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Methyl Parathion Induced Haematology Profile Alteration of Climbing Perch, *Anabas testudineus* (Bloch.)

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Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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ABSTRACT

Water pollution from agricultural wastes sources such as pesticides is now considered to be a major problem in worldwide. The present study includes the alterations induced by chronic (21 days) exposure of the fish Anabas testudineus to a sublethal concentration (0.047 ppm conc.) of methyl parathion on the haematology profile. The induced group shows significant alteration in the haematological parameters such as decreasing value in Hb, RBC, WBC while increasing value observed in DLC, Neutrophil, Monocytes and Eosinophil. The methyl parathion induced fishes may have various haematological diseases: Erythropoesis, anaemia, Leucocytopaemia, Neutropaemia, Lymphopaemia, Eosinophilia and Erythropaemia. Therefore, for the optimum growth performance of fish cultivation in contaminated water with pesticide, methyl parathion concentration should not be more than 0.047 ppm. The information will be major role on different levels of responses of organisms with respect to pollutant stress is a necessary pre-requisite for the proper management of pesticides application in agriculture.

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Keywords: Anabas testudineus; DLC (Differential leucocytes count); PCV (packed cell volume); haematology profile; methyl parathion and pesticides.

1. INTRODUCTION

Water pollution from agricultural wastes sources such as pesticides is now considered to be a major problem in worldwide. Fish population are one among the non- targeted species to most of the pesticides because the aquatic environment is the ultimate recipient of virtually every form of human waste, including a number of chemical biocidal agents [1]. Pesticide contamination of aquatic system has increased in the last decades due to extensive use of them in agricultural, chemical and industrial processes which are becoming threats to living organisms [2]. The use of chemicals in agriculture and horticulture is viewed as a panacea to improve the productivity of crops and storage of food resources. As a result, the application of chemical pesticides to improve crop health and yield has increased worldwide. Pesticides are used to control pests in field for the crop production and vector control for the public health. It has been observed that not all the pesticides applied will reach the targeted organisms. It has been estimated that only approximately 0.3 % of pesticides applied reach the target organisms, whereas 99.7 % contaminates the surrounding environmental, such as air, soil, and water, through runoff, spray drift and leaching [3].

Methyl parathion is an organochlorine pesticide have high insecticidal property and low cost production make them worldwide popular. Methyl parathion has a half-life of 175 days in aqueous solution and 10 days to 2 months in soils. The rate of degradation increases with temperature and with exposure to sunlight. It is a non-systemic pesticide that kills pests by acting as a stomach poison and is used to control chewing and sucking insects in wide range of crops, including cereals, fruits, vines, vegetables, ornamental plants, cotton and other crops. It is generally applied as spray, mainly as an emulsifiable concentrate formulation. Like other organophosphate insecticides, methylparathion is a chlonesterase inhibitor. Its toxicity is largely due to the inactivation of the enzyme acetylcholinesterase (AChE) in insects and mammals [4]. But due to its high persistent in nature and toxicity on non-target organisms especially fish in aquatic environment it is now banned. The world health organization classifies methyl parathion as a class 'Ia' extremely hazardous pesticide. It is highly toxic by inhalation and ingestion, and moderately toxic by dermal adsorption. Like other organophosphate. It has caused many health problems in human being, particularly in developing countries, since its introduction into the market in early 1950s.

The fish, *Anabas testudineus* (Bloch.), climbing perch is locally called 'Kawai', belong to family anabantidae of order perciformes. *Anabas* genus has two species, *Anabas testudineus* (Bloch, 1792) is bigger than *Anabas oligolepis*. These fishes can stay for long time alive, out of water and sold in live condition usually, due to having the presence of suprabranchial accessory respiratory organs. Market demands for this fish are throughout the year in West Bengal and Bihar [5,6]. This fish has unique feature sexually dimorphism, occurs in breeding season [7]. This is an important fish of paddy field culture in wetland region of this subcontinent. This is also subjected to severe effect of pesticides on fishes when huge application of pesticides in fields.

Therefore, in current paper an effort has been made to illustrate the methyl parathion induced haematological profile alterations of air breathing climbing perch, *Anabas testudineus.*

2. MATERIALS AND METHODS

The climbing perch, *Anabas testudineus*, live fish were procured from the local fish market, Darbhanga and brought to lab in open container. The healthy fish were measured 10±2 cm and weight 32±2 g, washed with 0.1% $KMnO_4$ to remove dermal infection if any. Acclimatization for 15 days before experiment started. Fish was fed with commercial feed (28% crude protein) through the experiment period at the rate 3% of body weight. No aeration was done and follows the methods of APHA [8].

The LC_{50} values of methyl parathion were determined for 24, 48, 72 and 96 hours following the static bioassay methods of APHA, AWWA & WPCF (1985). The resulted LC_{50} values for given period were 0.35 ppm, 0.25 ppm, 0.13 ppm and 0.095 ppm respectively. The sub-lethal concentration 0.045 ppm was determined [9]. Ten fish were treated with concentration 0.047 ppm of methyl parathion and along with ten fish were taken as control for 21 days. On 21st day the fish were anaesthetized with 1:4000 MS 222 (tricane, methane, sulfonate, sandoz) for two

minutes and blood samples were extracted at the site of caudal dorsal of the test fish. The haematological parameters were estimated haemoglobin, RBC, WBC, Lymphocytes, neutrophil, monocytes, basophil, eosinophil and determination of PCV (packed cell volume) as follow the methods (Akela et al. 1996), [10]. MCV (fl) = [PCV (%) x 10] / [RBC count in millions/mm^3], MCH (pg) = [HB (g/dl) x 10] / [RBC count in millions/mm^3] and MCHC (g/dl) = [HB (g/dl) x 100] / [PCV (%)].

3. RESULTS AND DISCUSSION

The current study undertaken was the alteration in haematological profile of the fish, *Anabas testudineus* induced to (0.047 mg/l) sublethal concentration of methyl parathion for 21 days. The result in Table -1 showed a highly significant (P<0.001) decreases was observed in haemoglobin (Hb) of induced fish 5.78±0.10 gm/dl than control 8.89 ±0.05 gm/dl. The present study revealed the decreases in haemoglobin (Hb) (5.78±0.10 gm/dl) of methyl parathion induced fish that was conformity with the works of Raizada and Gupta, [11] in their study found a decrease of haemoglobin in the fungicide RH-216 induced fish, *Trichogaster fasciatus*. Similar alteration in haematological parameters in *Channa striata* was also studied by Sasikala *et al*. [12]. Arjun *et al.* [13] have observed highly significant (P<0.001) as a decreased level of haemoglobin in the chromium exposed fish, *Clarias batrachus*. Similar haematological alterations results were observed by earlier workers with various toxicants treated fish; Hb decline was reported by Revathi *et al.* [14], Shipra *et al.* [15], Bruska *et al.* [16], Anwar and Choudhary [17]. Roy and Nath, [18] also reported similar haematological changes in case of Thiamethoxam treated *Oreochromis niloticus.*

The study revealed that RBC count in control fish was 5.35±0.05 x 10^6µl while in treated fish 4.11±0.05 x 10^6µl. The result showed decreasing a significant value (P<0.001) of RBC count in treated fish. Verma *et al.* [19] also reported the alteration in RBCs count and haemoglobin concentration in *Mystus vittatus* induced by pesticides and infection of parasites. That physiological change was caused of deleterious effect of toxicants on the erythropoietic tissue of fish. *Heteropneustes fossilis* induced by pesticide, malathion showed decrease in RBC count from 6,400,000 to 3,460,000/cm in LC_{50} 96 hr at 7.6 ppm reported by Mishra and Srivastava, [20]. Muthalagi [21] has found similar nature of decrease RBC count under sewage treatment to the fish *C. mrigala.* The present study showed also conformity with Arjun *et al.* [13] observed a decline in RBC under the treatment of chromium to the fish *C. batrachus.* Recently, Pratibha [22] have observed the *H. fossilis* (Bloch) induced to mercury chloride showed similar decline nature of RBC.

The Table -1 showed in treated fish the values of Neutrophil, Monocytes and Eosinophil were increasing such as 13.12±0.05, 7.0±0.05 and 3.2±0.05 in compare to control fish value such as 5.45±2.05, 4.0±0.05, 2.2±0.05 respectively. The value of Neutrophil was highly significant (P< 0.001), while Eosinophils showed significant value (P < 0.01). Whereas Basophil has decreasing value 1.4 ±0.02 in treated fish than 1.8 ±0.02 control. That has been found non significant (P < 0.05). The Table-1 revealed that in treated group the DLC (Differential leucocytes count) of Lymphocytes showed value was decreases 32.0±0.02 from control 52.13±2.40. The Lymphocytes value showed significant (P < 0.01). The present finding was conformity with Gomulka *et al.* [23] has reported the induced European whitefish to propofol showed the significant reduction in the counts of lymphocytes, neutrophils and monocytes in haematology profile. The differential count (DC) of leukocytes was found a reliable haematological index to investigate the environmental contamination by various pollutants [24]. Sharma and Gupta [25] found considerable lymphocytosis; i.e., within 6 days, lymphocytes increased from 33 to 72% when fish exposed with CCl_4 at concentration 0.03 and 0.06 ml/100 g body weight at intervals of 3 days. During present study the WBC decreases are close conformity with various workers, under the treatment of fertilizers, pesticides, alkaloids to fishes or mammals. In fishes Muthalagi [21] has been reported similar decrease of WBC under domestic sewage to the fish *C. mrigala.* Recently Arjun [26] has explained similar decrease of WBC under chromium exposure to *Clarias batrachus.* The present findings are conformity with various studies on mammals, such as rat, rabbit etc. under the exposure of metals, pesticides, alkaloids etc. On the basis of above facts it is quite clear that WBC plays a very important role in the defense mechanism of body. A decrease in WBC count in exposed fish is termed as leucopaemia. Another observation support the present work, Vasait and Patil [27] found decreasing lymphocyte count in *Nemacheilus botia* fish induced to

organophosphorous insecticide. The methyl parathion induced fish were showed that DLC-Neutrophil, Monocytes and Esnophil increase while Lymphocytes, Basophil decreases in present study has close conformity with earlier works like under exposure of sewage [21], chromium exposed to fish [26] and mercury chloride induced to the fishes [22]. Pratibha [28] reported that induced *Heteropneustus fossilis* to murcury chloride showed haematological alteration.

The Table-1 showed that the PCV (Packed Cell Volume) value was decreases in treated fish group 12.85±0.03 while in control fish group 34.91±0.06. The PCV value showed significant ($P < 0.01$). The present findings are conformity with Revathi *et al.* [14], Shipra *et al.* [15], Anwar and Choudhary [17]. Pratibha & Kumar [22] have explained exposure of mercury chloride to the fish *H. fossilis.* There were three ways as significant, highly significant or non-significant resulted by analysis of obtained haematological data. The methyl parathion induced fishes showed various physiological disorder in form of Erythropoesis, anaemia, Leucocytopaemia, Neutropaemia, Lymphopaemia, Eosinophilia and Erythropaemia.

Muthalagi [22], Arjun [26] and Pratibha [28] found haematological changes in fishes under exposure of sewage, chromium as well as cadmium chloride that results conformity of present work. Fish induced to pesticide, methyl parathion showed increase in MCH and MCHC levels which may be due to increased haemolysis of RBCs and the reduction in the Hb concentration resulted by a decrease in cellular blood iron. The present work also conformity of work of Revathi *et al.* [14], they observed similar in tannery effluent induced fish a decrease in PC, MCV, MCH and MCHC. The tannery effluent concentration influences the haematology profile. Similarly Arjun [26] observed a significant decrease in PCV, MCV, MCH and MCHC of *Clarias batrachus* induced to chromium. Under the Cadmium chloride exposure to the fish, *H. fossilis* (Bloch) same decrease of PCV, MCV, MCH and MCHC found reported by Pratibha [28]. In contrary found an increase in MCV, MCH and MCHC levels of *C. gariepinus* exposed by manganese [29]. No significant effect on monocytes and basophils in *A. testudineus* under exposure of sub-lethal concentrations of methyl parathion used in present study. The reduction in basophils and lymphocytes and an increase in monocytes and neutrophils counts were found in present work [30]. Whereas an increase in lymphocyte, eosinophils and monocytes with a decrease in neutrophils and basophils concentration in *Garra gotyla gotyla* exposed to various concentrations of manganese was reported by Sharma and Langer [25].

The haematological profile parameters like Hb, RBC, WBC were found decreases while in DLC, Neutrophil, Monocytes and Eosinophil values increases. Further Lymphocytes and PCV values decrease. The reduction of HB might be attributed to the blood coagulation. The reduction can be related to decrease RBC number which indicates haemolysis, haemorrahage and reduced erythropoisis in fishes on exposure to pesticide.

Table 1. Haematological profile changes in methyl parathion induced *Anabas testudineus*

Variable		**Methyl parathion (96 hrs) exposure**
Parameter	**Control**	**20 mg/l**
Blood Hb (gm/dl)	8.89 ±0.05	5.78±0.10 ***
TEC(RBC) (10^6 cell/mm^3)	5.35±0.05	4.11±0.05 ***
WBC (10^4 cell/mm^3)	4.92±0.05	2.25±0.05 ***
Neutrophil (10^4 cell/mm^3)	5.45±2.05	13.12±0.05 ***
Lymphocytes (10^4 cell/mm^3)	52.13±2.40	32.0±0.02 **
Monocytes (10^4 cell/mm^3)	4.0±0.05	7.0±0.05 *
Eosinophil (10^4 cell/mm^3)	2.2±0.05	3.2±0.05 **
Basophil (10^4 cell/mm^3)	1.8 ±0.02	1.4 ±0.02 *
PVC (%values)	34.91±0.06	12.85±0.03 **
MCV(fl/cell)	150.25±0.86	156.00±1.35
MCH(pg)	42.53±1.02	47.20±1.43
MCHC(g/dl)	24.05±1.05	29.38±1.05

Values are mean ± SE of 5 individual observations:-
** P<0.5 Non Significant,*
*** P<0.01 Significant,*
**** P<0.001 Highly Significant*

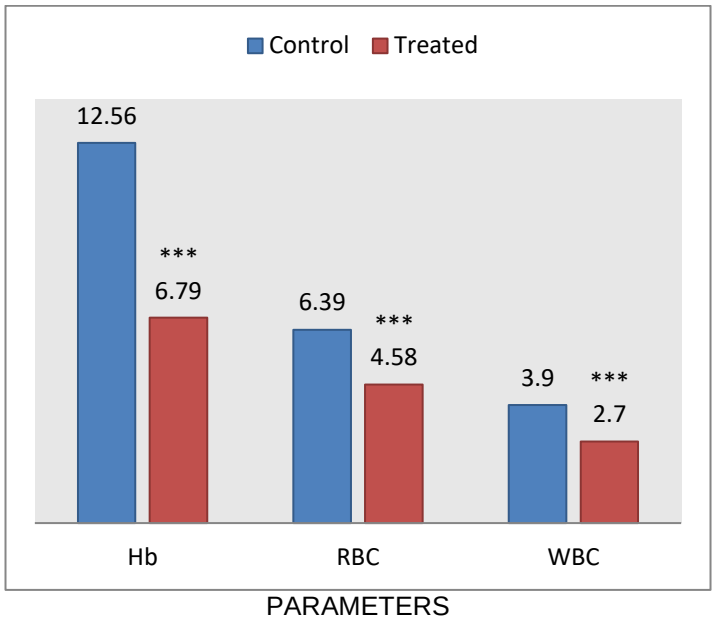

Fig. 1. Showing the effect of Methyl parathion on Hb, RBC, WBC in *Anabas testudineus* (96 hrs) ***P < 0.001

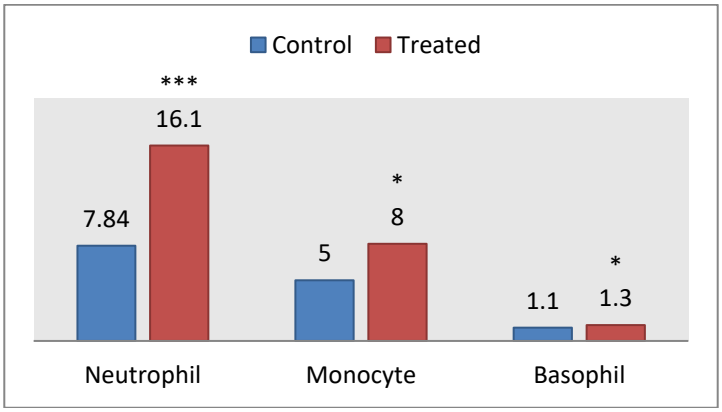

Fig. 2. Showing the effect of Methyl parathion on Neutrophil, Monocytes, Basophil in *Anabas testudineus* (96 hrs) *P<0.05, *** P<0.001

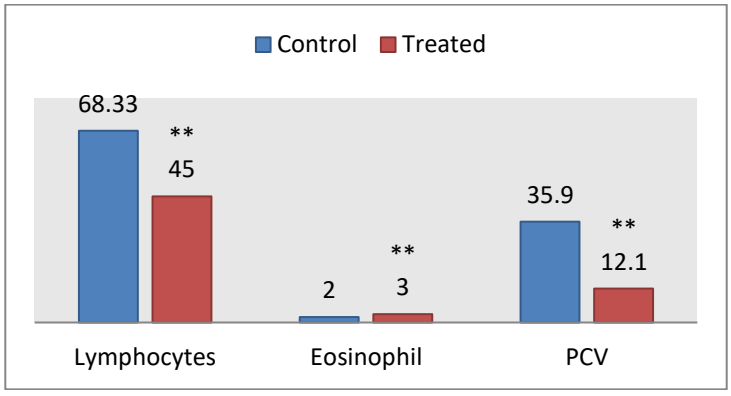

Fig. 3. Showing the effect of Methyl parathion on Lymphocytes, Eosinophil, PCV, in *Anabas testudineus* (96 hrs) ** P<0.01

4. CONCLUSION

The present study has concluded that methyl parathion pesticide is a toxic for *Anabas testudineus* (average weight 30.0± 4.0 g) culture at water contaminated with this at the concentration of < 0.047 mg/l. The chronic toxicity has detected through haematological profile alteration. The induced group shows significant alteration in the haematological parameters such as decreasing value in Hb, RBC, WBC while increasing value observed in DLC, Neutrophil, Monocytes and Eosinophil. The information will be major role on different levels of responses of organisms with respect to pollutant stress is a necessary pre-requisite for the proper management of pesticides application in agriculture.

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COMPETING INTERESTS

Author has declared that no competing interests exist.

REFERENCES

1. Moyle PB, Leidy RA. Loss of biodiversity in aquatic ecosystem: Evidence from fish faunas. In: Conservation Biology: (Ed. By Fiedler PL, Jain SK). New York: Champan and Hall. 1992;129-169.
2. Ajani F, Awogbade AA. Hematological changes of the African Catfish *Clarias gariepinus* (Burchell, 1822) Juveniles Induced by Diuron. British Biotechnology Journal. 2012;2(4):247-256.
3. Jerald Felix F, Saradhamani N. Impact of the herbicide glyphosate roundup (41%) On The Haematology of the Freshwater Fish, *Catla Catla* (Hamilton). *(IOSR-JESTFT).* 2015;9(4)III:56-60.
4. Farm Chemicals Handbook. Methyl parathion. Global guide to crop protection, In: R. Meister (ed.). Meister Publishing Company, Willoughby, OH. 2002;88:C270.
5. Mishra AB, Munshi JSD. On the accessory respiratory organs of *Anabas testudineus*. 15th International Congress of Zoology; 1958.
6. Roy T. Fishes of West Bengal which need immediate conservation for saving from extinction. Threatened Fishesof India. Nacton Publication. 1994;4:37-43.
7. Dehadari PV, Banerjee SR, Thakur NK, Das NK. Sexual dimorphism in certain air breathing teleost. Inland Fish. Soc. India. 1973;15:71-78.
8. Washington DC. APHA. Standard methods for the examination of water and waste water (16th Ed). American Public Health Assoc; 1985.
9. Hart WB, Dondoroff P, Greenbank J. The evaluation of toxicity of industrial wastes, chemicals and other substances to freshwater fishes. Atlantic Refining Company. Phil. Part. 1945;1:317-326.
10. Srivastava AK, Agarwal SJ. Hematological anomalies in a freshwater teleost, *Colisa Fasciatus*, on Acute Exposure to Cobalt. Acta. Pharmacol. Toxicol. 1979;44:197-199.
11. Raizada MN, Gupta A. Toxic effect of Rh-2 16 (a systemic fungicide) from total etythro- cyte counts (RBC) and haemoglobin (HB) content of Trichogasterfasciatus. Comp. Physiol. Ecol. 1982;7(1):29-30.
12. Sasikala G, Palanisamy P, Mallikaraj D, Bhuvaneshwari N, Natarajan GM. Metasystox Induced Haematological Modulation in the South Indian snake headed *Channa striata.* Int. J. Pharm. and Biol. Arch. 2011;2(2):775-777.
13. Arjun Sah, Roy DN Nutan. Effect of Hb parameters on chromium to *C. batrachus.* J. of Environ and Ecoplaning. 2009;16(1):93-101.
14. Rewathi KM, Yogananda, Kaplarasi K. Effect of tannery effluent on the Biochemical and Haematology on wistar albino rats. Indian J. Environ and Ecoplan. 2003;7(3):629-632.
15. Sharma S, Goyal RP, Chakravarty G, Sharma A. Orange red, a blend of permitted food colour induced haematological changes in Swiss albino mice, Mus musculus. Bull Pure App Sci. 2005;24:99-103.
16. Bruska-jastrzebska E, Protasowuki M. Effects of cadmium and nickel exposure on hematological parameters of common carp, *Cyprinus carpio*. Actalchthya et Piscatorial. 2005;35(1):29-38.
17. Anwar, Choudhary. Effects of Quinine and Atropine to rat. J. of Natural conservatives Indian. 2009;21(2):325-329.

18. Roy R, Nath S. Some hematological investigations on *Oreocromis niloticus* (Trewavas) following exposure to Thiamethoxam. Acta zool. Lituanica. 2011;21(4):301-305.
19. Verma SR, Sarita R, Dable RC. Indicators of stress induced by pesticides in *Mystus vittatus* haematological parameters. Indian J. Environ. Health. 1982;24(1):58-64.
20. Mishra J, Srivastava AK. Malathion-induced Haematological and biochemical changes in the Indian catfish, *Heteropneustes fossilis*. Environ. Res. 1983;30:393-398.
21. Muthalgi S. Effect of different concentration of sewage on the haematological parameters of *C. mirgila.* Indian J. Eniron and Ecoplan. 2006;12(2):409-412.
22. Pratibha, Kumar Effects of mercury chloride on haematological parameters of *Heteropneustes fossilis.*J. of Env and Ecoplann. 2011;18(23).
23. Gomulka P, Wlasow T, Szczepkowski M, Misiewicz L, Ziomek E. The effect of propofol anaesthesia on haematological and biochemical blood profile of European Whitefish. Turkish J. Fish. Aquat. Sci. 2014;14:331-337.
24. Goger M, Sawant V. Hematological changes during uranylnitrate induced acute toxicity. Effect of Sodium Loading. J. Environ. Biol. 1989;10(1):35-41.
25. Sharma J, Langer S. Effect of manganese on hematological parameters of fish, Garra gotyla gotyla. J. Entomol. Zool. Stud. 2014;2:77-81.
26. Arjun S. Effects of chromium on haematological and histopathological parameters, *C. batrachus.* Ph. D. thesis, L.N.M.U., Darbhanga; 2010.
27. Vasait JD, Patil VT. The toxic evaluation of organophosphorous insecticide monocrotophos on the edible fish species *Nemacheilus botia.* Ecol. Env. and Cons. 2005;8(1):95-98.
28. Pratibha P. Haematological and bio-chemical effects of mercuric chloride to *Heteropneustes fossilis.* Ph.D. thesis of L.N.M.U. Darbhanga; 2013.
29. Olojo EAA, Ladeji G. Haematological response of the African catfish, *Clarias gariepinus* (Clariidae) exposed to manganese. Asian J. Biol. Life Sci. 2012;1:126-133.
30. Finney DJ. Statistical methods in biological assay. 3rd ed. London UK: Griffin Press. 1978;508.

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