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Occurrence of Aquatic Hyphomycetes in Relation to Some Physico-Chemical Parameters in Urmil River

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Abstract: ***Aquatic hyphomycetes are mitosporic states of ascomycetes (Phylum Ascomycota) and basidiomycetes (Phylum Basidiomycota). Relative effect of some physico-chemical parameters of water to the occurrence of aquatic hyphomycetes was studied in Urmil river of Chhatarpur district. A total of 31 species belonging to 22 genera were isolated. The number of conidial fungal species was enumerated in water samples collected monthly during the period of March 2015 to February 2016. There was marked seasonal fluctuation in the occurrence of the species. The maximum number of species was found during winter and post-monsoon followed by early summer and late monsoon, while there was a decline in the number of species during late summer and rainy seasons. Species richness was correlated with four different water quality variables measured for each sample period, viz., temperature, pH, dissolved oxygen, and calcium hardness. The data were analyzed statistically for correlation and these factors were found to be significant for the occurrence of aquatic hyphomycetes.***
Key words: Aquatic hyphomycetes, Occurrence, Physico-chemical parameters and Seasonal fluctuation.

I. INTRODUCTION

Aquatic hyphomycetes, also known as freshwater hyphomycetes amphibious hyphomycetes or Ingoldian fungi belong to the Kingdom Fungi. They occur most commonly on deciduous leaves that have fallen into streams, where they perform a vital role in conditioning plant detritus for consumption by stream invertebrates. Fungal activity on leaves is affected by several environmental factors, such as dissolved nutrients in water, temperature and pH.

Temperature range of 10-25°C favors the growth and multiplication of conidial fungi in water bodies. Temperate countries have found abundant conidia in autumn, winter and early spring and abundance decreased in the late spring and summer.1

The occurrence and degradative ability of water borne conidial fungi colonizing on submerged leaf litter is influenced by the hydrogen ion concentration (pH) of water. 2 Found abundance of aquatic hyphomycetes at a site where pH ranges between 7.6 to 8.7, heavy leaf fall, rapid flow of clean water.3 Species richness of aquatic hyphomycetes declines noticeably at pH $\leq$ 4.5 and $\geq$ 8.0. 4&5. These fungi require a fresh oxygenated environment for their occurrence .6 Increase in fungal species number is related with increasing dissolve oxygen and dissolve organic matter of the stream.7 The present work was carried out to study the relation of physico-chemical factors to the occurrence and distribution of aquatic hyphomycetes in a fresh water Urmil river of Chhatarpur.

II. MATERIAL AND METHODS

A. Study area

The Urmil river was selected for he present It is nearly 20 Km away from Chhatarpur This river passes through teak (Tectona grandis L.), Salai (Boswellia serrate L.) Khair (Acacia catechu) and Bamboo (Dendrocalamus strictus) forest area.

B. Sampling

Monthly five samples were made from the five selected Sstes the study area for a period year (March 2015 to February 2016). Samples of five sites were taken as two replicates. Mycological analysis, samples of foam, submerged leave and twigs were collected in sterilized bags and were processed as described by Nilsson (1964) Species were identified using relevant monographs and literature Conidia of species were taken an index of occurrence. Water samples were also collected for physico-chemical analysis.

C. Analysis of water quality

The physico-chemical arameters of water viz., emperature(° C), water pH, dissolve oxygen (mg/l), and alcium hardness(mg/l) were analyzed following the methods of A.P.H.A(2005).

Temperature was measured by using a entigrade thermometer by dipping at a depth of 5-8 in water for 5 minutes, at the time of sample collection. pH was recorded on spot with the help a digital portable pH meter (Hanna).

Dissolve oxygen content (mg/l) was determined on the spot by making a composite sampling of water at each month following the Winkler's azida odification method Calcium hardness (mg/l) were analyzed following the methods A.P.H.A. (2005).

Statistical analysis

Each physico-chemical factors of water were analyzed statistically for the relationship with the occurrence of water borne conidial fungi on the basis of coefficient ofcorrelation (r).

III. RESULTS

A total of 31 species belonging to 21 genera of water borne conidial fungi viz., Alatospora, Anguillospora Arbusculina, Beltrania, Camposporium, Campylospora Ceratosporellac lavariopsis, dactylella, Dimorphospora Flabellospora,Flagellospora, Helicosporium isthmotricladia Lemonniera, Lunulospora, Setosynnema Trichocladium, Tricladium, Triscelophorus and Wiesneriomyces were isolated from Urmil river(Table 2).these species were isolated from different decomposed leaf litter of known and unknown species and foam.

A. Seasonal variation n species composition

During the course of present study a seasonal fluctuation in the occurrence of water borne conidial fungi was observed. aximum number fungi were found during winter (16-19 species) and post monsoon (13-16species) while number of species decline in summer season (with 2 species). It was interesting to note that some species appeared in particular seasons, Camposporium pellucidum occurred only in summer Dimorphospora oliicola, Flagellospora penicilloides, and Wiesneriomyces laurinus occurred only in winter; Helicosporium hongkongense, and Tricladium summer; Beltrania rhombica and Trichocladium angelicum were observed during monsoon to early summer Dactylella submersa, and Triscelophorus acuminatus were observed from monsoon to winter season; Lemonniera cornut observed from postmonsoon to summer; Alatospora acuminate and Isthmotricladia gombakiensis observed during monsoon post-monsoon season Anguillospora crassa,Campylospora chaetocladia and Lunulospora curvula appeared throughout the year in every season and can be regarded as temperature tolerant species, while other species were found during seasons. from five different sites is given in table 1.

The results different physico-chemical water parameters of species are summarized as below:

B. Temperature

Water temperature of Urmil river recorded during study period indicates a marked seasonal variation (Table1). The temperature of the river water ranges between 16.3-32.5° C. Fungal species were found temperature dependent, as fluctuation in the temperature also change the composition of water borne conidial fungi. Statistical analysis indicated a negative correlation (r = -0.20197) of the fungal with temperature It was noted that species declines with the rising of temperature (Fig. 1).

Hydrogen- ion concentration(ph) : pH of water ranged between 7.6 to 8.4 (Table 1), with minimum in summer and maximum in winter (Fig.2). Water pH had a close relationship with the occurrence of water borne conidial The number of fungal species had a negative correlation with pH, having values of (r = -0.22423).

C. Dissolved oxygen (DO)

Dissolved oxygen content of ranged between 6.3-7.2 mg/l (Table 1), with maximum in and minimum in summer. A positive correlation (r = 0.17621) was found between the dissolved oxygen content of water and occurrence of species (Fig. 3).

D. Calcium hardness

The values of alcium oncentration of river water ranges between 28.4 to 46.4 mg/l (Table1.). It was observed that the number of species decrease with the ncrease in the calcium concentration. A negative correlation (r =- 0.23994) was obtained between number of species and calcium concentration of water (Fig.4).

IV. DISCUSSION

The data btained during present investigation revealed that, the species composition of the aquatic hyphomycetes varied considerably from seasons seasons, that would be attributed to the variation in physico-chemical characteristics of the habitat which profound influence on the occurrence and distribution of water conidial fungi.

A perusal of seasonal occurrencen of different species in the habitat indicates that the aquatic hyphomycetes show a marked seasonal fluctuation in their occurrence. A maximum number of the fungal species was found during winter and post-monsoon seasons, while number of species in summer. Occurrence of maximum number species during winter and post-monsoon seasons in the present study might be due to moderate temperature and slightly higher percentage of organic And inorganic matter. Many investigators have observed similar maxima during post monsoon periods and suggested that after rainfall the large amounts of variousleaf detritus get transferred into the stream through rain wash from distant places and stream gets greater bundance of these fungi.[10] Figure1 the relationship between number of species and different physico-chemical parameters (Temperature,pH, dissolved oxygen Calcium hardness) Urmil river.

There was a correlation with species number and within certain range (r - 0. 2423) indicates that high and low pH might not be suitable for hese fungi. ccurrences of borne conidial fungi show negative correlation with temperature (r= 0.20197).Water borne conidial fungi calcium not only from the leaf litter, wood debris but also directly from water passing by ravine areas.[11&12] During the observation a negative correlation was found between the occurrence of aquatic hyphomycetes and calcium hardness of water (r =- 0.23994).It justifies the findings who reported that, the richness of these fungi was negatively correlated with hardness of water.[13]

Out of the 31species isolated from the fresh water of Urmil river Campylospora chaetocladia, Lunulospora curvula, and triscel-ophorus monosporus occur throughout the year, having maximum abundance. They may be regarded as temperature tolerant species and species of the fresh water and can be concluded, as their appearance does not seem to be affected by different physico-chemical factors. resent study, the impact of temperature, pH, dissolved oxygen, and calcium content showed a marked influence on the occurrence and distribution of the aquatic hyphomycetes. Relying upon the data observed inthe present study, it can beconclude that occurrence and distribution of the aquatic hyphomycetes is governed by interaction of temperature, pH, dissolved oxygen and calcium matter of the river water.

V. ACKNOWLEDGEMENTS

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VI. CONFLICT OF INTEREST

Authors would hereby like to declare that there is no conflict of interests that could possibly arise.

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Table 1. Occurrence of aquatic hyphomycetes and water physiochemical characters of Urmil river of Chhatarpur district during March 2015 to February 2016.

S. No.	Months Name	No. of Species Occurred	Temp (°C)	pH	DO (mg/l)	Calcium hard-ness (mg/l)
1.	March 2015	13	20.6	7.8	6.7	42.5
2.	April	12	27.4	7.7	6.5	44.9
3.	May	7	32	7.8	6.4	45.3
4.	June	6	32.5	7.6	6.3	46.4
5.	July	5	26.3	8.1	6.5	41.2
6	August	10	27.2	8	6.6	39.4
7.	September	15	26.6	8.1	6.6	36.7
8.	October	16	24	8.1	6.7	34.5
9.	November	13	20.3	8.2	6.7	33.3
10.	December	16	17.5	8.2	6.8	30.1
11.	January-2016	19	16.3	8.4	6.9	28.4
12.	February	18	19.2	8.1	7.2	30

DO = Dissolved Oxygen

* Average values of five samples studied at five sites

Table 2. Seasonal fluctuation of aquatic hyphomycetes of Urmil river, Chhatarpur during March 2015 to February 2016.

S. No.	Name of the Fungus	Summer				Monsoon			Post Monsoon		Winter			O
		M	Ap	My	Jn	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	
1.	Alatospora acuminata Ingold	-	-	-	-	-	+	+	+	+	-	-	-	04
2.	Anguillospora crassa Ingold	+	+	+	+	-	-	+	+	+	+	+	+	10
3.	A. longissima (Sacc. and Syd-ow) Ingold	+	+	+	-	-	-	-	-	-	+	+	+	06
4.	Arbusculina fragmentans Mava-nova	+	+	-	-	-	-	-	-	-	+	+	+	05
5.	Beltrania rhombica Penzig,	+	-	-	-	-	+	-	+	+	+	+	+	07
6.	Camposporium pellucidum (Groove) Hughes	-	+	+	+	-	-	-	-	-	-	-	-	03
7.	Camposporium antennatum Hark-ness	-	-	-	-	-	-	-	-	-	-	-	+	01
8.	Campylospora chaetocladia Ran-zoni	-	+	+	+	+	+	+	+	+	+	+	-	10
9.	Ceratosporella deviata Subramani-an,	-	-	-	-	-	-	-	-	-	+	+	+	03
10.	Clavariopsis aquatica de Wilde-man,	+	+	+	+	+	-	-	+	+	+	+	+	10
11.	Dactylella submersa (Ingold) Nilsson,	-	-	-	-	-	+	+	+	+	+	+	+	07
12.	Dactylella rhombospora Grove	-	-	-	-	-	-				-	+	+	02
13.	Dimorphospora foliicola Tubaki	+	+	-	-	-	-	-	-	-	+	+	+	05

14.	Flabellospora crassa Alasoadura	-	-	-	-	-	-	+	+	-	-	-	-	02
15.	Flabellospora verticillata Alasoa-dura	-	-	-	-	-	-	+	+	-	-	-	-	02
16.	Flagellospora penicilloides Ingold	-	-	-	-	-	-	+	+	-	-	-	-	02
17.	Flagellospora penicilloides Ingold	+	+	-	-	-	-	-	-	-	+	+	+	05
18.	Helicosporium hongkongense Tsui, Goh ,Hyde et. Hodgkess sp.nov.	-	-	-	-	+	+	+	-	-	-	-	-	03
19.	Helicosporium griseum Berkeley and Curtis	+	+	-	-	-	-	-	-	-	-	-	-	02
20.	Isthmotricladia gombakiensis Na-wawi,	-	-	-	-	-	+	+	+	+	+	+	+	07
21.	Isthmotricladia laeensis Matsu-shima	-	-	-	-	-	-	+	-	-	-	-	-	01
22.	Lemonniera cornuta Ranzoni	+	+	-	-	-	-	-	+	+	+	+	+	07
23.	Lunulospora curvula Ingold	+	+	+	+	+	+	+	+	+	+	+	+	12
24.	Lunulospora cymbiformis Miura	-	-	-	-	-	-	-	+	-	-	-	-	01
25.	Setosynnema indica sp. nov.	+	-	-	-	-	-	-	-	-	-	+	+	03
26.	Trichocladium angelicum Roldan and Honrubia	+	-	-	-	-	+	+	+	+	+	+	+	08
27.	Tricladium indicum Sati and Tiwari	-	-	-	-	+	+	+	-	-	-	-	-	03
28.	Triscelophorus acuminatus Na-wawi	-	-	-	-	-	-	+	+	+	+	+	+	06
29.	Triscelophorus monosporus In-gold	+	+	+	+	-	+	+	+	+	+	+	+	11
30.	Triscelophorus magnificus Pe-tersen	-	-	-	-	-	-	-	-	-	-	+	-	01
31.	Wiesneriomyces laurinus (Tassi) Kirk	-	-	-	-	-	-	-	-	+	-	-	-	01
Total		13	12	07	06	05	10	15	16	13	16	19	18	150

(M- March, Ap- April, My- May, Jn- June, Jul- July, Aug- August, Sep- September, Oct- October, Nov- November, Dec- December, Jan- January, Feb- February, + = Species present, - = Species absent, O- occurrence)

Figure 1. Relationship between number of fungal species and Temperature .

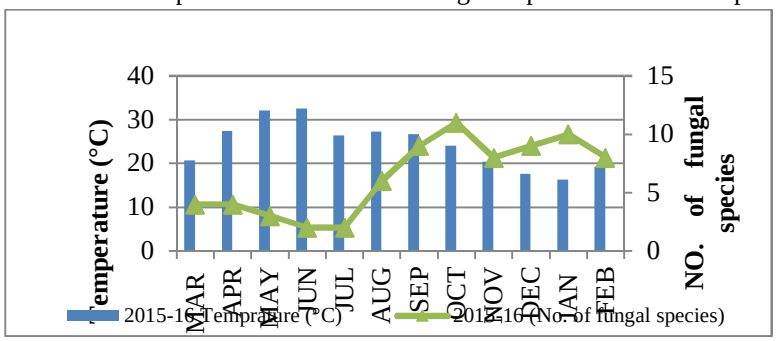


Figure 2. Relationship between number of fungal species and pH.

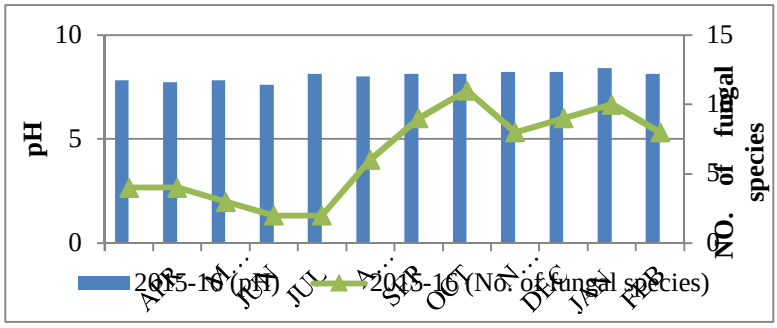


Figure 3. Relationship between number of fungal species and Dissolved Oxygen (DO).

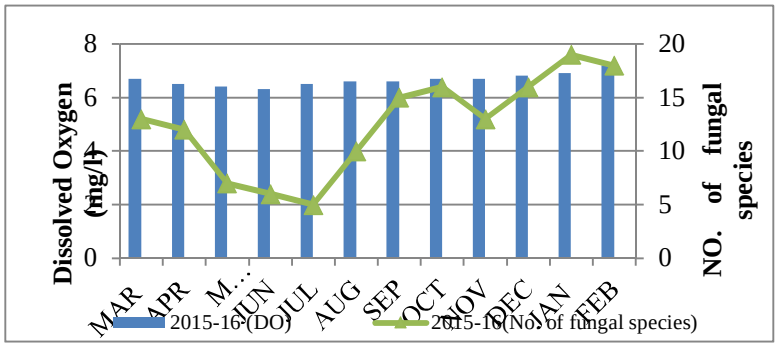
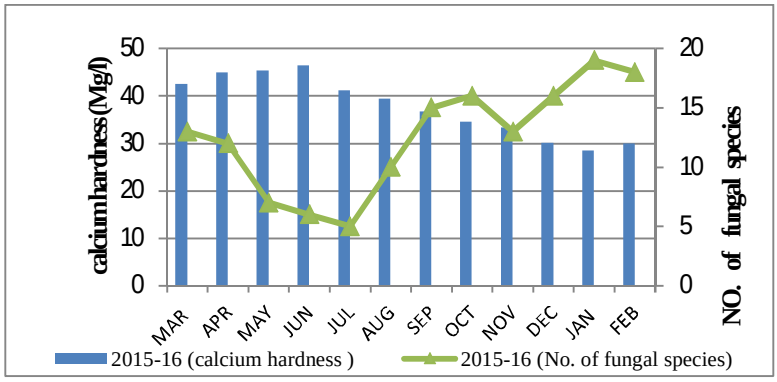
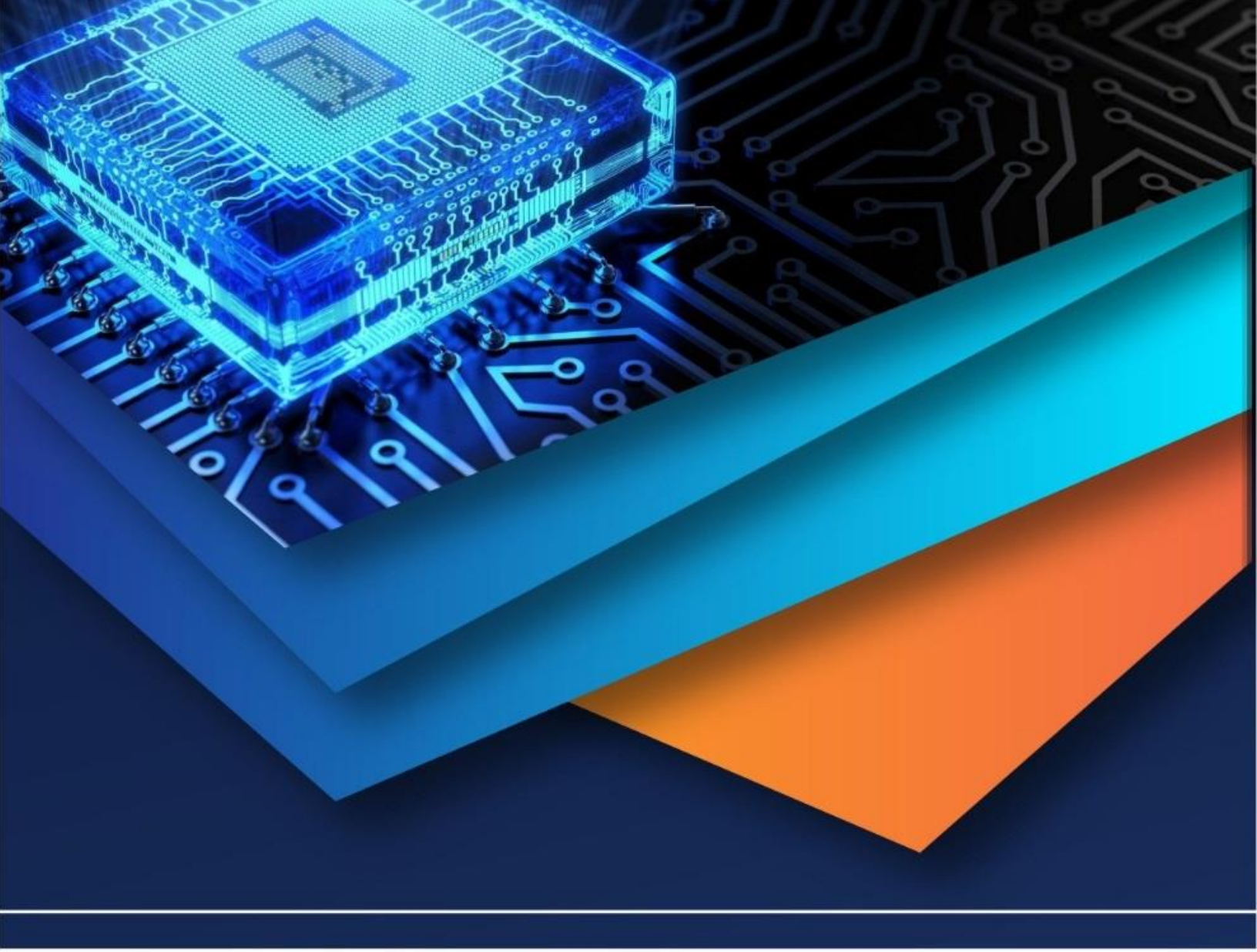


Figure 4. Relationship between number of fungal species and Calcium Hardness.





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