



PRESENT STATUS OF PHYTOPLANKTON DIVERSITY IN RAMOUA DAM DISTRICT GWALIOR, MADHYA PRADESH INDIA

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AUTHORS' CONTRIBUTIONS

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

The diversity of phytoplankton was studied for Ramoua Dam which is situated at eastern side of Gwalior City in Madhya Pradesh from June 2016 to May-2017. The phytoplankton was collected by standard plankton net from four different sites of Ramoua dam. In the present study total 20 species of phytoplankton were identified belonging to 13 families, 11 orders and 5 different classes. Euglenophyceae was found dominant with 7 species throughout the study period followed by Chlorophyceae with 5 species, Bacillariophyceae with 4 species, Cyanophyceae with 3 species and Myxophyceae with 1 species. During study time the highest plankton cell density was observed in the month of May and lowest plankton density was observed during the month of July. The study helps in better understanding for the management of the Ramoua Dam.

Keywords: Diversity; phytoplankton; dominant; Ramoua dam; Gwalior; Madhya Pradesh.

1. INTRODUCTION

Planktons are composed of algae and animals in various stages of development, where as only a portion of life cycles of meroplanktonic species occurs in plankton. Planktonic forms are relatively small in size and often lack locomotory organs. The plankton occurs in all natural waters as well as in artificial impoundment like ponds, tanks, reservoir and irrigation channels etc. The growth of the phytoplankton depends on the carbon dioxide availability, sunlight and the primary nutrients. Some of the phytoplanktons are able to nitrogen fixation and they are able to grow on that places where the concentration of nitrogen is very low [1].

Plankton is a general term for those organisms that drift or swim feebly in the surface water of ponds, lakes, streams, rivers, estuaries and oceans. Phytoplankton are autotrophs and belonging to first trophic level. They are the most important component of trophic structure which helps in transfer of energy to higher trophic levels. Phytoplanktons are primary producer community and consist mainly of algae such as diatoms, dinoflagellates and variety of forms from other divisions of plant kingdom. The phytoplankton, in a water body, is an important biological indicator of the water quality. Phytoplanktons are the major primary producer in an aquatic ecosystem which is grazed by zooplankton [2].

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The primary production of organic matter in the form of phytoplanktons which are more intense in reservoir, lake than in rivers [3]. Phytoplanktons are the grass of lakes and oceans and most species have worldwide distribution. Most of phytoplanktons are not visible to naked eye but when concentrated are responsible for the characteristic greenish colour and reduced transparency of some lake waters.

The scientific management of water body for its healthiness and fish production require a thorough understanding of its trophic structure, their population characteristics and the nature of nutrient cycling with a view to achieving optimum fish production [4]. The present study is aimed to determine the status of phytoplankton diversity in Ramoua Dam in Gwalior district that can help to sustainable development in many points of view.

1.1 Study Area

Ramoua Dam is situated at about 06 Km far from Gwalior city of Madhya Pradesh. The dam is situated between the ditches of valley, at one side of the dam valley is covered by dense forest while other site at the bank of dam Ramoua village is situated. It is a masonry dam which was located at latitude 26°9'32.20" and 78°13'24.91"L. The dam was constructed mainly for irrigation purpose. Ramoua is the nearest village, after the name of which the dam is known as Ramoua dam. Besides irrigation, the water of the dam is also used for washing, cattle wadding, drinking for wild animals and fish culture by local fishermen.

2. MATERIAL AND METHOD

The phytoplankton samples were collected to filter the 100 litre water through funnel shape plankton net of 35 µm mesh size and filtrate sample were fixed in 1 litre plastic bottle with 5% Lugol's solution which help to arrest cell activity, for sedimentation and better staining. The sample was stored in the laboratory for overnight sedimentation and the supernatant 900 ml of water was siphoned and 1 ml sub sample was used from the remaining 100 ml homogenized sample for quantitative and qualitative estimation [5].

The qualitative estimation or identification of phytoplankton was done with the help of keys given by Smith [6], Agarkar (1975), Adoni [7], Michael and Sharma [8], Edmondson (1963), Dhanapathi [9] and Altaff [10] while the quantitative estimation of phytoplankton was done by "lac keys" dropping method using the formula.

Plankton units /liter = $N \times C \times 10 / Y$

N = Number of phytoplankton counted 0.1 ml concentrate.

E = Total volume of concentrate in ml.

Y = total volume of water filtered for sample in liters

The phytoplankton was expressed cell/ l and organisms/l respectively. The compound microscope with 10 X and 40 X objective lens and three replicates of the sample were subsequently used.

3. RESULT AND DISCUSSION

In the present study total 20 species of phytoplankton were identified during the study period, which belonged to 5 classes, 11 orders and 13 different families (Table 1). Class Euglenophyceae represented to 7 species with 35% followed by Chlorophyceae to 5 species with 25%, Bacillorophyceae to 4 species with 20%, Cyanophyceae to 3 species with 15% and Myxophyceae to 1 species with 5% of total (Fig. 1). A review study has been done by [11] on freshwater phytoplankton diversity, their model, drivers and implication for ecosystem properties. Dochin and Ivanova [12] were studied in Bistricea Dam Lake to find out taxonomic structure of phytoplankton community and dynamics of hydrochemical regime as determining factors of trophic conditions. They reported seventy seven taxa in six divisions of planktonic algae viz: Cyanoprokaryota (8 species, 10.38%), Chlorophyta (34 species, 44.15%), Euglenophyta (6 species, 7.79%), Streptophyta (3 species, 2.59%), Pyrrophyta (3 species, 3.88%), Ochrophyta (24 species) including class Synurophyceae (3 species, 3.89%) and class Bacillariophyceae (21 species, 27.27%). Dominant and sub-dominant species were identified and seasonal dynamic of phytoplankton community was established of Bistricea Dam Lake.

Ferdoushi et al. [13] identified total 21 species of phytoplankton from Ramsagar Lake in Dinajpur district. Sasikala et al. [14] identified 15 species of phytoplanktons in Varaha reservoir. In their study, 10 species of Chlorophyceae, 2 species of Bacillariophyceae and 3 species of Cyanophyceae were found. They also reported Chlorophyceae to be the most dominant group with 10 species. Pandiammal et al., [15] reported total 5 groups of phytoplankton (Chlorophyceae, Bacillariophyceae, Cyanophyceae, Euglenophyceae, Dinophyceae) in Temple Pond at Thiruvottiyur, Chennai. Singh (1990) studied the phytoplanktons of Ramoua Dam and observed the presence of almost all groups of planktonic algae.

Monthly variation in species wise numbers of individuals with percentage of phytoplankton density shows in Table 2. The maximum numbers of phytoplankton was recorded in the month of May (1408) while least numbers of phytoplankton recorded in the month of July (522). Class Euglenophyceae represented to higher numbers of individuals in the month of May (362) with 24.01% while lower in the month of August (168) with 30.54%. Chlorophyceae represented maximum number of individuals in the month of May (382) with 20.42% while minimum in the month of September (120) with 19.54%. Dubey et al. [16] depicted that among the phytoplankton,

Chlorophyceae 39% (200-4850 cell/l) was dominated group followed by Cyanophyceae 32% (290-4600 cell/l) and Bacillariophyceae 29% (200-4000 cell/l). Among Chlorophyceae, the dominant species are *Ulothrix zonata*, *Spirogyra* sp, *Cosmarium reniforme* are majority of algae and the algal growth was affected when phosphorus level was below the critical level [17].

In the month of June (292) with 23.61% higher numbers of individual was recorded while in the month of August (10.3) with 18.73% least number of individuals was recorded of Bacillariophyceae class.

Table 1. Checklist of Phytoplankton species recorded from Ramoua Dam during study

S. No.	Class	Order	Family	Species
1				<i>Euglena acus</i>
2				<i>E. proxima</i>
3			Euglenaceae	<i>E. polymorpha</i>
4	Euglenophyceae	Euglenales		<i>Lepocinclis acuta</i>
5				<i>Phacus helicoides</i>
6			Phacaceae	<i>P. pseudoswirenkoi</i>
7				<i>Phacus meson</i>
8				<i>Scenedesmus alternans</i>
9			Scenedesmaceae	<i>Scenedesmus tropicus</i>
10	Chlorophyceae	Hydrodictyaceae		<i>S. prismaticus</i>
11			Vovocaceae	<i>Pediastrum duplex</i>
12		Zygnematales	Desmidiaceae	<i>Closterium dianae</i>
13			Gomphonemataceae	<i>Gomphonima</i> sp.
14		Pennales	Naviculaceae	<i>Navicula</i> sp.
15	Bacillariophyceae	Cymbellales	Cymbellaceae	<i>Cymbella</i> sp.
16		Naviculales	Pinnulariaceae	<i>Pinnularia</i> sp.
17		Oscillatoriales	Microcoleaceae	<i>Arthrospira platensis</i>
18		Nostocales	Aphanizomenonaceae	<i>Anabaenopsis arnoldii</i>
19	Cyanophyceae	Synechococcales	Merismopediaceae	<i>Merismopedia tenuissima</i>
20	Myxophyceae	Choroococcales	Choroococceae	<i>Microsystis aeruginosa</i>

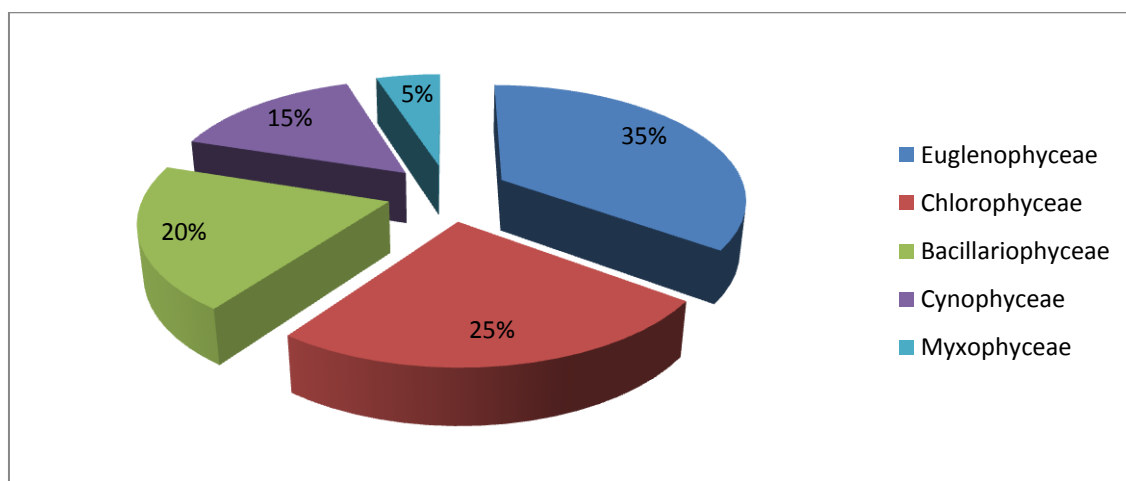


Fig. 1. Class wise percentage of species recorded at Ramoua Dam

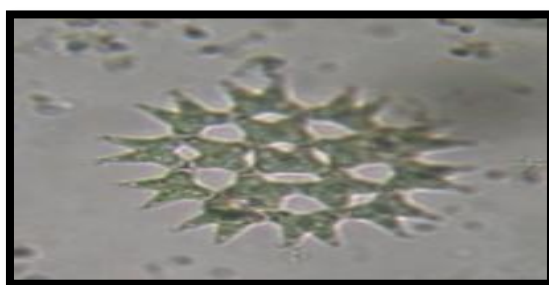
Ahmad et al., (2013) reported 29% of Bacillariophyceae among the phytoplankton in Pahuj reservoir Jhansi (U.P). Maximum number of phytoplankton was recorded in the month of April (289) with 19.90% while minimum number of phytoplankton was recorded in the month of August (52) with 9.45% of Cynophyceae class. Cyanophyceae showed the primary peak during summer and secondary peak during late monsoon (winter). The standing stock and percentage composition of phytoplankton flora due to the variation in composition of its different groups

seasonally [18]. Higher number of phytoplankton recorded in the month of February (258) with 22.07% while least number of phytoplankton recorded in the month of July (38) with 7.27% of class Myxophyceae. The plankton community on which the whole aquatic depends directly or indirectly was largely influenced by the interaction of number of factors [19]. Sharma and Yadav [20] total 31 species find out during investigation, belonging mainly from 3 families Cyanophyceae, Chlorophyceae and Bacillariophyceae. Study revealed that the water Mahil pond is highly eutrophic and organically polluted.

Table 2. Monthly variation in numbers with percentage of phytoplankton density (Cell/l)

S. No.	Month	Total Phytoplankton		Eup.		Chp.		Bap.		Cyp.		Myp.	
		n/l	%	n/l	%	n/l	%	n/l	%	n/l	%	n/l	%
1	June	1237		337	27.24	323	26.11	292	23.61	177	14.31	108	8.73
2	July	522		177	33.90	128	24.52	118	22.60	61	11.68	38	7.27
3	Aug.	550		168	30.54	158	28.73	103	18.73	52	9.45	69	12.55
4	Sep.	614		187	30.45	120	19.54	168	27.36	77	12.45	62	10.09
5	Oct.	781		196	25.09	186	23.82	173	22.15	65	8.32	161	20.61
6	Nov.	1077		252	23.39	223	20.71	276	25.63	138	12.81	188	17.45
7	Dec.	972		214	22.02	278	28.60	156	16.04	157	16.15	167	17.18
8	Jan.	980		253	25.81	213	21.73	214	21.84	143	14.59	157	16.02
9	Feb.	1169		247	21.13	281	24.04	224	19.16	159	13.60	258	22.07
10	Mar.	1244		303	22.54	356	26.48	245	25.66	212	15.77	128	9.52
11	April	1325		346	24.28	316	22.17	209	21.68	289	19.90	165	11.57
12	May	1408		362	24.01	382	20.42	274	24.80	248	16.45	142	9.41
Total		11879		3042	310.4	2964	286.8	2452	269.3	1778	165.5	1643	162.5

Eup. = Euglenophyceae, Chp. = Chlorophyceae, Bap. = Bacillariophyceae, Cyp. = Cynophyceae, Myp. = Myxophyceae

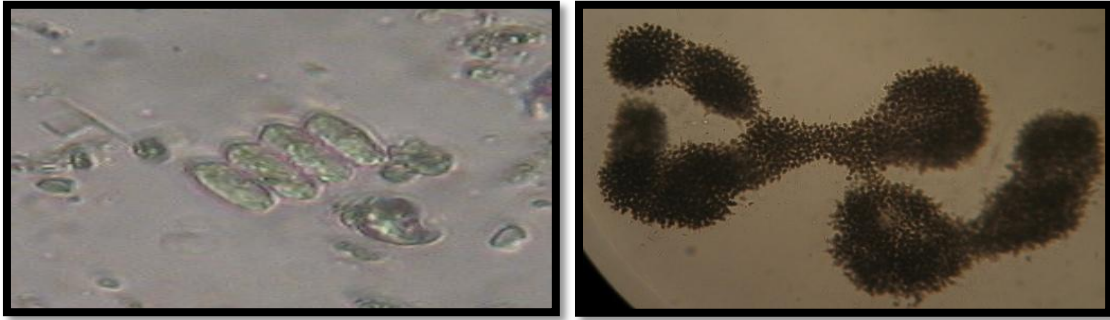


Pediatrum duplex Closterium sp.

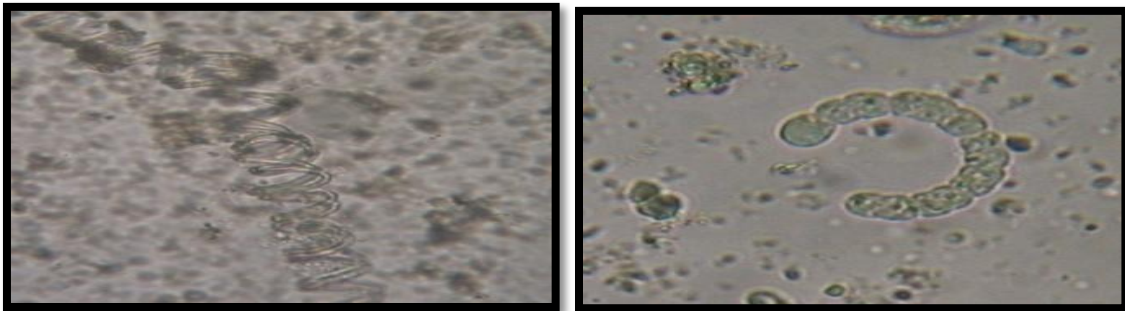


Scenedesmus alternans S. tropicus

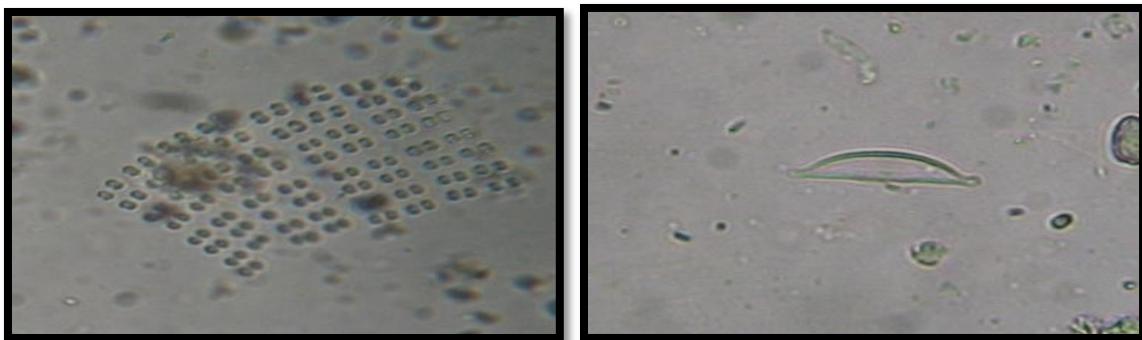
Plate 1. Specimen of phytoplanktons collected from the ponds during the study



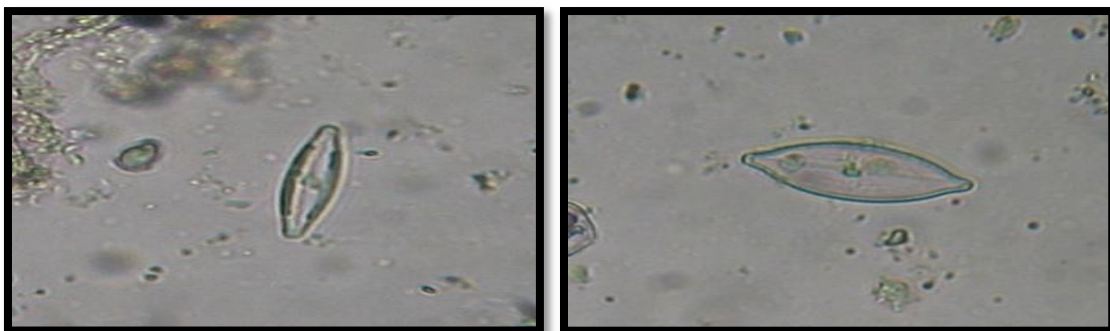
S. prismaticus *Microsystis aeruginosa*



Arthrospira platensis *Anabaenopsis arnoldii*

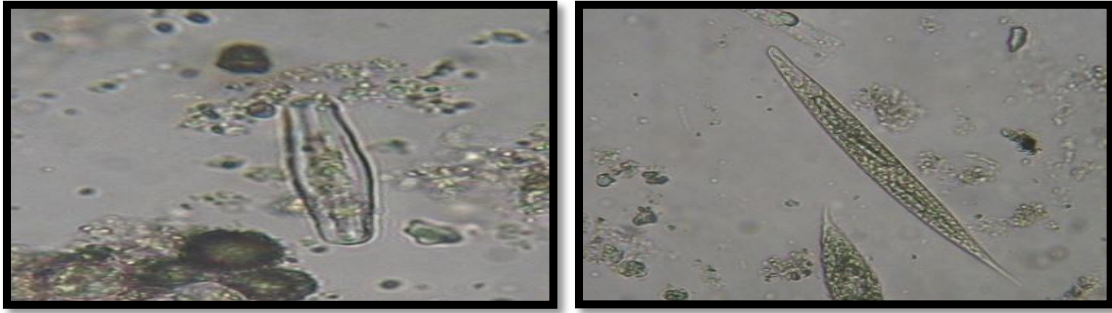


Merismopedia tenussima *Cymbella sp.*

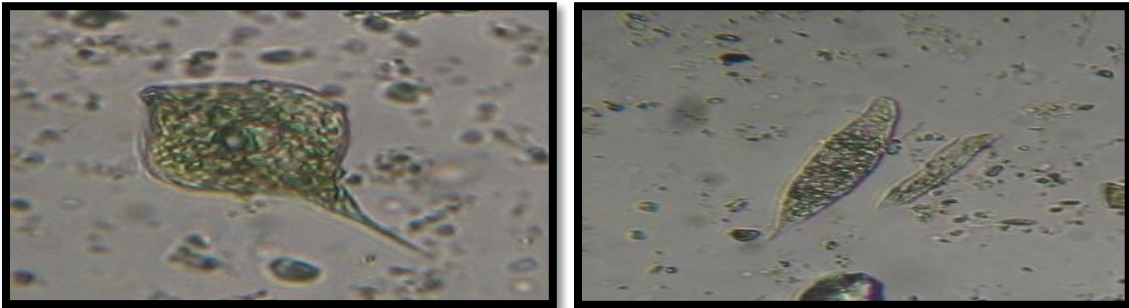


Gomphonima sp. *Nevicula sp.*

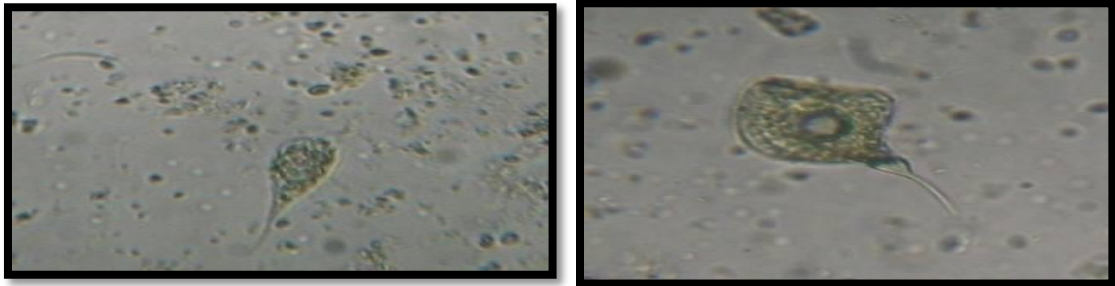
Plate 2. Specimen of phytoplanktons collected from the ponds during the study



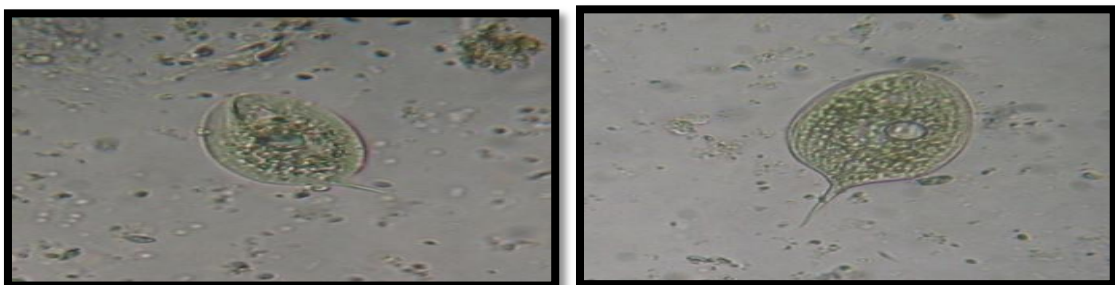
Pinnularia sp. Euglena acus



E. polymorpha E. proxima



Lepocinclis acuta Phacus helicoides



P. pseudoswirenkoi P. meson

Plate 3. Specimen of phytoplanktons collected from the ponds during the study

4. CONCLUSION

In the present study total 20 species were identify in study area. They belong to five different classes viz;

Euglenophyceae, Chlorophyceae, Bacillorophyceae, Cyanophyceae and Myxophyceae. Euglenophyceae was the most dominant class while Myxophyceae was less dominant class of phytoplankton species. Study

helps to suggest restorative measures, which are of great socio – economic importance to the region. The current prevailing condition of Aquatic diversity besides acting as potential bio indicators of tropic status requires the management strategies for the conservation.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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