Ecologica Montenegrina
ISSN 2336-9744 (online) | ISSN 2337-0173 (print)

Ecologica Montenegrina 71: 5-16 (2024)
This journal is available online at: www.biotaxa.org/em
https://dx.doi.org/10.37828/em.2024.71.2

Article

Ecological conditions of Javan langur (*Trachypithecus auratus* É. Geoffroy Saint-Hilaire, 1812) in Sokokembang Forest (Central Java, Indonesia) through distribution and food preferences

YUSUF MAULANA PUTRA[1], IKE NURJUITA NAYASILANA[1*], ANA AGUSTINA[1] & ARIF SETIAWAN[2]

[1]*Department of Forest Management, Universitas Sebelas Maret, Jl. Ir. Sutami 36 A, Kentingan, Surakarta, 57126, Cetral Java, Indonesia.*
E-mail: yusufmaulana@student.uns.ac.id; https://orcid.org/0009-0006-6764-3707
E-mail: ana.agustina2018@staff.uns.ac.id; https://orcid.org/0000-0001-8561-3524
[2]*SwaraOwa. Berbah, Sleman 55573, Yogyakarta, Indonesia.*
https://orcid.org/0000-0002-6090-906X
** Corresponding Author. E-mail: nayasilana@staff.uns.ac.id; https://orcid.org/0000-0001-9527-0449*

Received 15 November 2023 | Accepted by *V. Pešić*: 2 January 2024 | Published online 9 January 2024.

Abstract
Javan langur (*Trachypithecus auratus*) is endemic to Java Island with vulnerable conservation status according to IUCN. The study aimed to determine the distribution and food preferences of Javan langurs in Sokokembang Forest as part of understanding ecological conditions. The research used strip transect and concentration count methods, sampling the distribution of food using accidental sampling and recording data on the utilization of food plants with rapid assessment. The results showed that the types of food consumed by javan langurs were 14 types of plants, which were scattered at 6 points on five transect lines. The percentage of preferred plants was (*Pangium edule*) 29.4%, (*Artocarpus elasticus*) 17.6%, (*Dysoxylum excelsum*) 11.8%, (*Pometia pinnata*) 8.8%, (*Cinnamomum iners*) 5.9%, and others 2.9%. The average vertical space utilization of javan langurs during feeding activities was 17.3 m (stratum C) with a percentage of 70.6%. The percentage of tree crown space usage pattern of javan langur in CII (36.1%), CI (19.4%), BII (13.9%), AI (11.1%) BII, and CIII (8.3%), AII (2.8%). Food type and tree crown space are important parts of the presence of Javan langurs in Sokokembang.

Key words Food distribution, preference, sokokembang forest, space use, *Trachypithecus auratus*.

Introduction

Indonesia has a diversity of primates, 61 of the world's 479 primate species are recorded in Indonesia, and 38 are endemic species. This makes Indonesia third only to Brazil (116 species) and Madagascar (98 species). These primates are distributed from North Kalimantan to the southern coast of Java, and from the westernmost part of eastern Sumatra to Bacan and Timor Leste (Supriatna, 2022). Some of the

species still found in Java include the *Hylobates moloch*, *Presbytis comata*, *Presbytis fredericae*, *Nycticebus javanicus*, *Macaca fascicularis* and *T. auratus* (Supriatna, 2022).

Javan langurs belong to the family Cercopithecidae, subfamily Colobinae. The subfamily Colobinae has 10 genera, but only four of those are found in Indonesia, including the leaf monkeys *(Presbytis* and *Trachypithecus*) and the odd-nosed group (*Nasalis* and *Simias*) (Supriatna, 2022). Distribution of Javan langur in Java, Bali, Lombok Islands, Sempu, and Nusa Barung Islands, off the south coast of Java (Roos *et al.*, 2014). Javan langurs occupy various types of forest ecosystems, such as mangrove forests, coastal forests, freshwater forests, swamp forests, wet forests, lowland forests, dry forests, mountain forests up to 3,500 meters above sea level, and also in plantations (Nijman, 2000). The habitat of the Javan langur is widespread ranging from primary to secondary forests, as is the case in Sokokembang Forest, Kayupuring, Petungkriyono, Pekalongan, Central Java.

The Javan langur is protected under Indonesian law, categorized as vulnerable by the IUCN, and listed in Appendix II (CITES). Primates are the most commonly traded species for pets, after birds. Most of the traded primates come from captivity (Harianto and Dewi, 2017). Threats to the Javan langur population and habitat are increasingly worrying. The decline in the Javan langur population is caused by a decrease in the quantity and quality of habitat, poaching, land conversion, and wildlife trade (Nijman, 2000). Habitat fragmentation and degradation can lead to a decrease in the carrying capacity of the environment (Sulistyadi *et al.*, 2013). This then causes a decrease in population growth because animals must adapt to changes in their environment (Bismark *et al.*, 2019).

Biotic and abiotic components play an important role as constituents of Javan langur habitat. Vegetation is one of the most important biotic components that function as a source of food and protection for Javan langurs from predators (Ayunin *et al.*, 2014). Setiawan *et al.* (2012), explained that tree-cutting and agricultural expansion threaten almost all areas in the Dieng Mountains. Forest encroachment for plantation land and residential areas makes the original habitat of the Javan langur increasingly narrow. This can affect forest vegetation that is used as a source of food for the Javan langur. The presence of trees and dense canopy serves to support daily activities such as eating, resting, socializing, and activities (Ayunin *et al.*, 2014).

Food is an important factor for animals to sustain life. The availability of sufficient and quality food can support the life and reproduction process of animals well (Zakki *et al.*, 2017). Information on the types of food plants that play a role in supporting the survival of Javan langurs in the Sokokembang Forest is still not widely known. This study aims to determine the distribution and types of food plants, as well as to find information on food preferences that are most favored by javan langurs in Sokokembang Forest.

Material and methods

Study Site. This research was conducted in Sokokembang Hamlet, Kayupuring Village, Petungkriyono District, Pekalongan Regency, Central Java. The coordinates of the research location are located at 07°05'51.0" S, 109°43'29.9" E with an area of about 112.4 ha (Figure 1). The location of the transect lines is divided into two areas, namely the highway and the hill area.

Data Collection. This research was conducted from May to June 2023. Tools used include a distance laser meter, phiband, roll meter, tally sheet, Global Positioning System (GPS), Avenza Maps, compass, binoculars, camera, and QGis software Version 3.22. Materials used include maps of the area and plants that are food samples for Javan langur in Sokokembang Forest. Data collection of Javan langurs used the strip transect method. There were 5 transects used, each observation strip was 1,000 meters long, wide (20 m to the right and 20 m to the left). The calculation of individuals in each group of Javan langurs was carried out using the concentration count method or the calculating method of animal numbers in groups at known locations (Andarini *et al.*, 2021). Data were collected in the morning at 07.00-11.00 WIB, and in the afternoon at 15.00-17.00 WIB, data collection in the morning and afternoon was carried out on the same route. Each observation path was repeated 3 times. Sample data on the distribution of food plants were taken using the accidental sampling method, which is a method of recording by chance or accidentally when finding langurs who are eating (Retanti *et al.*, 2021). Data recording of food plant utilization uses the Rapid Assessment method. This method is used to quickly

and accurately record relevant observation data, both qualitatively and quantitatively at the observation location (IUCN, 2007; Syaputra *et al.*, 2017). Data is recorded in the form of food plant species, plant coordinates, parts eaten, and the height of langurs when performing feeding activities.

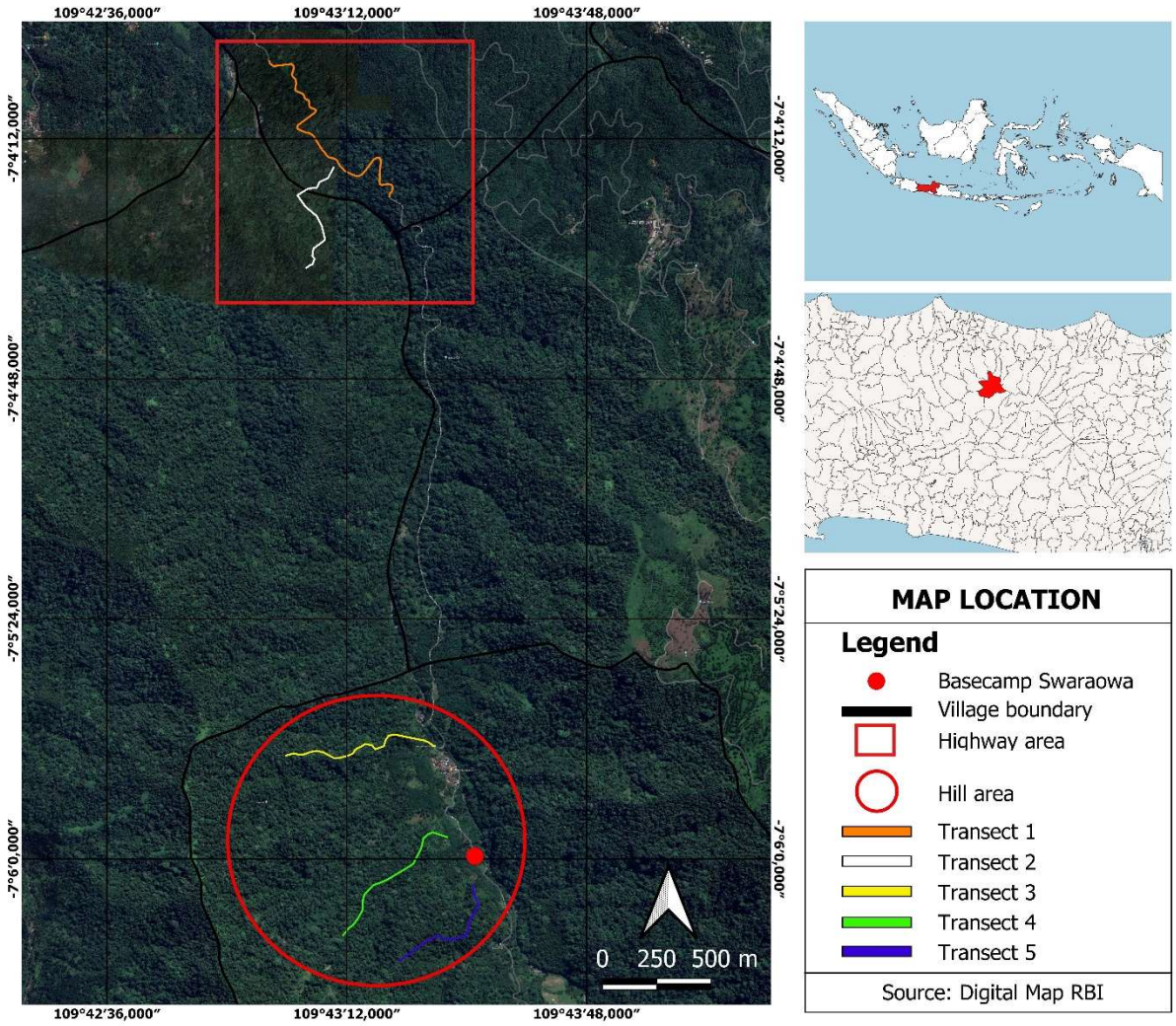

Figure 1. Location of Sokokembang forest, Pekalongan Regency, Central Java, Indonesia.

Data analysis

Feed proportion. The proportion of plant parts consumed using the formula Rachman *et al.* (2022):

$$\frac{Si}{St} \text{ x } 100\%$$

Description, Si: (number of plant species whose part i is consumed), St: (total number of food plant species).

Feed Preference. Feed preference was calculated using the formula from Zakki *et al.* (2017):

$$No = \frac{ni}{N} \text{ x } 100\%$$

Description, No: (relative frequency of food type), Ni: (Total frequency of each food type), N: (total frequency of all food types).

Forage Plant Distribution Map. Determination of the distribution of Javan langur food plants was carried out by making a map using QGIS software. This mapping process was used to determine the position of food in each transect line by entering tree coordinates obtained through GPS waypoints (Retanti *et al.*, 2021).

Vertical Space Usage. Javan langur space use is divided based on canopy strata. Determination of canopy strata according to Septiawan *et al.* (2017), stratum A has a height of more than 30 m, stratum B has 20-30 m, C has 4-20 m, D layer of shrubs and bushes with a height of 1-4 m, E layer of ground cover plants. The division of crown space based on Putri (2009) is divided into AI, AII, AIII, BI, BII, BIII, CI, CII and CIII (Figure 2). This division of space is used to determine the presence or position of the Javan langur in the utilization of its vegetation space.

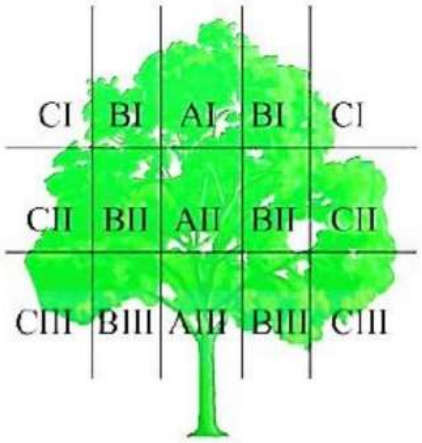

Figure 2. Tree crown space division (from Putri, 2009).

Results and Discussion

General Site Conditions

Sokokembang Forest is one of the remaining natural habitats for Javan langurs in Central Java province, including a secondary forest with a potential habitat area of 65.69 km^2 (Setiawan *et al.*, 2012). Wulandari *et al.* (2016) stated that Sokokembang Forest has an air temperature of 22-30°C, air humidity 75-88%. Light intensity is 46- 8640 lux and the altitude is approximately 500 meters above sea level. Air temperature has an important role for wildlife, low temperatures and high humidity in the morning will cause langurs to move and look for places with sunlight to warm their bodies (Wirdateti *et al.*, 2009).

Potential of Feed Plants in Sokokembang Forest

Food is one of the most important ecological factors to sustain animal life. Farida and Harun (2000) explain that to maintain the existence of primates in their natural habitat, it is necessary to identify the diversity of existing plant species because these plants are partly responsible for the survival of primates, diversity of existing plant species because these plants are partly a source of food for primates living in the habitat. In Sokokembang Forest, there were 14 species of plants eaten by Javan langurs (Table 1).

The above species consisted of 12 higher plants (trees) and 2 species of ferns. The nature of life of the Javan langur is arboreal, so it has a high level of dependence on trees (Kurniawan *et al.,* 2019). According to Ayunin *et al.* (2014), Javan langurs tend to choose trees that are large and have many branches, making it possible for all members to pass, rest, find food, and protect from predators. Javan langurs are folivorous primates, eat more leaves (Nijman, 2021). Javan langurs have a stomach with a lot of space so that food components in leaves including fiber can be digested properly (Najiboer *et al.* 2006).

Based on the results of the study, the leaves had the largest percentage consumed by langurs at 75%, flowers at 12.5%, and petioles and stems at 6.25% (Figure 3). This is to Aryanti and Azizah (2019), the composition of Javan langur food is dominant in leaves with a percentage of 38.4% for old leaves, 26.9% for leaf shoots, 30.7% for fruit, and 3.8% for flowers. Young leaves or leaf tops are the preferred part by Javan langurs with a percentage of 58.30% (Figure 3). Tsuji *et al.* (2019) stated that langurs eat young leaves (69.9%), followed by fruits (21.2%), and the least consumed old leaves (0.8%). According to Pratiwi (2008), Javan langurs prefer to eat young leaves or leaf shoots because they are easier to digest.

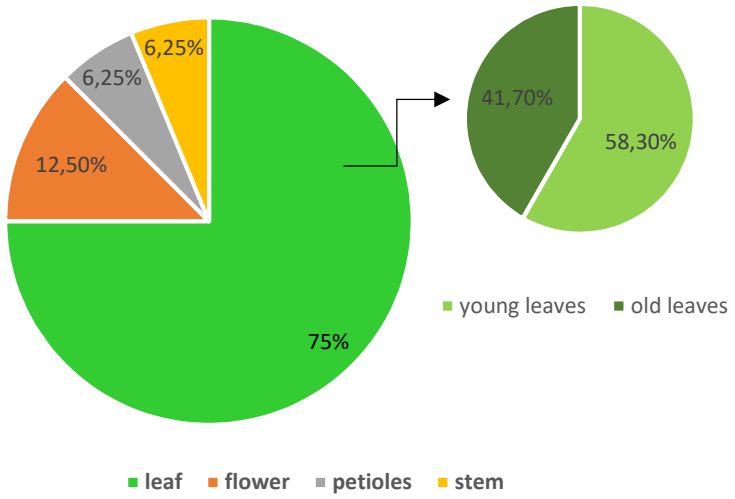

Figure 3. Percentage composition of plant parts eaten by Javan langurs in Sokokembang forest.

The choice of feed type (preference) indicates the most preferred feed type and the least preferred feed type (Zakki *et al.*, 2017). Javan langurs in each encounter location tend to certain plants that are chosen as food sources. Javan langurs in Sokokembang Forest had the most preferred plant preference (*Pangium edule*) with a percentage of 29.4% eaten, (*Artocarpus elasticus*) 17.6%, (*Dysoxylum excelsum*) 11.8%, (*Pometia pinnata*) 8.8%, and the remaining 2.9% each (Table 1).

Table 1. Javan langur food plant species and preferences in Sokokembang forest.

Species	Family	Part of plant	Frequency %
Pangium edule	Achariaceae	Leave & petioles	29,4
Artocarpus elasticus	Moraceae	Leave	17,6
Pometia pinnata	Sapindaceae	Leave	8,8
Horsfieldia irya	Myristicaceae	Young leaves	2,9
Litsea angulata	Lauraceae	Young leaves	2,9
Elaeocarpus ganitrus	Elaeocarpaceae	Young leaves	2,9
Litsea umbellata	Lauraceae	Leave & flower	2,9
Dysoxylum excelsum	Meliaceae	Leave	11,8
Cinnamomum iners	Lauraceae	Leave	5,9
Laportea stimulans	Urticaceae	Flower	2,9
Sterculia oblongata	Malvaceae	Leave	2,9
Ficus annulata	Moraceae	Leave	2,9
Asplenium nidus	Aspleniaceae	Stems	2,9
Cyathea contaminans	Cyatheaceae	Leave	2,9

According to Bismark (2009), members of the colobinae subfamily have a digestive system with fermentation techniques, like the digestion of ruminants (polygastric digestive system). Half of the food intake for Javan langurs consists of protein-rich leaves (Kool, 1992; Amekae, 2019). Supriatna (2022), explained that the parts eaten by langurs are low in fiber content and easier to digest than the uneaten parts of the vegetation. uneaten parts of the vegetation. *P. edule* leaves have nutrient content in the form of water 14.24%, ash 7.60%, protein, 20.88%, fat 1.99%, crude fiber 15.53%, Ca 1.169%, P 0.16%, and gross energy 3787 (kcal/kg) (Najoan *et al.* 2020). This explains why Javan langurs prefer *P. edule* as the most preferred plant. It can be seen that the plant has a high protein content and lower fiber content. The composition of food such as chemical composition will affect animal feeding behavior (Liu *et al.*, 2018).

Distribution of forage plants

Javan langurs perform feeding activities in groups. From the results of the study, 6 groups were observed feeding in the Sokokembang Forest with the number ranging from 7-23 individuals in each group (Table 2). This is in accordance with the statement of Supriatna (2022), that the number of individuals in each group ranges from 6-21 individuals. Primates have strategies to survive efficiently. One of the strategies used is to live in groups. The reasons primates live in groups include maintaining resources, protection from predators, efficient foraging, and ensuring reproductive success (Indriyati *et al.*, 2017).

Table 2. Coordinates of feed distribution of Javan langur in Sokokembang forest.

Coordinates	Group	Number of individuals	Species
7°04'10.3" S, 109°43'04.4" E	1	13	*Pangium edule* *Dysoxylum excelsum* *Pometia pinnata* *Cinnamomum iners* *Artocarpus elasticus*
7°04'18.8" S, 109°43'16.2" E	3	9	*Artocarpus elasticus* *Pometia pinnata* *Horsfieldia irya* *Asplenium nidus* *Elaeocarpus ganitrus*
7°06'05.7" S, 109°43'14.7" E	6	7	*Artocarpus elasticus* *Sterculia oblongata* *Litsea angulata*
7°05'43.5" S, 109°43'14.4" E	8	8	*Ficus annulata* *Litsea umbellata*
7°04'29.6" S, 109°43'05.8" E	10	11	*Pangium edule*
7°04'07.1" S, 109°43'07.0" E	11	23	*Pangium edule* *Laportea stimulans* *Cyathea contaminans*

Table 2 shows the coordinates of the encounter points and the types of plants consumed at the study sites. At each encounter location, the Javan langur had different plant species. This indicates that each group of langurs tends to a particular species that is used as a food source. Javan langur foraging encounters were found at 6 points spread across different transects, 4 points were found in the highway area and 2 points were found in the hill area (Figure 4). The conditions at each transect have different slopes, transect 1 has a flat while transect 5 has a very steep slope (Table 3). Figure 4 shows the feeding distribution points near the river. Javan langurs are found close to food sources and springs (Eliana *et al.*, 2017). Astriani *et al.* (2015), explained that langurs like places close to water to find food. This is correlated with vegetation around water sources that is relatively more abundant and more fertile than locations far from water sources, especially branch and crown growth.

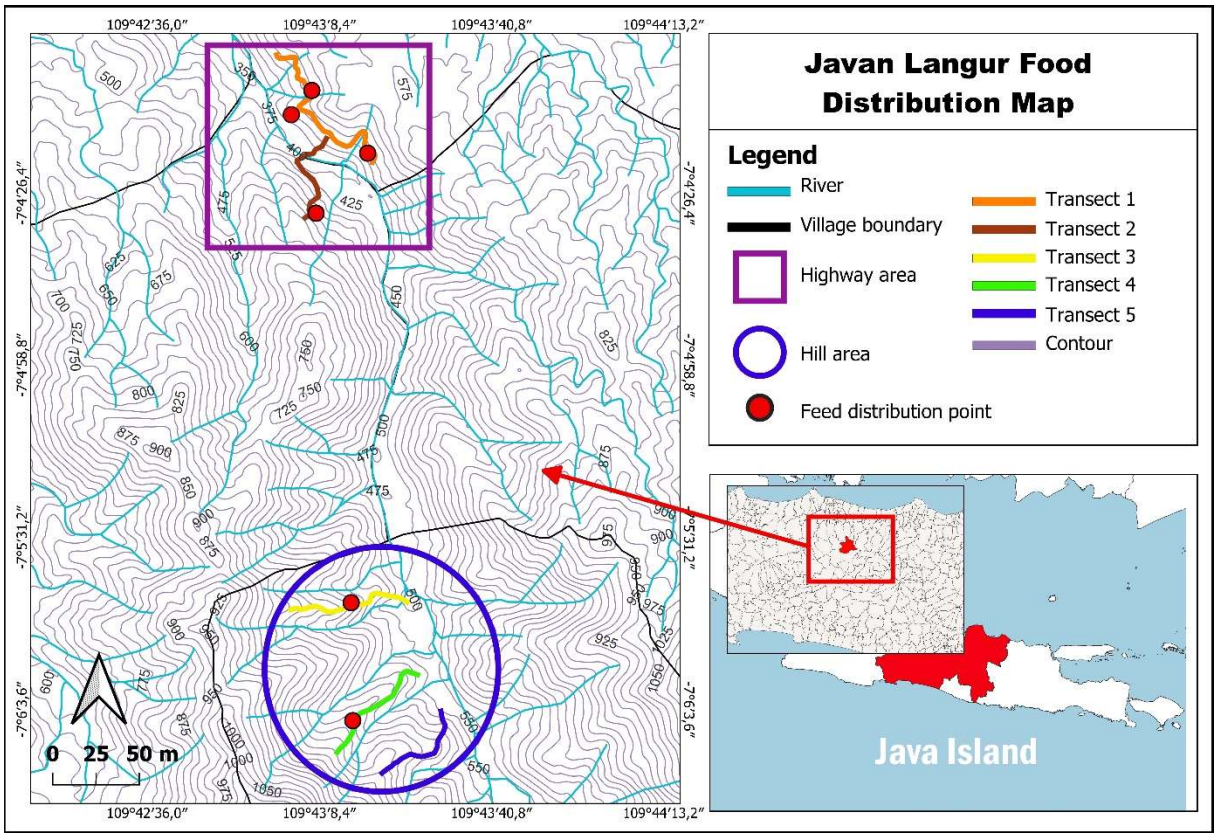

Figure 4. Distribution map of Javan langur food plants.

Vertical space usage

Based on the results of the study, the average eating activity of Javan langurs in Sokokembang Forest was using height 17.3 m in the tree or in stratum C. The percentage of Javan langurs in Sokokembang Forest conducting eating activities in stratum C amounted to 70.60%, and in stratum B amounted to 29.4% (Figure 5). The statement of Ihsanu *et al.* (2013), that Javan langur feeding activities in the upper strata (altitude >15 meters, 81%) middle strata (altitude 6-15 meters, 18%), and lower strata (altitude 0-5 meters, 1%).

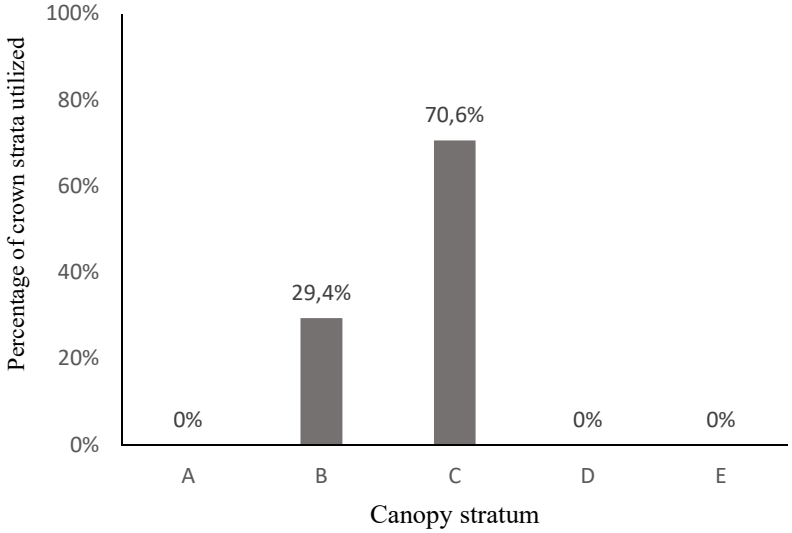

Figure 5. Percentage of canopy stratum utilization by Javan langurs in Sokokembang forest.

Table 3. Characteristics of transects conducted in Sokokembang forest.

Transect	Characteristic	
	Elevation	Slope inclination
1	425-475 mdpl	6,5% (flat)
2	425-575 mdpl	35,7% (steep)
3	500-750 mdpl	39,7% (steep)
4	550-750 mdpl	35,7% (steep)
5	550-750 mdpl	47,6% (extremely steep)

Javan langurs in Sokokembang Forest occupy spaces AI, AII, BII, BIII, CII, and CIII in conducting feeding activities. The yellow color indicates the tree corwn space used for feeding activities (Figure 6a). Based on the results of observations of the use of the most space by Javan langurs, namely in the CII room (36.1%), CI (19.4%), BII (13.9%), AI (11.1%) BII and CIII (8.3%), while the smallest in the AII room (2.8%). According to the statement (Hidayatullah, 2015), the highest frequency is in the BII and CII rooms which are used by all individuals.

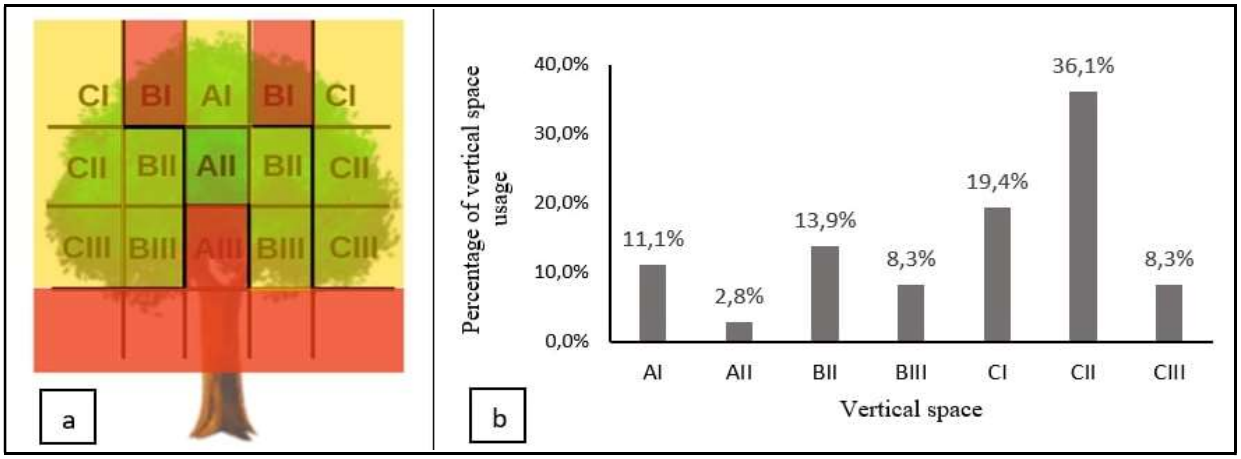

Figure 6. (a) Vertical Crown space of tree usage patterns (yellow color indicates the space used for feeding activities, red color space not used), (b) Percentage of vertical crown space of tree usage.

In the CII room, many langur cubs were found doing feeding activities, besides that, adult males were also found monitoring their group members (Figure 7). Sulistyadi *et al.* (2013) stated that adult males are often seen sitting on fairly open tree branches to observe the surrounding conditions and sometimes move from one side to the other to ensure the safety of their group. The use of CI space is not only for foraging but also as a connecting corridor between trees. The BII room is used by adult female langurs for feeding activities, in addition to adult females there are juvenile langurs who carry out resting and grooming activities (Figure 8). Akbar *et al.* (2019), explained that juveniles spend less time eating than adult female langurs. This is possible because adult females need more energy to breastfeed and care for babies. The AI room is the highest point of the tree where there are abundant young leaves. Spaces BIII and CIII are rarely used for feeding activities. In general, room AII is used for resting adult langurs.

Figure 7. (a) Javan langur males monitoring their group; (b) langur cubs feeding activities in in Sokokembang forest. Photos by Y.M. Putra.

Figure 8. Grooming activities of Javan langurs in Sokokembang forest. Photo by Y.M. Putra.

Conclusions

There were 14 species identified as food plants for javan langur in Sokokembang Forest. Food plants were found in 6 locations spread across five transect lines. The most preferred plant preference was *Pangium edule* (29.4%). Javan langurs conducted feeding activities at an average height of 17.3 m (stratum C) with a percentage of 70.6%. The pattern of space use of the Javan langur is largest in CII (36.1%) while the smallest in space AII (2.8%). Ecologically Sokokembang Forest has food availability to support the existence of Javan Langurs. The vertical pattern of space utilization indicates that Sokokembang Forest supports the life of Javan langurs as arboreal animals.

Acknowledgements

The authors thank to NGO Swaraowa for providing financial support and research tools. KPH Pekalongan Timur and BAPPEDA Pekalongan for granting research permits, and the Forest Management Study Program, Faculty of Agriculture, Sebelas Maret University.

References

Akbar, M.A., Rizaldi, R., Novarino, W., Farajallah, D.P. & Tsuji, Y. (2019) Activity budget and diet in silvery lutung *Trachypithecus cristatus* at Gunung Padang, West Sumatra, Indonesia. *Biodiversitas Journal of Biological Diversity,* 20(3), 719–724.

Amekae, Y.S. (2019) *Komposisi Jenis Tumbuhan Pakan Dan Kandungan Nutrisi Pakan Lutung Jawa di Hutan Lindung Coban Talun Batu*. Institut Pertanian Malang, Malang, 19 pp.

Andarini, F.M., Meylia, S.A., Widiani, E., Perdana, R., Ardiansyah, I.R., Zahra, N.F., Badawi, W.T.A., Aziz, M.A., Rahman, R., Muhammad, F. & Mustari, A.H. (2021) Populasi dan Potensi Pakan Lutung jawa (*Trachypithecus auratus*) di Resort Cibodas Taman Nasional Gunung Gede Pangrango, Jawa Barat. *Prosiding Seminar nasional Konservasi untuk Kesejahteraan Masyarakat II*, 98–109.

Aryanti, N.A. & Azizah, L.N. (2019) Karakteristik Habitat Lutung jawa (*Trachypithecus auratus*) di Kawasan Hutan Lindung RPH Sumbermanjing KPH Malang. *Jurnal Primatologi Indonesia*, 16(1), 24–30.

Astriani, W.I., Arief, H. & Prasetyo, L.B. (2015) Populasi dan habitat lutung jawa (*Trcyphitecus auratus* e. Geoffrey 1812) di resort balanan, taman nasonal baluran. *Media Konservasi*, 20(3), 226–234.

Ayunin, Q., Pudyatmoko, S. & Imron, M.A. (2014) Seleksi habitat lutung jawa (*Trachypithecus auratus* E. Geoffroy SaintHilaire, 1812) di Taman Nasional Gunung Merapi. *Jurnal Penelitian Hutan dan Konservasi Alam*, 11(3), 261–279.

Bismark, M. (2009) *Biologi Konservasi Bekantan* (*Nasalis larvatus*). Pusat Penelitian dan Pengembangan Hutan dan Konservasi Alam, Bogor.

Bismark, M., Iskandar, S., Sawitri, R., Heriyanto, N.M. & Yuleka. (2019) Habitat siamang (*Symphalangus syndactylus*, Raffles 1821) di kawasan terdegradasi Taman Nasional Kerinci Seblat, Kabupaten Pesisir Selatan. *Jurnal Penelitian Hutan dan Konservasi Alam*. 16(2), 133–145.

Eliana, D., Nasution, E. K. & Indarmawan, I. (2017) Tingkah Laku Makan Lutung Jawa *Trachypithecus auratus* di Kawasan Pancuran 7 Baturaden Gunung Slamet Jawa Tengah. *Scripta Biologica*, 4(2), 125–129. https://doi.org/10.20884/1.2017.4.2.403

Farida, W.R. & Harun. (2000). Keragaman Jenis Tumbuhan sebagai Sumber Pakan bagi Owa Jawa (*Hylobates moloch*), Surili *(Presbytis comata*), dan Lutung (*Trachypithecus auratus*) di Taman Nasional Gunung Halimun. *Jurnal Primatologi Indonesia*, 3(2), 55–61.

Harianto, S.P. & Dewi, B. S. (2017). *Biodiversitas Fauna Di Kawasan Budidaya Lahan Basah. Buku Ajar Biologi Konservasi*. Uiversitas Lampung, Lampung, 98pp.

Hidayatullah, R.R. (2015). *Parameter Demografi Dan Penggunaan Ruang Vertikal Lutung Jawa (Trachypithecus Auratus Geoffroy 1812) Di Resort Tamanjaya Taman Nasional Ujung Kulon*. Departemen Konservasi Sumberdaya Hutan Dan Ekowisata Fakultas Kehutanan Institut Pertanian Bogor, Bogor, 10 pp. [in Indonesia]

Ihsanu, I.A., Setiawan, A. & Rustiati, E.L. (2013) Studi Perilaku Makan Dan Analisis Vegetasi Pakan Lutung Jawa (*Trachypithecus auratus*) di Taman Nasional Gunung Ciremai. *Jurnal Sylva Lestari*, 1(1), 17–22.https://doi.org/1.2396/jsl1117-22

Indriyati, E., Nugroho, A.S. & Kaswinarni, F. (2017) Bentuk Interaksi Intraspesifik Lutung Budeng (*Trachypithecus auratus*) di Kawasan Hutan Adinuso Kecamatan Subah Kabupaten Batang. *Bioma: Jurnal Ilmiah Biologi*, 6(1).

Kool, K.M. (1989) *Behavioural ecology of the silver leaf monkey, Trachypithecus auratus sondaicus, in the Pangandaran Nature Reserve, West Java, Indonesia.* University of New South Wales Sydney, Sydney, 239 pp.

Kurniawan, A., Baskoro, K. & Jumari, J. (2019). Komposisi Vegetasi Habitat Lutung Jawa (*Trachypithecus auratus*) di Kawasan Wana Wisata Kalipaingan Kabupaten Pekalongan. *Bioma: Berkala Ilmiah Biologi*, 21(2), 132–138.

Liu, T., Yu, L., Li, M., Wu, J., Li, H., Whalen, J. K. & Hu, F. (2018) Food familiarity does not change nematode feeding behavior. *Soil Biology and Biochemistry*, 125, 136–143. https://doi.org/10.1016/j.soilbio.2018.07.011

Najiboer, J., Clauss, M., Olsthoorn, M., Noordermer, W., Huisman, T.R., Verheyen, C., Kuilen, J.V.D., Streich, W.J. & dan Beynen, A.C. (2006) Effect of diet on the feces quality in javan langurs (*Trachypithecus auratus*). *Journal Zoo Wildlife Med*, 37(3), 366–372.

Najoan, M., Wolayan, F.R. & Sompie, F.N. (2020). *Identifikasi Kandungan Nutrien, Senyawa Bioaktif dan Penentuan Energi Metabolis Daun Pangi (Pangium edule Reinw) sebagai Pakan Alternatif Ayam Kampung.* Universitas Sam Ratulangi, Manado, 9 pp.

Nijman, V. (2000). Geographic distribution of ebony leaf monkey *Trachypithecus auratus* (E. Geoffroy Saint-Hilaire, 1812) (Mammalia: Primatas: Cercopithecidae). *Contributions to Zoology*, 69(3), 157–177.

Nijman, V. (2021) Trachypithecus auratus. The IUCN Red List of Threatened Species 2021: e.T39848A17988500. https://www.iucnredlist.org/species/39848/17988500 (06-11-2023)

Pratiwi, A. (2008). *Aktivitas Pola Makan dan Pemilihan Pakan Pada Lutung Kelabu Betina (Trachypithecus cristatus, Riffles 1812) di Pusat Penyelamatan Satwa Gadog Ciawi-Bogor*. Fakultas Peternakan. Insitut Pertanian Bogor, Bogor, 42. [in Indonesia]

Putri, A.S. (2009). *Pola Penggunaan Ruang Owa Jawa (Hylobates moloch Audebert, 1798) berdasarkan Perilaku Bersuara di Taman Nasional Gunung Halimun Salak, Provinsi Jawa Barat.* Institut Pertanian Bogor, Bogor, 41. [in Indonesia]

Rachman, N., Farajallah, D.P. & Iskandar, E. (2022) Kepadatan Populasi dan Jenis Pakan Lutung Kelabu (*Trachypithecus cristatus*) di Hutan Mangrove, Kalimantan Timur. *Jurnal Penelitian Hutan dan Konservasi Alam,* 19(1), 119–137.

Retanti, R., Fithria, A. & Rudy, G, S. (2021) Sebaran Pohon Pakan di Habitat Bekantan (*Nasalis lavartus* Wurmb.) di Hutan Riparian Areal Pertambangan PT Jorong Barutama Greston. *Jurnal Sylva Scienteae,* 4 (3), 517–524.

Roos, C., Boonratana, R., Supriatna, J., Fellowes, J.R., Groves, C.P., Nash, S.D., Rylands, A.B. & Mittermeier, R.A. (2014) An updated taxonomy and conservation. Status review of Asian primates. *Asian Primates Journal*, 4(1), 2–38.

Setiawan, A., Nugroho, T. S., Wibisono, Y., Ikawati, V. & Sugardjito, J. (2012) Population density and distribution of Javan gibbon (*Hylobates moloch*) in Central Java, Indonesia. *Biodiversitas Journal of Biological Diversity*, 13(1), 23–27. https://doi.org/10.13057/biodiv/d130105

Septiawan, W., Indriyanto, I. & Duryat, D. (2017) Jenis tanaman, kerapatan, dan stratifikasi tajuk pada hutan kemasyarakatan kelompok tani rukun makmur 1 di register 30 gunung tanggamus, lampung. *Jurnal Sylva Lestari*, 5(2), 88–101. https://doi.org/10.23960/jsl2588-101

Sulistyadi, E., Kartono, A.P. & Maryanto, I. (2013) Pergerakan lutung jawa *Trachypithecus auratus* (E. Geoffroy 1812) pada fragmen habitat terisolasi di Taman Wisata Alam Gunung Pancar (TWAGP) Bogor. *Berita Biologi*, 12(3), 383–395.

Supriatna, J. (2022) *Field Guide To The Primates Of Indonesia*. Springer Nature, Gewerbestrasse, 97–143.

Syaputra, M., Webliana, K. & Indriyanto. (2017) Populasi Dan Sebaran Lutung (*Trachypithecus Auratus)* Di Kawasan Hutan Dengan Tujuan Khusus (KHDTK) Senaru. *Jurnal Sangkareang Mataram*, 3(4), 20–26.

Tsuji, Y., Mitani, M., Widayati, K.A., Suryobroto, B. & Watanabe, K. (2019) Dietary habits of wild Javan lutungs (*Trachypithecus auratus*) in a secondary-plantation mixed forest: Effects of vegetation composition and phenology. *Mammalian Biology*, 98, 80–90. https://doi.org/10.1016/j.mambio.2019.08.001

Wulandari, Y., Nugroho, A.S. & Ulfah, M. (2016) Karakteristik Pohon Tidur dan Pohon Cover Owa Jawa (*Hylobates moloch*) di Hutan Lindung Petungkriyono Jawa Tengah. In *SNSE III 2016*, 303–307.

Zakki, A., Sukarno, A. & Farida, S. (2017) Preferensi Jenis-Jenis Pakan Lutung Jawa (*Trachypithecus auratus* É. Geoffroy Saint-Hilaire, 1812.) Di Hutan Lindung Coban Talun. *Konservasi Sumberdaya Hutan Jurnal Ilmu Kehutanan,* 1(4), 86–91.