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Comparative Nest-site Characteristics and Relative Abundance of Black Drongo (*Dicrurus macrocercus*) and Long-tailed Shrike (*Lanius schach*) in District Dir Lower, Pakistan

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ABSTRACT

Information on the nest characteristics and relative abundance of Black Drongo (*Dicrurus macrocercus*) and Long-tailed Shrike (*Lanius schach*) in District Dir Lower, Pakistan, remains limited. **Objectives:** To compare the composition of nesting material, nesting-tree species, nest height, and relative abundance of avian species in the study area. **Methods:** A field-based observational study was conducted from February to September 2025. Fourteen vacated nests (seven per species) were selected to inspect nest-material composition, nesting-tree species, and nest height. Relative abundance was assessed from repeated line-transect counts across different habitats in the seven tehsils. Nest-material composition was examined using the chi-square goodness-of-fit test, whereas paired-samples t-tests compared tehsil-wise nest distribution and locality-wise relative abundance. **Results:** Grasses and twigs were the most abundant nesting materials in both species. Grasses comprised 46.94% of nest materials in *D. macrocercus* and 50.00% in *L. schach*. Nest-material composition varied significantly from the expected equal distribution ($p<0.001$; Cohen's $w \geq 0.87$). Black Drongo nests were located at greater heights than those of the Long-tailed Shrike. Lal Qalla recorded the highest number of active nests, with a significant variation in tehsil-wise nest distribution ($p=0.014$). The observed relative abundance was highest in open fields, whereas Timergara recorded the highest locality-wise relative abundance. No significant difference was observed between the species in locality-wise relative abundance (paired-samples t-test, $p>0.050$). **Conclusions:** These findings provide baseline descriptive information and a foundation for future ecological studies on the nest characteristics and relative abundance of both species in District Dir Lower.

INTRODUCTION

Birds represent one of the most diverse vertebrate groups on the planet, with approximately 10,000 species distributed across a wide range of ecosystems across the world. The animals play an integral part in the maintenance of ecosystem stability by carrying out processes such as pollination, seed dispersion, cleaning, and insect population control [1]. Among the most essential of these biological control agents are insect-eating birds that are crucial for regulating insect pests in agricultural landscapes. Despite the biological significance of birds in the ecosystem, their populations are declining due to various factors such as environmental degradation and agricultural intensification in various parts of the world [2, 3]. Avian fauna diversity is very high in South Asia owing to its unique position where several different biogeographic regions converge, as well as the existence of important bird migration corridors [4, 5]. In Pakistan, more than 700 species of birds exist, which include numerous residents as well as migratory insectivorous passerines inhabiting agricultural, forested, and wetland areas [6]. The agro-ecological landscapes in the Khyber Pakhtunkhwa province are characterized by fragmented natural habitats

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utilized by passerine species for breeding as well as foraging. Nevertheless, anthropogenic changes such as deforestation and agriculture have greatly disturbed the habitat conditions in the region [7]. The species Black Drongo (*Dicrurus macrocercus*) is a widely distributed insectivorous passerine occupying agricultural lands, orchards, grasslands, and anthropogenically disturbed habitats. This is a very territorial and aggressive bird that feeds on insects and participates actively in the biological control of agricultural pests [8]. In addition, the Long-tailed Shrike (*Lanius schach*) inhabits open areas with scattered wooded areas, scrublands, as well as cultivated fields. It feeds on a wide range of large insects, small mammals, birds, birds' eggs, lizards and amphibians. The various types of this species are found widely distributed across Asia, with distinct variations in plumage across the range [9]. Nesting is an essential component of avian reproductive ecology that affects their breeding and survival rates. This process offers protection from predators, harsh environmental conditions, and climate change [10]. Nesting generally involves constructing nests made up of natural materials like grass, sticks, leaves, and feathers to offer strength and insulation [11-13].

Even though the two species are ecologically significant, the literature dealing with their nesting ecology and distributional patterns is limited, especially under increased anthropogenic activities, including farming, deforestation, and habitat degradation in Lower Dir District. It is crucial to comprehend the ecological differences or similarities between the two bird species to understand their adaptability and survival in common habitats. Therefore, the present study aimed to compare the composition of nesting materials, nesting-tree characteristics, nest height, the distribution of active nests, and the relative abundance of Black Drongo and Long-tailed Shrike in District Dir Lower, Pakistan.

METHODS

This A field-based observational study was carried out in District Dir Lower, Khyber Pakhtunkhwa, Pakistan, from February to September 2025, encompassing the breeding season of the Black Drongo (*Dicrurus macrocercus*) and Long-tailed Shrike (*Lanius schach*). Repeated field observations were undertaken to record the distribution of nests, nesting-tree characteristics, nest height, nest-material composition, and relative abundance of both species in different habitats within the study area (Figure 1) [14].

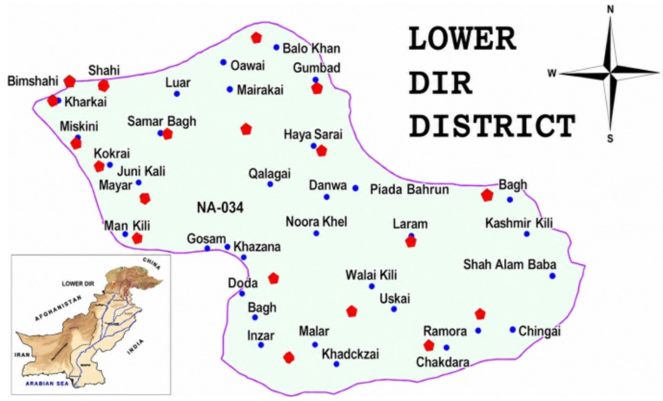

Figure 1: Map of District Lower Dir, Khyber Pakhtunkhwa, Pakistan [14]

Bird surveys were conducted during peak activity periods (06:00–10:00 h and 16:00–18:30 h). The sites for bird surveys were selected systematically across the seven tehsils of District Dir Lower (Adenzai, Timergara, Khal, Munda, Balambat, Samarbagh, and Lal Qalla). Fixed-line transects were conducted in representative habitats within each tehsil and were surveyed repeatedly throughout the study period. Individual birds, either observed or recognized through their unique calls, were counted directly. Species were identified during field visits using plumage, body size, vocalizations, and foraging behaviour. Active nests were observed from the behavior of adult birds exhibiting territorial defense, nest building, food carrying, or repeated visits to nesting sites. Purposive sampling was used for a detailed evaluation of nests. Although all active nests identified during repeated transect surveys were recorded to assess tehsil-wise nest distribution, only a subset of nests was selected for detailed examination. To avoid disturbing breeding birds, only nests confirmed to have been actively occupied during breeding but subsequently vacated, intact, and easily accessible were selected for detailed structural analyses. Due to the observational nature of this study and the need to avoid disturbance to breeding birds, a convenience-sampling approach was adopted. Only vacated nests that were intact, safely accessible, and clearly not reused were selected for detailed structural analysis. Consequently, the sample (n = 7 per species) is not random, and findings apply strictly to this subset of accessible nests. Formal power analysis was not possible because baseline data on nest availability in this region were lacking. Therefore, the primary focus of this study is descriptive baseline reporting, and inferential statistics were not applied to nest-level data. A descriptive sample of seven vacated nests per species (14 nests in total) met these predefined criteria and was used to evaluate nest-material composition, nesting-tree species, and nest height. Because only intact, vacated nests that met predefined inclusion criteria were available during the study period, no

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formal a priori sample size calculation was performed. Consequently, the unit of analysis for material composition was the individual nesting material, the individual tree for nesting-tree characteristics, and individual birds recorded during repeated surveys for relative abundance. Vacated nests were sampled after fledging, and their components were manually separated into twigs, grasses, leaves, feathers, plastic pieces, rubber pieces, and cloth pieces. The frequency of each material type was determined, and representative lengths were measured (inches) using a measuring tape. Percentage composition was calculated from the total number of material items recovered for each species (*D. macrocercus*, N = 343; *L. schach*, N = 406). Nesting trees were identified to species level, while tree height and nest height above ground were measured in meters. Measurements were taken directly where feasible or estimated independently by two experienced observers. Relative abundance was assessed from repeated counts of individual birds observed in six habitat categories: open fields, riverbanks, hilly areas, forests, near-aquatic habitats, and areas near human settlements. Furthermore, five localities within each tehsil were selected using purposive sampling and surveyed repeatedly to assess locality-wise relative abundance.

IBM SPSS Statistics version 25.0 was used for data analysis. Data were expressed in terms of descriptive statistics, which were frequencies, percentages, and mean ± SD. The chi-square goodness-of-fit test with Cohen's w was used to analyze nest-material composition. Shapiro–Wilk test was used to check the normality of the data while paired-samples t-tests were employed to compare the distribution of nests among tehsils, relative abundance of the two species in the habitats, and relative abundance of the two species in the localities. A p-value of less than 0.050 was used for statistical significance.

RESULTS

There were six categories of nesting materials used by *Dicrurus macrocercus* in the seven inactive nests. Grasses and twigs were the most abundant materials in the nests of both species. For *D. macrocercus*, the mean proportion of grasses across the seven nests was 46.94% (± SD), followed by twigs (26.53% ± SD), leaves (12.24% ± SD), feathers (6.12% ± SD), and artificial materials (plastic and rubber combined; 8.16% ± SD). For *L. schach*, the mean proportion of grasses was 50.00% (± SD), followed by twigs (29.31% ± SD), leaves (10.34% ± SD), feathers (6.90% ± SD), and cloth pieces (3.45% ± SD). the small, purposively selected sample (n = 7 nests per species) precluded robust statistical comparison of material composition between species.

Table 1: Nest-Material Composition of Black Drongo (*Dicrurus macrocercus*) and Long-tailed Shrike (*Lanius schach*) Based on Seven Vacated Nests

Sr. No.	Nesting Material	n (%)	Average Length (inch)
Black Drongo (*Dicrurus macrocercus*)			
1	Twigs	91 (26.53%)	4.0
2	Grasses	161 (46.94%)	4.7
3	Leaves	42 (12.24%)	3.5
4	Feathers	21 (6.12%)	3.33
5	Plastic Pieces	14 (4.08%)	3.5
6	Rubber Pieces	14 (4.08%)	2.5
Total	–	100.0	–
Long-tailed Shrike (*Lanius schach*)			
1	Twigs	119 (29.31%)	4.0
2	Grasses	203 (50.00%)	6.2
3	Leaves	42 (10.34%)	3.5
4	Feathers	28 (6.90%)	5.0
5	Cloth Pieces	14 (3.45%)	3.5
Total	–	100.0	–

Chi-square goodness-of-fit test: χ^2 = 300.71, df = 5, p<0.001; Cohen's w = 0.94. Expected frequencies assumed an equal distribution among the six nest-material categories. Chi-square goodness-of-fit test: χ^2 = 309.69, df = 4, p<0.001; Cohen's w = 0.87. Expected frequencies assumed an equal distribution among the five nest-material categories

The number of active nests observed during repeated field surveys varied among the seven surveyed tehsils. For *D. macrocercus*, nest numbers ranged from 43 in Munda to 71 in Lal Qalla, with a mean of 56.86 ± 11.08 nests. For *L. schach*, nest numbers ranged from 59 in Balambat to 76 in Lal Qalla, with a mean of 68.14 ± 5.30 nests. Tehsil-wise comparison between the number of nests of both the species through paired samples t-test revealed a statistically significant difference (t (6) = 3.43, p=0.014; Cohen's d = 1.30), indicating that significantly more active nests of *L. schach* were recorded than *D. macrocercus* across the surveyed tehsils (Table 2).

Table 2: Tehsil-Wise Distribution of Active Nests of Black Drongo (*Dicrurus macrocercus*) and Long-Tailed Shrike (*Lanius schach*) Recorded During Repeated Field Surveys

Sr. No.	Tehsil	Black Drongo	Long-tailed Shrike
1	Adenzai	63	70
2	Timergara	51	65
3	Khal	59	67
4	Munda	43	71
5	Balambat	44	59
6	Samarbagh	67	69
7	Lal Qalla	71	76
Mean ± SD	–	56.86 ± 11.08	68.14 ± 5.30

Paired sample t-test: t = 3.43, df = 6, p=0.014

The seven selected abandoned nests of *D. macrocercus* were recorded on seven different tree species. Mean

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nesting-tree height was 5.50 ± 0.49 m, whereas mean nest height above ground was 4.97 ± 0.40 m. The tallest nesting tree was *Populus nigra* (6.3 m), whereas the shortest was Melia azedarach (5.0 m). Similarly, the seven selected vacated nests of *Lanius schach* were observed on seven different tree species. Mean nesting-tree height was 4.96 ± 0.60 m, whereas mean nest height above ground was 4.50 ± 0.50 m. The tallest nesting tree was *Robinia pseudocacia* (6.0 m), whereas the shortest was *Punica granatum* (4.3 m) (Table 3).

Table 3: Nesting-tree Characteristics of Black Drongo (*Dicrurus macrocercus*) and Long-tailed Shrike (*Lanius schach*) Based on Seven Vacated Nests

Sr. No.	Nesting Tree Species	Average Tree Height (m)	Average Nest Height from Ground (m)
Black Drongo (*Dicrurus macrocercus*)			
1	*Melia azedarach L.*	5.0	4.7
2	*Ailanthus altissima*	6.0	4.6
3	*Morus alba L.*	5.3	5.1
4	*Morus nigra L.*	5.2	4.9
5	*Robinia pseudocacia L.*	5.6	4.9
6	*Populus nigra*	6.3	5.8
7	*Salix babylonica L.*	5.1	4.8
Mean ± SD	–	5.50 ± 0.49	4.97 ± 0.40
Long-tailed Shrike (*Lanius schach*)			
1	*Melia azedarach L.*	4.6	4.0
2	*Ailanthus altissima*	5.5	4.9
3	*Morus nigra L.*	4.8	4.1
4	*Robinia pseudocacia L.*	6.0	5.3
5	*Salix babylonica L.*	5.0	4.8
6	*Ficus carica L.*	4.5	4.3
7	*Punica granatum L.*	4.3	4.1
Mean ± SD	–	4.96 ± 0.60	4.50 ± 0.50

Relative abundance varied among different habitat categories across the seven surveyed tehsils. For *D. macrocercus*, the highest relative abundance was recorded in the open fields of Munda [175 (34.52%)], followed by Balambat 164 (34.89%)], whereas the lowest occurred near human settlements in Khal, 45 (16.61%). For *L. schach*, the highest relative abundance was observed in the open fields of Balambat 179 (37.37%), followed by Munda 170 (35.56%), whereas the lowest occurred near human settlements in Lal Qalla, 43 (12.68%). Percentages in table 6 represent habitat-specific observations within each tehsil. Habitat-wise relative abundance did not differ significantly between the two species (paired-samples t-test: t (6) = 0.855, p=0.426)(Table 4).

Table 4: Relative Abundance of Black Drongo (*Dicrurus macrocercus*) and Long-tailed Shrike (*Lanius schach*) Across Habitat Categories in The Seven Surveyed Tehsils

Tehsil	Habitat	Black Drongo, n (%)	Long-tailed Shrike, n (%)
Adenzai	Open fields	161 (30.78%)	151 (30.32%)
	Bank of river	156 (29.83%)	143 (28.71%)
	Hilly areas	93 (17.78%)	85 (17.07%)
	Near houses	113 (21.61%)	119 (23.90%)
	Total	523	498
Timergara	Open fields	154 (32.22%)	168 (36.21%)
	Bank of river	146 (30.54%)	136 (29.31%)
	Hilly areas	103 (21.55%)	97 (20.91%)
	Near houses	75 (15.69%)	63 (13.58%)
	Total	478 (100.00%)	464
Balambat	Open fields	164 (34.89%)	179 (37.37%)
	Bank of river	153 (32.55%)	157 (32.78%)
	Hilly areas	97 (20.64%)	87 (18.16%)
	Near houses	56 (11.91%)	56 (11.69%)
	Total	470	479
Khal	Open fields	86 (31.73%)	95 (32.76%)
	Bank of river	78 (28.78%)	78 (26.90%)
	Hilly areas	62 (22.88%)	66 (22.76%)
	Near houses	45 (16.61%)	51 (17.59%)
	Total	271	290
Munda	Open fields	175 (34.52%)	170 (35.56%)
	Near aquatic habitat	170 (33.53%)	159 (33.26%)
	Hilly areas	93 (18.34%)	88 (18.41%)
	Near houses	69 (13.61%)	61 (12.76%)
	Total	507	478
Samarbagh	Open fields	110 (34.38%)	118 (36.99%)
	Ban	80 (25.00%)	80 (25.08%)
	Hilly areas	73 (22.81%)	67 (21.00%)
	Near houses	57 (17.81%)	54 (16.93%)
	Total	320	319
Lal Qalla	Open fields	115 (34.02%)	120 (35.40%)
	Bank of river	90 (26.63%)	90 (26.55%)
	Forest	86 (25.44%)	86 (25.37%)
	Near houses	47 (13.91%)	43 (12.68%)
	Total	338	339

Paired-samples t-test: t(6)=0.855, p=0.426

Locality-wise observations varied among the surveyed localities. *D. macrocercus* reached its highest abundance in Talash, Timergara 146 (29.20%), followed by Nasafa 125 (25.00%), and the lowest in Asbanr, Adenzai 40 (10.05%). For *L. schach*, the highest count was also recorded in Talash 176 (35.77%), followed by Nasafa 144 (29.27%), and the lowest in Shagokus, Timergara 42 (8.54%). At the tehsil level, Timergara showed the highest total observations for both species (500 and 492, respectively), whereas Samarbagh (351) and Lal Qalla (328) recorded the lowest totals for *D. macrocercus* and *L. schach*, respectively. Percentages represent observations within each tehsil.

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Locality-wise relative abundance did not differ significantly between the two species (paired-samples t-test: t(6)=−0.336, p=0.749)(Table 5).

Table 5: Locality-Wise Relative Abundance of Black Drongo (*Dicrurus macrocercus*) and Long-tailed Shrike (*Lanius schach*) in the Seven Surveyed Tehsils

Tehsil	Locality	*D. macrocercus*, n (%)	*L. schach*, n (%)
Adenzai	Chakdara	73 (18.34%)	67 (15.40%)
	Badwan	110 (27.64%)	98 (22.53%)
	Asbanr	36 (9.05%)	54 (12.41%)
	Ouch	115 (28.89%)	138 (31.72%)
	Osakai	64 (16.08%)	78 (17.93%)
	Total	398	435
Timergara	Nasafa	125 (25.00%)	144 (29.27%)
	Talash	146 (29.20%)	176 (35.77%)
	Shagokus	58 (11.60%)	42 (8.54%)
	Thrai	91 (18.20%)	63 (12.80%)
	Timergara	80 (16.00%)	67 (13.62%)
	Total	500	492
Balambat	Morani	83 (20.60%)	74 (17.01%)
	Odigram	120 (29.78%)	143 (32.87%)
	Haji Abad	90 (22.33%)	79 (18.16%)
	Malakand	56 (13.90%)	58 (13.33%)
	Lajbok	54 (13.40%)	81 (18.62%)
	Total	403 (100.00%)	435
Khal	Saparay	86 (24.29%)	78 (21.73%)
	Toormang	68 (19.21%)	48 (13.37%)
	Rani	82 (23.16%)	88 (24.51%)
	Bar Kalay	45 (12.71%)	61 (16.99%)
	Kandaro	73 (20.62%)	84 (23.40%)
	Total	354	359
Munda	Kotki	60 (15.71%)	52 (15.29%)
	Makhai	65 (17.02%)	58 (17.06%)
	Gossum	93 (24.35%)	86 (25.29%)
	Munda	67 (17.54%)	58 (17.06%)
	Rahim Abad	97 (25.39%)	86 (25.29%)
	Total	382	340
Samarbagh	Samarbagh	80 (22.79%)	92 (24.27%)
	Sadbar Kalay	73 (20.80%)	70 (18.47%)
	Kambat	57 (16.24%)	68 (17.94%)
	Mayar	81 (23.08%)	78 (20.58%)
	Maskini	60 (17.09%)	71 (18.73%)
	Total	351	379
Lal Qalla	Lal Qalla	86 (24.36%)	80 (24.39%)
	Kumbar	47 (13.31%)	56 (17.07%)
	Zimdara	76 (21.53%)	58 (17.68%)
	Takatak	69 (19.55%)	71 (21.65%)
	Chinarkot	75 (21.25%)	63 (19.21%)
	Total	353	328

Paired-samples t-test: t(6)=−0.336, p=0.749

DISCUSSION

Natural plant materials constituted the principal structural framework of the examined nests of *Dicrurus macrocercus* and *Lanius schach*, with grasses (46.94% and 50.00%) and twigs (26.53% and 29.31%, respectively) representing the dominant nesting components. The chi-square goodness-of-fit analysis demonstrated a highly uneven distribution of nesting materials among categories, supported by exceptionally large effect sizes (Cohen's w = 0.94 for *D. macrocercus* and 0.87 for *L. schach*) [15]. Grass as the dominant nesting material in nests has also been documented extensively in passerine bird populations within agricultural environments. James *et al.* [12] found that open-nesting birds living in temperate and semi-open ecosystems regularly utilize grass as the main nesting material, constituting up to 40-60% of the total composition of the nests in question based on the availability of vegetation. It can thus be concluded that nest-building material is dependent largely on vegetation and accessibility. The predominance of grasses and twigs provides structural support, flexibility, and insulation, while softer or less abundant materials are incorporated in smaller quantities according to local availability and nest function [15, 16]. The comparatively low incorporation of artificial materials agrees with the findings of Li, who reported less than 5% anthropogenic material in rural passerine nests [17], whereas urban ecosystems typically demonstrate much higher incorporation (10–25%) because of the limited availability of natural materials [18], and forest ecosystems show little or no anthropogenic material due to minimal human disturbance [19]. This pattern suggests that, despite human encroachment within agricultural landscapes, natural plant materials remained the dominant structural components of nests [20]. For both species, the greatest numbers of active nests were recorded in Lal Qalla, whereas the lowest numbers were clustered in Munda. This spatial heterogeneity suggests that breeding pairs are distributed unevenly across landscapes under natural field conditions, likely associated with localized microclimates, vegetative cover, or localized resource pulses [21]. Liu *et al.* and Matysioková and Remeš found that the decision of nest height was highly affected by the predator defense mechanism [22, 23], where high nests minimized ground attacks while low nests provided camouflage among the foliage. Similarly, locality-wise variation was not significant (p=0.749), although higher abundance was recorded in Timergara and Lal Qalla, whereas lower values occurred in more disturbed localities. Likewise, Zhu *et al.* and López-Martínez *et al.* reported that open habitats favor higher numbers of individuals due to favorable foraging conditions and greater prey availability [24, 25], whereas areas with greater human disturbance support fewer bird populations.

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A primary limitation of this descriptive survey is the small sample size of active nests available for material examination (n = 7 per species), which prevents a robust inter-nest composition analysis. Furthermore, because habitat availability, tree species abundance, food resource biomass, and pressure of potential predators were not quantified, this study cannot determine true habitat preference, nesting-tree selection, or the precise ecological mechanisms driving distribution patterns. Future multi-season studies should utilize larger sample sizes and adopt standardized census approaches—such as distance sampling or occupancy modeling—to provide reliable, detection-corrected estimates of true population density and resource selection functions within rapidly changing semi-natural habitats.

CONCLUSIONS

Dicrurus macrocercus and *Lanius schach* both predominantly used grass and twigs in nest building, and there was variation in the composition of nesting material amongst nests within individual species. Nest abundance was higher amongst *L. schach* compared to *D. macrocercus*, while distribution among habitats and localities was more or less comparable. Open field and riverine habitats and several different species of trees served as nesting sites for both species. These findings emphasize the significance of the agricultural landscape in the nesting ecology of insectivorous birds in District Lower Dir.

Authors' Contribution

Conceptualization: AA
Methodology: AA, AK
Formal analysis: AA, AUR, FUI
Writing and Drafting: AA, AK, AUR, FUI
Review and Editing: AA, AK, AUR, FUI

Author approved the final manuscript and take responsibility for the integrity of the work

Conflicts of Interest

All the authors declare no conflict of interest.

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