

Preliminary Studies on the Diversity of Butterfly Species in Ponda Education Society's Ravi S. Naik College Campus, Goa, India

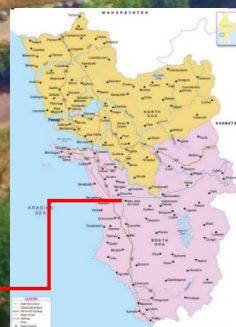
Butterflies are integral components of biodiversity and play crucial ecological roles in forest ecosystems. They have a symbiotic relationship with plant diversity (Singh 2011), and their presence in a habitat indicates the occurrence of particular plant and animal species (Gupta & Majumdar 2012). Butterflies are valuable ecological indicators (Kearney et al. 2010) and can reflect environmental factors such as physiological resilience, habitat territory, temperature, and light (Gaonkar 1996; Kunte 2000; Singh & Bhandari 2003). Additionally, butterflies act as predators (Sharma et al. 2020).

Their role in natural pest control and as prey for other wildlife directly ties their presence to the stability of local biodiversity (Gupta & Majumdar 2012; Swengel & Swengel 2013).

Given their ecological importance, studying butterflies in semi-protected environments, such as educational campuses, provides valuable insights into conservation potential and the health of local ecosystems. The P.E.S. College campus offers a relatively undisturbed landscape ideal for studying butterfly diversity. This study aims to investigate the diversity of butterfly species on the P.E.S. College campus.



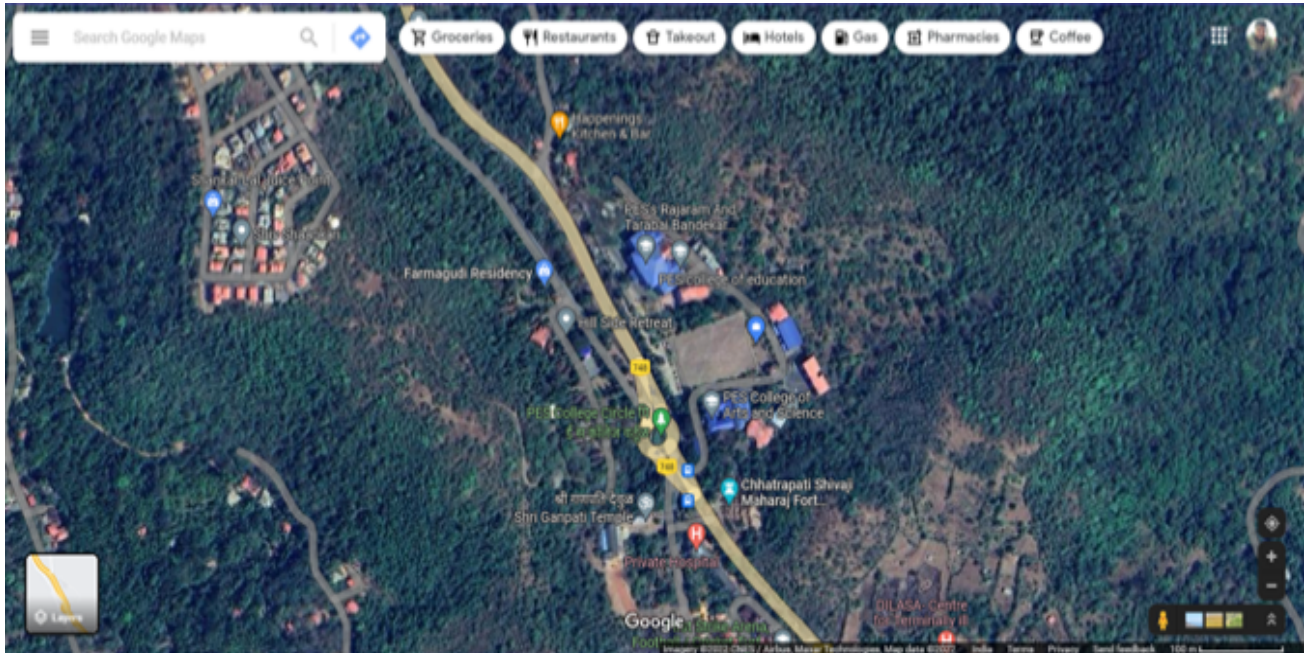
Aerial photograph of PES college campus



Map 1: Map of study area

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Satellite images of study area

Study area

The present study was conducted in P.E.S College campus situated at Farmagudi plateau lies between 15.413611° N, 73.989444° E with an area of 35000 km^2 . Farmagudi plateau is home to various residential colonies, government buildings, and educational institutions. It is also a tourist destination, known for the famous Gopal Ganesh temple and the Shivaji fort.

The college campus is surrounded by moist deciduous vegetation mixed with evergreen species, scrub jungle, and lateritic vegetation. Sloping hills around the campus are used by locals for cultivating seasonal vegetables.

Significant cashew and banana plantations are also present around the campus, while small patches of Acacia plantations are found within the campus. The campus is surrounded by

grasslands, bushy forests, wild trees, flowering plants, shrubs, and other plantations.

Materials and methods

The butterfly study was conducted using the visual encounter method and transect method (Murugesan et al. 2013; Saha et al. 2015; Panda et al. 2016; Abdullahi et al. 2019; Kumar et al. 2019). During random walks and opportunistic sighting (Bowalkar et al. 2017) butterfly species were noted and later were included in the checklist. Visually encountered butterflies were identified on the field using photographic guides (Kunte & Gadgil 2000; Rangnekar 2007; Singh 2011; Kehimkar 2008). Online source <https://www.ifoundbutterflies.org> was also used to identify butterfly.

The pooled data of the each survey from the site were separately maintained. A preliminary

Checklist of butterfly species reported from study area

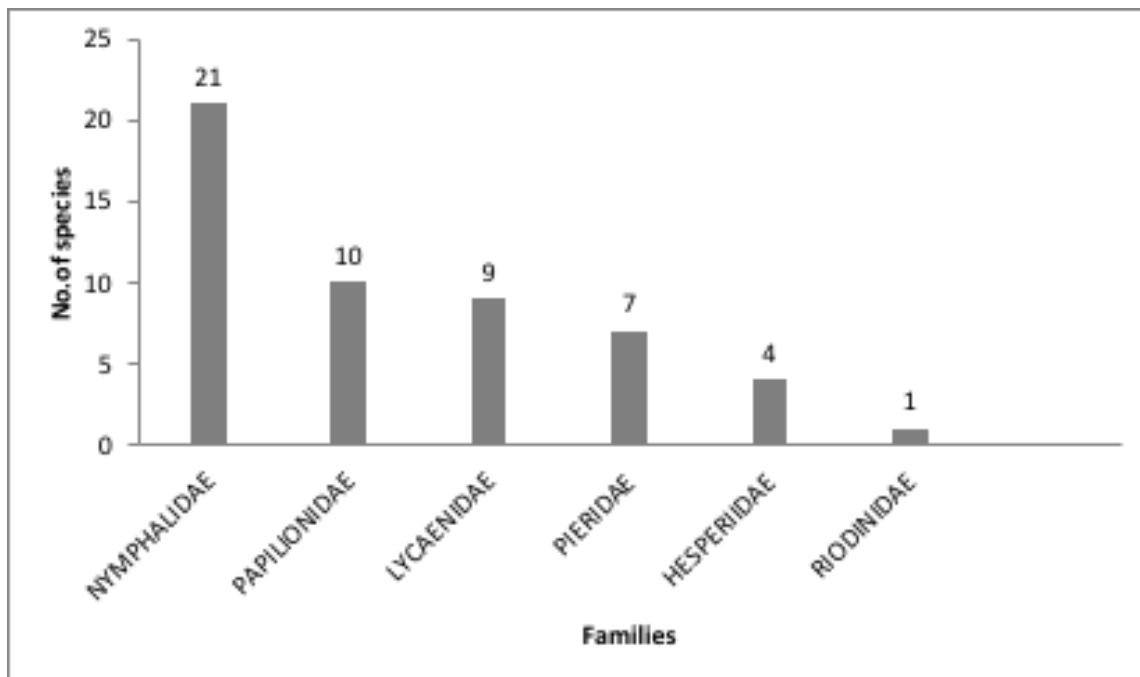
Sr. No.	Family / Species	Common Name	IUCN Red List	WLP Act. Scheduled	Endemic
Family: Nymphalidae					Southeast Asia, Indian Subcontinent
1	<i>Neptis hylas</i>	Common Sailor			
2	<i>Parantica aglea</i>	Glassy Tiger			
3	<i>Junonia almana</i>	Peacock Pansy	Least Concern		
4	<i>Junonia lemonias</i>	Lemon Pansy			
5	<i>Ypthima huebneri</i>	Common Four-ring			
6	<i>Hypolimnas misippus</i>	Danaid Eggfly		Schedule I	
7	<i>Orsotriaena medus</i>	Medus Brown			
8	<i>Danaus chrysippus</i>	Plain Tiger			
9	<i>Junonia iphita</i>	Chocolate Pansy			
10	<i>Euploea core</i>	Common Crow		Schedule IV	
11	<i>Junonia atlites</i>	Grey Pansy			
12	<i>Melanitis leda</i>	Common Evening Brown	Least Concern		
13	<i>Mycalesis perseus</i>	Common Bushbrown			
14	<i>Ypthima baldus</i>	Common Five-ring			
15	<i>Hypolimnas bolina</i>	Great Eggfly			
16	<i>Euthalia aconthea</i>	Common Baron			
17	<i>Acraea terpsicore</i>	Tawny Coster			
18	<i>Idea malabarica</i>	Malabar Tree- Nymph***	Near Threatened		
19	<i>Danaus genutia</i>	Striped Tiger			
20	<i>Kallima inachus</i>	Orange Oakleaf			
21	<i>Elymnias hypermnestra</i>	Common Palmfly			
Family: Papilionidae					
22	<i>Troides minos</i>	Southern Bird wing*	Least Concern	Schedule I	Sri Lanka, Western Ghats
23	<i>Pachliopta aristolochiae</i>	Common Rose	Least Concern		Sub continent of India, Sri Lanka
24	<i>Graphium agamemnon</i>	Tailed Jay			
25	<i>Graphium sarpedon</i>	Common Blue bottle	Least Concern		
26	<i>Papilio buddha</i>	Malabar Banded Peacock		Schedule II	Western Ghats
27	<i>Papilio polymnestor</i>	Blue Mormon**			Sri Lanka, Peninsular India
28	<i>Pachliopta hector</i>	Crimson Rose	Least Concern	Schedule I	
29	<i>Papilio clytia</i>	Common Mime	-	Schedule I	
30	<i>Graphium nomius</i>	Spot Swordtail	Least Concern	-	
31	<i>Papilio polytes</i>	Common Mormon			
Family: Pieridae					
32	<i>Delias eucharis</i>	Common Jezebel			
33	<i>Catopsilia pomona</i>	Lemon Emigrant			
34	<i>Eurema hecabe</i>	Common Grass Yellow			
35	<i>Leptosia nina</i>	Psyche			
36	<i>Cepora nerissa</i>	Common Gull		Schedule II	
37	<i>Catopsilia pyranthe</i>	Mottled Emigrant			

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Sr. No.	Family / Species	Common Name	IUCN Red List	WLP Act. Scheduled	Endemic
38	<i>Eurema brigitta</i>	Small Grass Yellow			
Family: Lycaenidae					
39	<i>Castalius rosiman</i>	Common Pierrot	-	Schedule I	
40	<i>Zinina otis</i>	Lesser Grass Blue	Least Concern	-	
41	<i>Lampides boeticus</i>	Pea Blue	Least Concern	Schedule II	
42	<i>Caleta caleta</i>	Angled Pierrot			
43	<i>Prosotas nora</i>	Common Lineblue			
44	<i>Rathinda amor</i>	Monkey Puzzle			
45	<i>Chilades pandava</i>	Plains Cupid			
46	<i>Loxura atymnus</i>	Yamfly			
47	<i>Euchrysops cnejus</i>	Gram Blue		Schedule II	
Family: Hesperidae					
48	<i>Oriens goloides</i>	Smaller Darlet			
49	<i>Spialia galba</i>	Asian Grizzled Skipper			
50	<i>Celaenorrhinus ambareesa</i>	Malabar Spotted Flat			
51	<i>Pseudocoladenia dan</i>	Fulvous Pied Flat			
Family: Riodinidae					
52	<i>Abisara bifasciata suffusa</i>	Suffused Double Banded Judy			

*-State butterfly of Maharashtra; **- State butterfly of Karnataka; ***- State butterfly of Goa



Graph showing dominant family in a study area.

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1. Common Sailor (*Neptis hylas*)



2. Glassy Tiger (*Parantica aglea*)



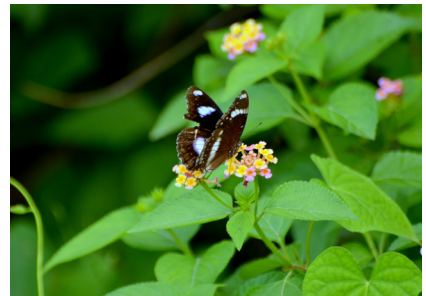
3. Peacock Pansy (*Junonia almana*)



4. Lemon Pansy (*Junonia lemonias*)



5. Common Four-ring (*Ypthima huebneri*)



6. Danaid Eggfly (*Hypolimnys misippus*)



7. Medus Brown (*Orsotriaena medus*)



8. Plain Tiger (*Danaus chrysippus*)



9. Chocolate Pansy (*Junonia iphita*)



10. Common Crow (*Euploea core*)



11. Grey Pansy (*Junonia atlites*)



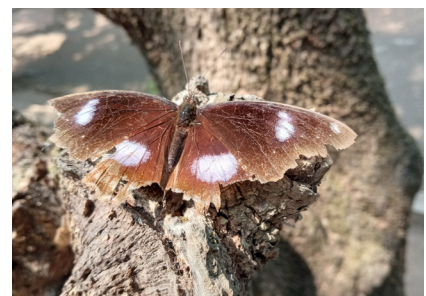
12. Common Evening Brown (*Melanitis leda*)



13. Common Bushbrown (*Mycalesis perseus*)



14. Common Five-ring (*Ypthima baldus*)



15. Great Eggfly (*Hypolimnys bolina*)

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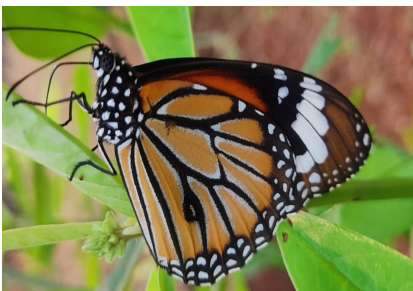
16. Common Baron (*Euthalia aconthea*)



17. Tawny Coster (*Acraea terpsicore*)



18. Malabar Tree Nymph (*Idea malabarica*)



19. Striped Tiger (*Danaus genutia*)



20. Orange Oakleaf (*Kallima inachus*)



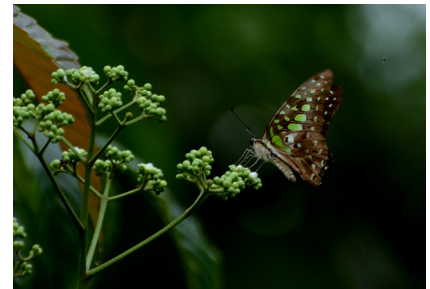
21. Common Palmfly (*Elymnias hypermnestra*)



22. Southern Bird Wing (*Troides minos*)



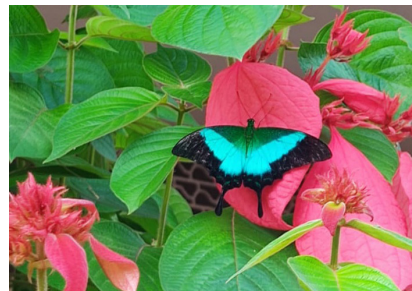
23. Common Rose (*Pachliopta aristolochiae*)



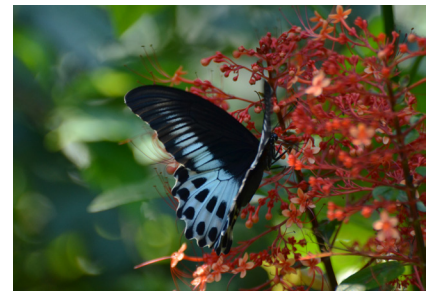
24. Tailed Jay (*Graphium agamemnon*)



25. Common Blue Bottle (*Graphium sarpedon*)



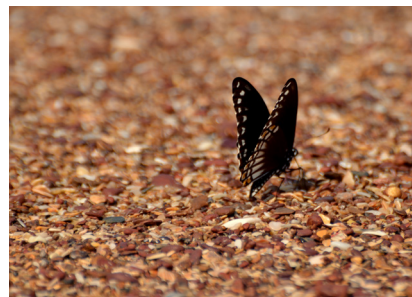
26. Malabar Banded Peacock (*Papilio buddha*)



27. Blue Mormon (*Papilio polymnestor*)



28. Crimson Rose (*Pachliopta hector*)



29. Common Mime (*Papilio clytia*)



30. Spot Swordtail (*Graphium nomius*)

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31. Common Mormon (*Papilio polytes*)



32. Common Jezebel (*Delias eucharis*)



33. Lemon Emigrant (*Catopsilia pomona*)



34. Common Grass Yellow (*Eurema hecabe*)



35. Psyche (*Leptosia nina*)



36. Common Gull (*Cepora nerissa*)



37. Mottled Emigrant (*Catopsilia pyranthe*)



38. Small Grass Yellow (*Eurema brigitta*)



39. Common Pierrot (*Castalius rosimon*)



40. Common Lesser Grass Blue (*Zinina otis*)



41. Pea Blue (*Lampides boeticus*)



42. Angled Pierrot (*Caleta caleta*)



43. Common Line Blue (*Prosotas nora*)



44. Monkey Puzzle (*Rathinda amor*)



45. Plains Cupid (*Chilades pandava*)

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46. Yam Fly (*Loxura atymnus*)



47. Gram Blue (*Euchrysops cnejus*)



48. Smaller Darlet (*Oriens goloides*)



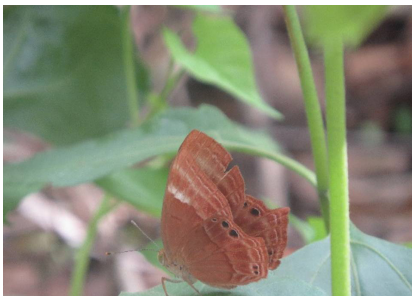
49. Asian Grizzled Skipper (*Spialia galba*)



50. Malabar Spotted Flat (*Celaenorrhinus ambareesa*)



51. Fulvous Pied Flat (*Pseudocoladenia dan*)



52. Suffused Double Banded Judy (*Abisara bifasciata suffusa*)

Photos: © Authors

checklist was prepared and used for further census work. The common name and scientific nomenclature of butterfly were adopted from Kunte (2000), Rangnekar (2007), and Singh (2011).

Results and discussion

A total of 52 butterfly species were documented, accounting for 20.47% of the total butterfly species known in Goa. The family Nymphalidae was the most dominant with 21 species followed by Papilionidae with 10 species, Lycaenidae with 9, Pieridae with 7, and Hesperidae with 4

species. The least represented was Riodinidae, with only one species.

The dominance of the Nymphalidae family aligns with previous studies (Kunte 1997; Kunte et al. 1999; Eswaran & Pramod 2005; Priya et al. 2008; Dolia et al. 2008; Krishnakumar et al. 2008; Gaude & Janarthanam 2015; Umapati et al. 2016; Bowalkar et al. 2017; Kumar et al. 2019; Koirala et al. 2020), being the largest butterfly family accounting for one third of known species world-wide (Kunte 1997; Chandekar & Nimbalkar 2015; Prajapati et al.



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2000; Kumar & Sharma 2013; Basavarajappa et al. 2018; Boruah et al. 2018; Koirala et al. 2020). Their dominance highlights the availability of larval host plants and adult nectar plants within the study area. Their ability to feed on various kinds of food could be the reasons for its dominance (Priya et al. 2008; Murugesan et al. 2013; Kumar et al. 2019; Koirala et al. 2020) also many species of this family are active fliers thus having ecological advantages to forage larger areas (Koirala et al. 2020). Plateaus in Goa are known for their rich floral diversity (Joshi & Janarthanam 2004) this is true for Farmagudi plateau also.

Several notable species, *Pachliopta hector* Crimson Rose, *Troides minos* Southern Bird Wing, *Castalius rosimon* Common Pierrot, *Papilio clytia* Common Mime, and *Hypolimnas misippus* Danaid Eggfly of schedule I, *Papilio buddha* Malabar Banded Peacock, *Euchrysops cnejus* Gram Blue, *Lampides boeticus* Pea Blue and *Cepora nerissa* Common Gull of schedule II and *Euploea core* Common Crow of schedule IV are protected under Indian Wildlife Protection Act, 1972.

Several endemic species, *Neptis hylas* Common Sailor endemic to Southeast Asia and Indian subcontinent, *Troides minos* (Southern Bird Wing) and *Papilio buddha* (Malabar Banded Peacock), endemic to the Western Ghats, *Pachliopta aristolochiae* Common Rose and *Papilio polymnestor* Blue Mormon are endemic to subcontinent of India and peninsular India was also reported from the study area indicating a rich habitat supporting unique

biodiversity. Other rare sightings, including species from the Lycaenidae and Hesperidae families, may reflect the scarcity of specific host plants or the difficulties of detecting smaller butterfly species in dense vegetation. The presence of Near Threatened species, such as *Idea malabarica* (Malabar Tree Nymph) recently declared as state butterfly of Goa, also highlights the conservation potential of this area.

The observed diversity can be attributed to a variety of host and nectar plants, such as *Hibiscus rosa-sinensis*, *Cassia fistula*, *Caesalpinia pulcherrima*, *Bauhinia racemosa*, *Tabernaemontana divaricata*, *Plumeria obtusa*, *Plumeria rubra*, *Vinca rosea*, *Gardenia jasminoides*, *Tridax procumbens*, *Mimosa pudica*, *Acalypha hispida*, *Ziziphus mauritiana* and *Bougainvillea spectabilis*, known for high nectar production and essential for butterfly existence (Lakshmi & Raju 2011). Additionally, the social forestry program along the nearby highway introduces native nectar plants, enriching the habitat further. The prevalence of high nectar-producing invasive species, like *Chromolaena odorata* and *Lantana camara*, has similarly contributed to the campus's capacity to support a wide range of butterfly species (Day et al. 2003).

The diversity and assemblage of butterflies on the P.E.S. College campus underscore the ecological value of maintaining natural vegetation and minimizing development. Butterflies serve as indicators of local biodiversity health, and their presence suggests a stable ecosystem capable of supporting a



variety of species. The campus habitat benefits from a mix of native and exotic plants, which provide essential resources for butterfly survival. By integrating more native species and focusing on landscaping practices that attract butterflies, the campus could further enhance its ecological richness and support conservation efforts for threatened and endemic species.

Conclusion

The Presence of 52 butterfly species in and around the P.E.S. college campus reflects a healthy ecosystem patch. If the landscaping and maintenance of campus gardens and nearby natural vegetation if carefully planned, the diversity of butterflies may increase in the P.E.S. college campus providing a rich ground for butterfly conservation as well as for research (Saha et al. 2015) also it will help to conserve other insects, birds and small mammals. The wide assemblage of butterfly species in and around the PES college campus indicates rich floral diversity at the study area as butterflies are directly or indirectly depends on plants for their survival. Therefore, further research on the biodiversity of butterflies with special reference to their host plants and other factors (s) that contribute to their distribution, diversity and abundance may be investigated in future.

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Kiran Gaude¹, Sonal Naik², Vinisha Parab³ & Aakanksha Prabhu⁴

^{1,2,3,4} P.E.S's Ravi S.Naik College of Arts & Science, Farmagudi, Ponda, Goa, 403401, India.

Email: ¹kiran.gaude@gmail.com, ²naiksonal1301@gmail.com; ³vinishaparab@gmail.com; ⁴aakanshaprabhu16@gmail.com

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