# Rotifer Fauna of Rajasthan, India

by

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#### INTRODUCTION

The rotifer fauna of India is comparatively less known. The earliest report of the Indian rotifers is that of ANDERSON (1889) who collected his material from Calcutta. His list included 10 new species. MURRAY (1906) listed 32 species of rotifers collected from the slopes of the Sikkim Himalaya at an altitude of 610 to 2440 m. STEWART (1908) collected 17 species from the Tibet region at an altitude of 4000 m. EDMONDSON & HUTCHINSON (1934) during their Yale North India Expedition recorded 100 species of rotifers from different localities of Kashmir, Ladak, Punjab and Nilgiri (Southern India). AHLSTROM (1940) described 2 new varieties Keratella quadrata var. edmondsoni (=Keratella edmondsoni) and K. quadrata var. pyriformis. Recent studies on Indian rotifers include those of BREHM (1950), PASHA (1961), GEORGE (1961), ARORA (1963a, 1963b, 1965) and NAYAR (1964, 1965a, 1965b). The only rotifers known from Rajasthan are Keratella tropica (APSTEIN), K. edmondsoni (AHLSTROM), K. procurva (THORPE) (NAYAR 1965) and Brachionus calyciflorus PALLAS (NAYAR, 1964, 1965a).

The present communication deals with 36 species, including one new species, of which 14 are reported for the first time from India. The samples of plankton have been collected with the help of tow nets made of nylon cloth, from 32 water bodies located in 8 districts of Rajasthan. The following list gives the localities from where the species have been collected, and also, as far as it is known, their distribution.

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SPECIES	OCCURRENCE	DISTRIBUTION
Brachionus rubens Ehr.	Pilani, Khetri, Shivpur, Gangana-	Cosmopolitan.
B. falcatus ZACHARIAS	gar. Khetri, Mt. Abu.	Subtropicopolitan.
B. caudatus var. aculeatus	Pilani	India.
B caudatus f maiusculus	Jainur, Pilani	N America, India
B. forficula WIERZESKI	Mt Abu	Asia, Europe
B. angularis GOSSE	Pilani Churu	Cosmonolitan in alkaline
		fresh waters.
B. dimidiatus (BRYCE)	Pilani	Africa, India, Australia.
B. calyciflorus PALLAS	Pilani, Khetri, Jai- phur, Mt. Abu, Udaipur	Cosmopolitan in alkaline habitats.
B olicatilis MILLER	Pilani	Cosmopolitan
B auadridentatus HERMANN	Khetri	Cosmopolitan in alkaline
D. qualitatilitatilis IID.		waters.
B. diversicornis (DADAY)	Alwar	Europe, Asia, Africa.
Anuraeopsis fissa Gosse	Pilani	Africa, Madagaskar, India.
Keratella tropica (APSTEIN)	Pilani, Khetri Al- war, Mt. Abu, Bi- kaner, Udaipur	North and South America, Asia, Africa, Australia.
K procurya (THORPE)	Pilani, Bikaner	Africa, Ascension island,
		Madagaskar, India, New
		Zealand, Australia, Sumatra
K. edmondsoni (Ahlstrom)	Chirawa	India.
Macrochaetus collinsii (Gosse)	Pilani	N. America, Africa, India.
Mytilina ventralis (EHR.)	Pilani	Africa, Malaya, India,
		North America, Sweden,
<b>T</b> , <b>1 27</b> , <b>21 (3 F</b> )	D'1 '	Australia.
Lepadella patella (MULL.)	Pilani	dia, Ghana, Egypt, Antarc-
		tic.
Lecane papuana (MURRAY)	Pilani	Florida, Guatemala, Egypt,
		New Guinea, India, Fiji.
L. luna (MULLER)	Pilani	Africa, India, Australia.
L. tryphema HARRING & Myers	Pilani	India, N. America.
L. ploenensis (VOIGT)	Pilani	India, N. America.
L. nana (MURRAY)	Pilani	Americas, India.
Monostyla quadridentata EHR.	Pilani	Africa, India, N. America.
M. punctata MURRAY	Pilani	N. America, India, Austra- lia.

SPECIES	OCCURRENCE	DISTRIBUTION
M. hamata STOKES	Khetri, Pilani	Cosmopolitan.
M. bulla Gosse	Khetri, Pilani	Cosmopolitan.
M. closterocerca SCHMARDA	Pilani	Cosmopolitan.
M. paradecipiens sp. nov.	Pilani	India.
Trichocerca similis WIERZEJSKI	Alwar	N. America, India, Sweden, Australia.
Trichocerca stylata (GOSSE)	Jaipur	Sweden, India.
Polyarthra multiappen- diculata Arora	Alwar	India.
Filinia longiseta Ehr.	Pilani	Cosmopolitan.
F. pejleri HUTCHINSON	Alwar, Pilani	India, N. America, S. Afri- ca.
F. opoliensis (ZACHARIAS)	Mt. Abu, Chirawa, Pilani	India, N. America, Austra- lia, Nigeria.
Hexarthra mira (Hudson)	Pilani	N. America, India, Ghana, Australia, Egypt.
Lacinularia flosculosa (Muller)	Khetri	India, America.

## DESCRIPTION OF SPECIES

1. Brachionus rubens EHRENBERG 1838 (Fig. 1).

A large number of them have been found attached to the body of the shrimp *Branchinella kugenumaensis* collected from Khetri Fort. In all the localities the water was turbid at the time of collection.

This species is recorded for the first time from India.

Measurements:	Pilani specimen	Ganganagar specimen
Length of the lorica	$156\mu$	$188\mu$
Maximum width of the lorica	132	152
Width at the occipital margin	92	
Foot orifice	_	44

Variation has been observed in the size of the lorica, nature of the median spines, size and shape of the foot opening and in the ornamentation of the lorica. Some of the specimens collected from Pilani show a Y-shaped median sinus (Fig. 1) where the median spines are well developed and distally bent outwards. The occipital margin is markedly elevated in the specimens from Shivpur than in others. The lorica is smooth in specimens from Ganganagar and Shivpur while heavily stippled in those from Pilani.

2. Brachionus falcatus ZACHARIAS 1898.

They agree well with the description given by AHLSTROM (1940).



Fig. 1. Brachionus rubens dorsal view, from Pilani. Fig. 2. Brachionus caudatus var. aculeatus from Pilani tank. Fig. 3. lateral view of the same. Figs. 4-8 B. angularis The individual in Fig. 5 is from Churu while all the others are from different localities of Pilani. Fig. 9. B. caudatus f. majusculus from Jaipur. Fig. 10. Anterior margin of B. calyciflorus from Khetri in ventral view. Fig. 11. B. diversicornis from Alwar. Fig. 12. Mytilina ventralis in lateral view.

Variation has been noticed in the length of the intermediate spines. Measurements of Khetri specimen:

Theast of the of	
Length of the lorica (middle region)	168µ
Maximum width	188
Anterior lateral spine	28
Intermediate spine	120
Posterior spine	84
-	

This species has been recorded from India by BREHM (1950) and GEORGE (1961).

## 3. Brachionus caudatus BARROIS & DADAY 1894.

Brachionus caudatus var. aculeatus (HAUER) (Fig. 2 & 3).

This variety can be distinguished from others in having an additional spur-like spine on the inner dorsal side of the posterior spine. A pair of posterolateral spines has been observed in all the specimens examined, the size of which varies in different individuals.

Measurements:

Total length	$200\mu$
Maximum width	136
Posterior spines	44
Posterolateral spine	16

This variety has been known earlier only from Sholavaram Lake and Almati Lakes, Madras (India) (AHLSTROM 1940). The present collection is from a concrete tank in Pilani. They were very common in the samples collected during March-April 1963.

## Brachionus caudatus f. majusculus (fig. 9).

They were abundant in the samples collected from a cement cistern at Amer near Jaipur and a single specimen was seen in the sample from a pond at Pilani. The only other report of this form is from Kissimere, Florida (AHLSTROM 1940).

## Brachionus caudatus f. apsteini.

A number of specimens of this form have been collected from a monsoon ditch near Pilani.

Measurements: Total length  $188\mu$ Maximum width 136 Posterior spine 20

## 4. Brachionus forficula WIERZESKI 1891.

A large number of them have been collected from Nakki Lake, Mt.Abu (3800 ft above sea level). This species is recorded for the first time from India.

#### Measurements:

Length of the lorica	$124\mu$
Maximum width of the lorica	124
Lateral occipital spine	40
Median spine	12
Posterior spines	112, 116

5. Brachionus angularis Gosse 1851 (Figs. 4-8).

This is one of the most common forms met with in the samples collected from Pilani and Churu. This species has been earlier reported from India by EDMONDSON & HUTCHINSON (1934) and AHLSTROM (1940).

Measurements of Pilani specimen: Length of the lorica  $120\mu$ Width of the lorica 96

Specimens from different localities and collected during different seasons show variation in their size, nature of the cuticular protuberances flanking the foot opening and in the anterior median spines. In all the specimens the intermediate spines of the occipital margin were completely lacking or very slightly developed. The specimens collected from Churu (fig. 5) have an elongate body, their width being less than 3/4 of the length. The anterior median spines are small and straight with a deep U-shaped sinus in between. The anterior half of the lorica is broader, the posterior half is somewhat triangular and narrows posteriorly. The cuticular protuberances of the foot opening are markedly convergent. The lorica is heavily stippled. The outline of the lorica of the specimens collected from Pilani is somewhat circular (Fig. 7 & 8). The anterior median spines show varying degree of bending towards the middle. The cuticular protuberances of the foot opening are parallel to each other. The lorica is lightly stippled. In the specimens collected from a monsoon ditch in Pilani the median spines are greatly reduced (Fig. 6).

#### 6. Brachionus dimidiatus (BRYCE) 1931.

They have been collected from a cement cistern in a garden at Pilani.

Measurements:Length of the lorica $108\mu$ Width of the lorica76Anterior margin44

## 7. Brachionus calyciflorus PALLAS 1776.

EDMONDSON & HUTCHINSON (1934) reported this species from the Punjab and Kashmir. This species is found to be one of the most variable species collected (NAVAR 1964) and shows cyclomorphosis (NAVAR 1965a). The specimens collected from Khetri and Mt. Abu show a pair of spine like projections one on either side of the deep median sinus of the vental margin. (Fig. 10). 8. Brachionus plicatilis MULLER 1786.

EDMONDSON & HUTCHINSON (1934) reported this species from Ladak and Tibet. The present collection is from a small cement cistern at Pilani.

Measurements:

Length of the	e lorica	196µ
Maximum w	idth of the lorica	164

9. Brachionus quadridentatus HERMANN 1783.

Only one specimen of this species was obtained from the sample collected from Ajit Sagar (Khetri) on 26.10.1963. It measured as follows:

Total length	$200\mu$
Maximum width	108
Occipital margin	80
Occipital spines	24, 20, 40
Posterior lateral spines	60
Cuticular process of the foot	
sheath (right)	40

AHLSTROM (1940) considers *Brachionus longipes* ANDERSON synonymous with *B. quadridentatus*. ANDERSON (1889) described this form from Calcutta and GEORGE (1961) from Delhi.

## 10. Brachionus diversicornis (DADAY) 1883 (Fig. 11).

A few specimens of this species have heen collected from a lake at Jaisamund near Alwar. In all the specimens examined the left posterior spine was considerably shorter than the right. The measurements of the smallest and the biggest specimens obtained are given below.

	Specimen No. 1	No.2
Total length	$140 \mu$	320 µ
Length of the lorica	108	180
Maximum width	60	128
Posterior width	28	48
Anterior spines	6, 22	10, 60
Posterior spines	4, 14	24, 64

## 11. Anuraeopsis fissa Gosse 1851.

The outline and ornamentation of the specimens collected from Pilani agree with the form described by GREEN (1960) collected from the River Sokoto, who identified it as *Anuraeopsis navicula* ROUSSEL- LET. BERZINS (1962) regards it as conspecific to A. fissa coelata BEAUCHAMP. It is a tropical form known from East Africa, Nigeria, Madagaskar and India. The present collection has been made from two localities in Pilani when the temperature was below  $17^{\circ}$ C and pH between 8 and 8.5. In Pilani tank this form constituted 5% of the total rotifers on 11.12.1963 when the pH was 8.1.

## 12. Keratella tropica (APSTEIN) 1907.

This is one of the most common rotifers found to occur in small ditches, ponds and lakes throughout Rajasthan. Earlier this species has been reported from many places in India (EDMONDSON & HUTCHINSON 1934, BREHM 1950, GEORGE 1961, NAYAR 1965b).

## 13. Keratella procurva (THORPE) 1891.

This has been collected from a small pond in Pilani and a concrete tank at Bikaner (NAYAR 1965b).

## 14. Keratella edmondsoni (AHLSTROM) 1943.

This species is known only from Ootacamund (Madras) and Chirawa (Rajasthan). Its diagnosis and measurements are given in my earlier paper (NAYAR 1965b).

#### 15. Macrochaetus collinsii (Gosse).

A number of specimens of this species has been collected from a concrete canal at Pilani. The measurements of one specimen are given below:

Total length	$128\mu$
Length of the lorica	88
Maximum width	88
Anterior margin	44
Posterior margin	48
Claw	20

Macrochaetus serica (THORPE) is the other species of the genus reported from India (ARORA 1965).

## 16. Mytilina ventralis (EHRENBERG) 1832 (Fig. 12).

In all the specimens collected the posterior spines were well developed, ventral one being longer than the dorsal. Lorica heavily stippled especially in the anterior region.

## Measurements:

Total length	208µ
Length of the lorica	180
Width of the lorica	76

The specimens I have collected resemble greatly the unidentified form described by ANDERSON (1889; p. 354 fig. 8). He distinguished them from *M. brevispina* based on their size and considered them an intermediate form between it and *M. macracantha*. Now those two species have been regarded as two distinct varieties of *M. ventralis* (EHRENBERG) (GREEN 1960). The specimens of *M. ventralis* collected by RUSSELL from West Africa (RUSSELL 1956) and Malaya (RUSSELL 1958) have a total length of  $280\mu$  and  $116\mu$  respectively. The specimens from Pilani measured about  $208\mu$ . This reveals the highly variable nature in the size of *M. ventralis*. Therefore, the forms collected by ANDERSON (1889) cannot be regarded as a new species and I consider them along with mine as belonging to *M. ventralis* (EHR.). The specimens collected from Pilani correspond with the form *brevispina*.

## 17. Lepadella patella (MULLER).

This species occurred along with *Mytilina ventralis*. It measured  $87\mu$ . Its anterior dorsal margin is slightly convex or straight, and ventral margin with a V-shaped sinus. Lorica is rounded posteriorly. PEJLER (1962) discussed in detail the wide variation in the shape of the lorica and the foot groove exhibited by this species.

## 18. Lecane luna (MULLER) 1776 (Fig. 13-19).

This species has been collected from a small pond in Pilani

The measurements of two sn	ecimens are	given below:
Total length	168µ	176µ
Length of the ventral plate	140	140
Length of the dorsal plate	124	
Anterior ventral margin	62	56
Width of the ventral plate	116	100
Width of the dorsal plate		104
Toe (including claw)	48	36
Claw	8	—

RUSSELL (1957) suggests that 'the anterior margin appears to be an irreliable specific characteristic for the identification of Lecanes'. He further says that the lorica of *L. luna* is more flexible than generally thought, and that the variation of this species which has been described may be due to the state of contraction of the specimens (RUSSELL 1957 p. 899). The present observations support his findings. The figures 13 to 19 are of many individuals taken from the same sample. All of them are drawn to the same scale. Lecane dorsicalis ARORA very



Figs. 13-19 Lecane luna, all from Pilani. Figs. 20-21 Monostyla paradecipiens sp. nov. Fig. 20 dorsal view and Fig. 21 ventral view. Fig. 22 Lecane tryphema, ventral view Figs. 23-24 Monostyla closterocerca, Fig. 23 ventral view Fig. 24 dorsal view.

much resembles L. luna, especially in the ventral view (Fig. 2b ARORA 1965) and I consider it a form of L. luna.

## 19. Lecane papuana (MURRAY) 1913.

This species occurred along with L. luna. EDMONDSON & HUT-CHINSON (1934) reported this species from Punjab and PASHA (1961) from Madras.

Measurements:	
Total length	$156\mu$
Anterior margin	72
Length of the dorsal plate	116

Length of the ventral plate	124
Maximum width of the lorica	100
Toe	36
Claw	8

RUSSELL (1957) suggested that *L. papuana* can be only a variety of *L. luna* based on some of his studies on the rotifers from Fiji. But the observations I have made do not indicate that *L. papuana* is a variety of *luna*. Although both the species were present in the same sample the anterior ventral margin was characteristic for *L. papuana* and no intermediate stages could be observed. Therefore, I regard them as two distinct species. Moreover, *L. luna* is a cosmopolitan species while *L. papuana* is a tropicopolitan form.

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20. Lecane tryphema HARRING & MYERS 1926 (Fig. 22).

They were common along with the other two species of Lecane.

Measurements:	
Total length	$84\mu$
Length of the ventral plate	64
Width of the dorsal plate	60
Width of the ventral plate	56
Anterior dorsal margin	42
Anterior ventral margin	46
Тое	24

The anterior dorsal margin of the present specimen is nearly straight or slightly convex. In this character it differs from the description given by HARRING & MYERS (1926). But it appears that the difference is attributable to the flexible nature of the anterior margin of the lorica.

21. Lecane ploenensis (VOIGT) 1902.

Measurements:	
Total length	$144\mu$
Length of the dorsal plate	112
Length of the ventral plate	120
Width of the dorsal plate	92
Anterior ventral margin	66
Toe	44

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22. Lecane nana (MURRAY) 1913.

Measurements:	
Total length	$78\mu$
Length of the dorsal plate	52
Length of the ventral plate	60
Width of the dorsal plate	56
Anterior dorsal margin	52
Toe	18

23. Monostyla quadridentata Ehrenberg 1832.

Measurements:	
Length of the dorsal plate	$140\mu$
Length of the ventral plate	160
Width of the dorsal plate	100
Width of the ventral plate	114
Anterior ventral margin	56
Toe	68

Variation has been observed in the anterior median sinus of the dorsal margin. The closeness of the spines varies from 4 to  $16\mu$  in the specimens of the same sample.

This species has been earlier reported from India by ANDERSON (1889), EDMONDSON & HUTCHINSON (1934) and ARORA (1965).

24. Monostyla punctata MURRAY 1923.

This is one of the common species of *Monostyla* collected from Pilani.

Measurements	
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$108\mu$
76
80
30
54
64
28

25. Monostyla hamata STOKES 1896.

They have been collected from a pond at Pilani and Ajit Sagar, Khetri.

Measurements:	
Total length	$112\mu$
Length of the ventral plate	84

Width of the ventral plate	52
Width of the dorsal plate	60
Тое	28

This species has been reported earlier from India by EDMONDSON & HUTCHINSON (1934) and PASHA (1961).

## 26. Monostyla bulla Gosse 1851.

PASHA (1961) reported this species from Madras and ARORA (1965) from Nagpur. The present collection is from a pond in Pilani and Ajit Sagar, Khetri.

$180\mu$
120
84
48
60
20

27. Monostyla closterocerca SCHMARDA 1859 (Fig. 23 & 24).

A single specimen of this species was obtained from the sample collected from Pilani. It measured as follows:

Total length	$104\mu$
Length of the dorsal plate	72
Length of the ventral plate	80
Width of the dorsal plate	72
Width of the ventral plate	60
Anterior margin	40
Toe	24

The present specimen differs from the description given by HARRING & MYERS (1926) in two characters. The anterior margin of the dorsal plate is not coincident with that of the ventral plate. The toe is relatively short.

## 28. Monostyla paradecipiens sp. nov. (Fig. 20 & 21).

The outline of the lorica is broadly ovate, its width being about three fifth of the length. Anterior margins coincident except in the middle region. The ventral plate has a very deep sinus, rounded posteriorly and is with a slight lateral cusp on either side. Anterior dorsal margin shallower. The dorsal plate is broadly ovate its maximum width being in the middle region. The ventral plate is narrow and ovate. The first foot joint is distinct, the second robust projecting a little beyond the posterior segment. The toe is long and slender, parallel sided terminating in a claw with basal spicules.

This form has been collected from a concrete canal in Pilani.

Measurements:	
Length of the lorica	$144\mu$
Maximum width	88
Anterior ventral margin	56
Тое	64
Claw	16

Although the present form resembles *Monostyla decipiens* MURRAY and *M. thalera* HARRING & MYERS it differs from them in a few characters. The difference from *M. decipiens* is in the presence of shallower anterior dorsal margin and the presence of basal spicules. *M. thalera* differs from the present form in having a subrhomboidal dorsal plate and a spindle shaped toe which is enlarged near the middle.

#### 29. Trichocerca similis (WIERZEJSKI).

This species was common in the plankton samples collected from Alwar. They could be easily distinguished by their slender body and nature of the anterior teeth.

Measurements:

Total length	232µ
Body length	160
Longer toe	44

#### 30. Trichocerca stylata (GOSSE).

A few specimens of this species have been collected from Amer near Jaipur. In general form and size they resemble the form described by PEJLER (1957b) from the pond Svandammen, Uppsala.

#### Measurements:

Length of the body	$84\mu$
Width in the middle	40
Longest toe	40

## 31. Polyarthra multiappendiculata ARORA 1963.

In general, the specimens collected from Alwar agree with the description given by ARORA (1963a). The length of the filiform appendages has been found to vary; sometimes they were about

double the length of the sword-shaped appendages. Of the six filiform appendages on each side 3 are stouter than others. ARORA (1963a) has described this species from Nagpur.

Measurements:	
Length of the body	<b>96</b> μ
Length of the sword shaped appendages	68
Length of the filiform appendages	96
Width of the body	68
Maximum body size measured	108

## 32. Filinia longiseta (EHRENBERG).

This is one of the most common limnetic rotifers found in the samples from Pilani. The posterior seta is ventral or subterminal in position.

Measurements:

Length of the lorica $176\mu$ Width in the middle108Anterior seta420

33. Filinia pejleri HUTCHINSON 1964.

('Filinia terminalis' (PLATE) EDMONDSON & HUTCHINSON 1934). The fact that PLATE (1886) has not given any illustration for his Filinia terminalis has brought much confusion regarding its identification. EDMONDSON & HUTCHINSON (1934) collected 2 species of Filinia from Ootacamund Lake. One of them was F. longiseta EHR. and the other was identified as 'F. terminalis' (PLATE) on the basis of its 'small spindle shaped body' and terminal seta. PEJLER (1957a) is of the opinion that all forms with terminal posterior process which have been figured have a broad body; the form of EDMONDSON & HUTCHINSON being the only exception. He suggests that only those specimens of Filinia with broad body should be called F. terminalis and he considers F. maior (COLDITZ) as a synonym of F. terminalis (PEJLER 1957a) while 'F. terminalis' of EDMONDSON & HUTCHINSON is representing a new form. Agreeing with this, HUTCHINSON (1964) described it as a new species and named it Filinia pejleri.

A few specimens of *Filinia* collected from Pilani and Alwar are comparable to '*F. terminalis*' of EDMONDSON & HUTCHINSON (1934). They are identified as *F. pejleri* based on the diagnosis given by HUTCHINSON (1964). But the present specimens are smaller than any known *pejleri* and have proportionately a broader body.

	Length of body	Dorsoventral depth	$\frac{\text{Length}}{\text{Depth}}$	Anterior appendages	Posterior appendages
Pilani Alwar	$\frac{116\mu}{108}$	56µ 48	2.07 2.25	240, 280μ 236, 244	$\frac{200\mu}{140}$

#### 34. Filinia opoliensis (ZACHARIAS 1898).

They were present in the samples from Mt. Abu, Pilani and Chirawa. ARORA (1962) reported this species from Nagpur.

Measurements:

Total length	$400\mu$
Length of the body	192
Width at the anterior end	52
Maximum width	76
Posterior spines	208, 30

#### 35. Hexarthra mira (HUDSON).

Quite a good number of this species have been collected from Pilani.

## 36. Lacinularia flosculosa (MULLER) 1773.

This species, collected from Ajit Sagar (Khetri), agrees with the description given by ARORA (1963) who reported this from Nagpur.

#### SUMMARY

Thirty six species of rotifers have been reported from Rajasthan including a new species of *Monostyla*. Lecane dorsicalis ARORA (1965) is regarded as a synonym of L. luna (MULLER) 1776.

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