resource. But, unfortunately, there were only a few spots available to have food. The natural habitat of langur was also studied for Fortnite, and the observations were noted.

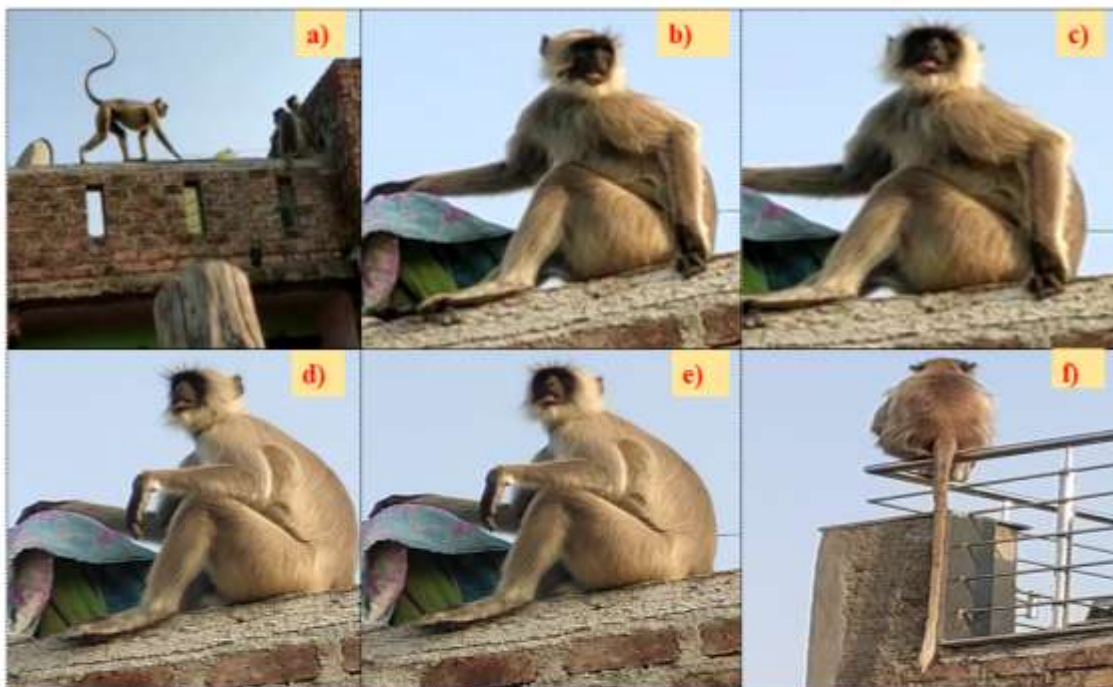


Fig. 2. A) Langur in stress and illness situation due to heat wave a-f) Showing the effect of heat wave and the protruding tongue indicates the langurs in a stress condition of water, food and becomes ill with running nose.

3.3.1. AVAILABLE FOOD RESOURCE AND WATER QUALITY CHECK

A. HUMAN LOCALITY

It was observed that the langur feed most of the time on *Moringaoleifera* plant in human locality present in abundance. They used to eat the drum stick seed and throw the tough covering. Also, they prefer newly grown leaves of drum stick plants as food. The *Moringaoleifera* plant is of scientific importance and is an ayurvedically proven plant as a healthy nutrient source for living beings. Therefore, the drum stick was one of the favourite food of langurs during summer. Instead of

such a vegetable diet, the most attraction of langur toward human-made food products. They loves the food prepared by human and sometimes they try to snatch it as well from the children's hand. The water quality of the urban area was good as it is the human

drinking water, so a pure and relying entity for consumption was available. Hence, langurs sometimes visit the places where they get good water quality. One more observation is that humans will not drink stagnant or waste and gutter water. Therefore they are very much conscious of a natural things.



B. NATURAL HABITAT

For the fortnight, in the afternoon sessions, we were visiting the natural habitat of langur. As the summer season was at its peak level, there was no activity of langurs observed during the afternoon. Everywhere there was a silence, and only hot air was blowing around. The langurs were gathered over the mango tree as the other trees were affected by the sunlight and shades of their leaves. The food material is available in nearby langurs' habitats also limited. As the dog days were going on, there

was no crop production on the farm and no greenery in those places. The small bushes and other plants could not eat as they started secondary metabolite production to survive in a harsh climate. We visited the water resource, which was very limited with the harmful biological entity inside the water, Including mosquito larvae, planktons, dust particles, and yellowish-coloured warm water not suitable to drink at all. Just by physical appearance, one can predict the quality of water.

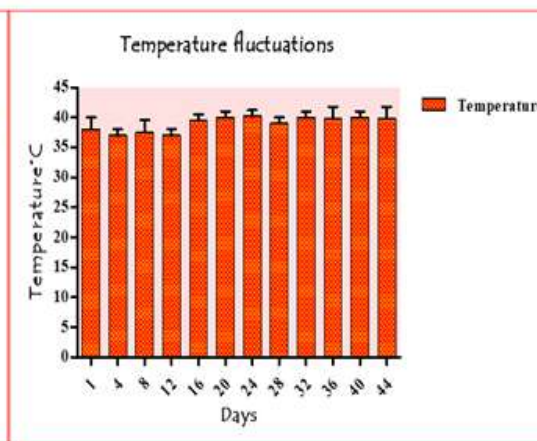
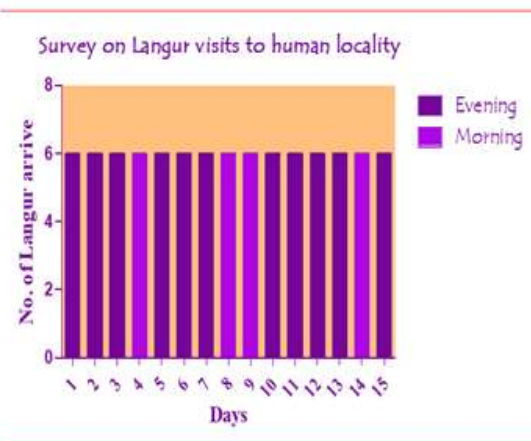


Fig. 6. A) Survey on Langur visit to human locality, B) Temperature fluctuations in Hingoli sub-urban area.

3.4 CRITICALLY ILL OBSERVATIONS IN LANGURS PHYSIOLOGY

It was observed that the Indian grey langurs were poorly affected by running nose; it may be due to the viral infection and the cumulative effect of impure water. The visual observations found that there were 3 pairs of langurs in the survey area of Kamla Nagar, Hingoli, Maharashtra, India. Out of these 6 langurs, mostly the male langurs were affected. Therefore, The observations also include the running watery nose with a high breathing rate and increased heartbeats due to the heat effect of sunny days. The pictures were captured and collected. The keen observations indicate that the langur species were going through terrible physical stress with mouth opening broad and little dialeted tongue with in and out movement of the mouth. This suggests that the Indian grey langurs were under stressful conditions. These observations were noted in the evening between 4-

6 PM. The langurs searched for water as the signs of viral infections were visible.

3.5 ANALYSIS OF THE COLLECTED DATA AND STATISTICAL INTERPRETATION

The data in the form of pictures and numerical were plotted in GraphPad Prism 5 software regarding standard deviation and predicted results. The statistical analysis showed that the langurs were visiting the other places rather than their habitat and its possibility was one-third times.

IV. CONCLUSIONS

From the observations and collected data, the following conclusion can be drawn. The summer season affects the Indian grey langur for food and water. The natural resources were unavailable in those days leading to the survival issues in langurs. Therefore, they move toward the human-occupied area to complete their basic needs. The dog days lose langurs immunity, and it comes

with various infections such as flu and running nose. The shelter issues are also one of the major causes behind the weakening of their immunity, as they do not get proper rest due to hot waves in summer. Therefore such hot summer spoils normal langurs' life and becomes a disaster in the path of their survival. Hence, it is necessary to keep and maintain water pits in summer so that they will become drinking water sources for animals and langurs as well. This study provokes the conservation strategy and will help to reduce the loss of biodiversity in the future and possibly promote langurs' growth and survival.

Declaration Of Competing Interest

The author declares there is no conflict of interest.

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