



## MORPHOLOGICAL CHARACTERIZATION AND ABUNDANCE OF *MELANOIDES TUBERCULATA* FROM MAJOR MARKETS IN MAKURDI, BENUE STATE, NIGERIA

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### ABSTRACT

Freshwater snail (*Melanoides tuberculata*) samples were purchased from five major markets (Modern, Wadata, Rail way, Wurukum and North bank markets) in Makurdi, Benue State, Nigeria for four months. The morphometric measurements of the shell were taken with the help of a venial caliper in millimeters (mm). The weight of the snail flesh and its shell were measured in grams using an electronic weighing balance. Total length of the snail shell, large diameter, spire height, shell height and opening width were measured using a pair of compass and placed on a meter rule and readings were taken in consideration. The number of whorls on each snail was counted with the help of naked eyes and recorded. Statistically no significant difference ( $p < 0.05$ ) existed among the body parameters of the snail (*Melanoides tuberculata*). The highest percentage *M. tuberculata* (36.89%) was recorded in the month of October, 2016 while the lowest (14.29%) was recorded in the month of November, 2016. The highest percentage *M. tuberculata* (31.90%) was recorded in Wadata market, Makurdi, Benue State, Nigeria while the lowest (12.89%) was recorded in North bank market Makurdi, Benue State, Nigeria.

**KEYS:** Morphological characterization, *Melanoides tuberculata*, Markets, Benue, Nigeria.

### INTRODUCTION

Snail is a member of the phylum Mollusca. The snail's general features include a soft body with a hard calcium carbonate shell. In addition, the body is coated by a thin tissue called the mantle which secretes the shell (Castro and Huber, 2003). Snails are an important food source for fishes and are eaten in abundance by waterfowl. They act as primary consumers eating diatoms, algae and plants and thus are important aspects of aquatic primary production. Many snails are also nonspecific feeders acting as detritivores (Dillon, 2000).

*Melanoides tuberculata* is a tropical freshwater gastropod, native to eastern Africa and the Middle East, which has established widely throughout the tropics. It has been demonstrated that it can rapidly colonize many types of habitat. *Melanoides tuberculata* is a ubiquitous species and can tolerate a broad spectrum of environmental conditions. It is able to colonize disturbed habitats (especially man-made habitats) such as garden ponds, artificial lakes and irrigation systems. Reproduction is mainly by parthenogenesis but sexual reproduction

does occur, with a resulting increase in genetic variance and/or heterosis effect (Facon *et al.*, 2005). These recombination events can produce new genotypes that may invigorate the invasive ability (Facon *et al.*, 2008). In its introduced range, there are reports of *M. tuberculata* outcompeting native species, however, the consequences are not always negative.

Several studies have been conducted on the fauna of *M. tuberculata* with focus on its trematode infections, not only in Asia but also Africa and Australia but not much has been done on its morphological characterization, abundance and distribution, length weight relationship and condition factor. Owing to the economic importance of *M. tuberculata* as a source of income and its medical significance in the lives of its consumers and the dearth of information on aspects of biology of *M. tuberculata* in Benue state and Nigeria at large, this study aimed at providing base line information on some aspects of the biology of *M. tuberculata* that is considered to be

of economic and medical significance, and this will also help in its management.

## MATERIALS AND METHODS

### Study sites, collection and identification of *M. tuberculata* samples

Monthly samples of freshwater snail (*M. tuberculata*) were collected from five major markets (Modern, Wadata, Rail way, Wurukum and North bank markets) in makurdi, Benue State, Nigeria for a period of four months. In the laboratory, samples of *M. tuberculata* were counted and identified with the help of standard keys by Léo Neto (2009), key and catalogue like "Handbook of freshwater mollusks ( Ramakrishna and Key, 2007).

### Morphometric analysis of *M. tuberculata*

The morphometric measurements of the shell were taken with the help of a venial caliper in millimeters (mm). The weight of the snail flesh and its shell were measured in grams using an electronic weighing balance. Total length of the snail shell, large diameter, spire height, shell height and opening width were measured using a pair of compass and placed on a meter rule and readings were taken in consideration. The number of whorls on each snail was counted with the help of naked eyes and recorded.

## RESULTS

Results of the mean morphometric analysis of obtained *M. tuberculata* from the five major markets in Makurdi, Benue State from September 2016 to December 2016 are presented in Table 1a, b, c and d, respectively.

In the month of September, the highest mean total weight (73.58±5.25), weight of flesh (44.58±2.37), shell height (9.24±0.53), large diameter (5.65±0.44), spire height (4.91±0.21), peristome height (0.57±0.05) and weight of shell (32.72±2.72) of *M. tuberculata* were recorded for Modern market while the lowest (24.70±5.15, 10.82±2.81, 4.78±0.13, 1.84±0.17, 1.76±0.33, 0.20±0.01, 10.72±2.35) were recorded for railway market. Also, lowest mean spire height was recorded for Wurukum market. Mean number of whorls was highest in Rail way market (6.95±0.28) but lowest in North bank market, though there was no significant difference ( $p < 0.05$ ).

In the month of October, the highest mean total weight (63.53±3.29), weight of flesh (40.07±2.29), shell height (8.21±0.22), large diameter (6.04±0.95), spire height (4.73±0.15<sup>b</sup>), opening width (3.03±0.07), peristome height (0.37±0.02) and weight of shell (27.54±1.65) of *M. tuberculata* were recorded for

North bank market while the lowest was recorded for railway market (35.87±4.89, 20.04±2.87, 6.44±0.19, 2.76±0.12, 1.85±0.14, 0.29±0.02 and 15.28±2.14 ) were recorded for Modern market with the exception of mean number of whorls which was highest in Wurukum market (8.47±0.39) but lowest in Railway market (6.16±0.15). Mean spire height was highest in North bank market (4.73±0.15<sup>1</sup>) but lowest (6.16±0.15) in Railway market though there was no significant difference ( $p < 0.05$ ).

In the month of November, the highest mean total weight (62.25±3.25), weight of flesh (31.84±2.02<sup>b</sup>) and shell height (7.74±0.07) were recorded for North bank market with the corresponding lowest mean total weight, weight of flesh and shell height of 34.55±4.30, 17.87±2.96 and 5.10±0.09, respectively being recorded for Wadata market. Highest weight of shell with its corresponding lowest value were recorded for North bank and Wadata markets while highest mean number of whorls ay and Wurukum markets, respectively.(7.62±0.22) with its lowest mean value were recorded for Rail. Highest mean large diameter (4.19±0.12), opening width (3.07±0.07) and Peristome height were recorded Wuerukum market with the corresponding lowest mean of 2.96±0.23, 2.09±0.13 and 14. 67±1.82, respectively, being recorded for Wadata market. The highest mean spire height (4.49±0.15) with the corresponding lowest mean value (3.39±0.14) was recorded for Railway and Wadata markets, respectively. No significant difference ( $p < 0.05$ ) existed among the parameters. No *M. tuberculata* was found in Modern market in the month of November, 2016

In the month of December, the highest mean total weight (65.78±2.54), weight of flesh (41.06±2.08), shell height (8.26±0.31), large diameter (6.27±0.01), opening width (3.10±0.07) spire height (4.86±0.15<sup>b</sup>), peristome height (0.42±0.02) and weight of shell (27.72±1.48) of *M. tuberculata* were recorded for North bank market with the corresponding lowest mean total weight (33.20±3.84) and weight of flesh (19.67±2.56) in Wurukum market, respectively. The lowest mean shell height (5.31±0.51), large diameter (2.06±0.51), opening width (1.15±0.15) spire height (4.11±0.35) and peristome height (0.18±0.01) were recorded for Modern market while the lowest mean weight of shell (15.44±1.54) and number of whorls (8.63±0.30) were recorded for Railway market. No significant difference existed among these measured and non-measured characters.

Table 1a: Mean morphometric analysis of collected *M. tuberculata* from the five major markets in Makurdi, Benue State in September, 2016

Parameters	Markets				
	NBMKT	WUMKT	WDMKT	RWMKT	MDMKT
TW	60.40±2.56 <sup>cd</sup>	43.93±4.82 <sup>b</sup>	55.20±4.07 <sup>bc</sup>	24.70±5.15 <sup>a</sup>	73.58±5.25 <sup>d</sup>
WF	36.80±1.60 <sup>cd</sup>	25.07±2.79 <sup>b</sup>	31.00±2.27 <sup>b</sup>	10.82±2.81 <sup>a</sup>	44.58±2.37 <sup>d</sup>
H	8.59±0.26 <sup>c</sup>	6.45±0.16 <sup>b</sup>	6.46±0.19 <sup>b</sup>	4.78±0.13 <sup>a</sup>	9.24±0.53 <sup>c</sup>
LD	4.86±0.20 <sup>d</sup>	4.17±0.19 <sup>c</sup>	3.43±0.15 <sup>b</sup>	1.84±0.17 <sup>a</sup>	5.65±0.44 <sup>e</sup>
DW	3.20±0.11 <sup>a</sup>	2.56±0.30 <sup>b</sup>	2.48±0.12 <sup>ab</sup>	1.76±0.33 <sup>a</sup>	3.13±0.20 <sup>b</sup>
SH	4.25±0.13 <sup>b</sup>	3.57±0.12 <sup>a</sup>	3.76±0.11 <sup>a</sup>	3.39±0.12 <sup>a</sup>	4.91±0.21 <sup>c</sup>
PE	0.54±0.03 <sup>d</sup>	0.12±0.12 <sup>b</sup>	0.39±0.02 <sup>c</sup>	0.20±0.01 <sup>a</sup>	0.57±0.05 <sup>d</sup>
WS	27.60±1.60 <sup>a</sup>	18.08±1.75 <sup>b</sup>	22.07±1.76 <sup>b</sup>	10.72±2.35 <sup>a</sup>	32.72±2.72 <sup>d</sup>
NOW	5.85±0.17 <sup>A</sup>	6.89±0.24 <sup>c</sup>	5.91±0.23 <sup>a</sup>	6.95±0.28 <sup>c</sup>	6.61±0.21 <sup>ab</sup>

Mean in the same column with different superscript differ significantly (p>0.05)

Table 1b: Mean morphometric analysis of collected *M. tuberculata* from the five major markets in Makurdi, Benue State in October, 2016

Parameters	Markets				
	NBMKT	WUMKT	WDMKT	RWMKT	MDMKT
TW	63.53±3.29 <sup>c</sup>	42.76±5.68 <sup>ab</sup>	47.65±3.80 <sup>bc</sup>	54.97±2.32 <sup>bc</sup>	35.87±4.89 <sup>a</sup>
WF	40.07±2.29 <sup>c</sup>	25.15±3.09 <sup>ab</sup>	27.76±2.24 <sup>b</sup>	30.71±1.65 <sup>b</sup>	20.04±2.87 <sup>a</sup>
H	8.21±0.22 <sup>c</sup>	7.41±0.22 <sup>b</sup>	6.70±0.16 <sup>a</sup>	7.33±0.18 <sup>b</sup>	6.44±0.19 <sup>a</sup>
LD	6.04±0.95 <sup>d</sup>	3.77±0.14 <sup>b</sup>	3.95±0.17 <sup>b</sup>	4.71±0.10 <sup>c</sup>	2.76±0.12 <sup>a</sup>
OW	3.03±0.07 <sup>c</sup>	2.13±0.31 <sup>a</sup>	2.22±0.19 <sup>ab</sup>	2.80±0.08 <sup>bc</sup>	1.85±0.14 <sup>a</sup>
SH	4.73±0.15 <sup>b</sup>	4.71±0.11 <sup>b</sup>	4.55±0.09 <sup>b</sup>	3.73±0.01 <sup>a</sup>	3.81±0.11 <sup>a</sup>
PE	0.37±0.02 <sup>b</sup>	0.30±0.03 <sup>a</sup>	0.30±0.02 <sup>a</sup>	0.37±0.01 <sup>b</sup>	0.29±0.02 <sup>a</sup>
WS	27.54±1.65 <sup>c</sup>	20.22±2.54 <sup>ab</sup>	19.48±1.67 <sup>ab</sup>	25.29±1.15 <sup>bc</sup>	15.28±2.14 <sup>a</sup>
NOW	6.95±0.11 <sup>b</sup>	8.47±0.39 <sup>d</sup>	7.02±0.19 <sup>b</sup>	6.16±0.15 <sup>a</sup>	7.80±0.29 <sup>c</sup>

Mean in the same column with different superscript differ significantly (p>0.05)

**NOTE:**

TW = Total weight of the *M. tuberculata*, WF = weight of flesh of *M. tuberculata*, H = shell height *M. tuberculata*, LD = large diameter of *M. tuberculata*, OW = opening width *M. tuberculata*, SH = spire height *M. tuberculata*, pe = peristome height of *M. tuberculata*, WS = weight of shell of *M. tuberculata* and NOW = number of whorls *M. tuberculata*.

NBMKT = North Bank Market, WUMKT = Wurukum Market, WDMKT = Wadata Market, RWMKT = Railway Market, MDMKT = Modern Market.

Table 1c: Mean morpholmetric analysis of collected *M. tuberculata* from the five major markets in Makurdi, Benue State in November, 2016

Parameters	Markets			
	NBMKT	WUMKT	WDMKT	RWMKT
TW	62.25±3.25 <sup>b</sup>	55.99±2.57 <sup>b</sup>	34.55±4.30 <sup>a</sup>	50.34±4.69 <sup>ab</sup>
WF	31.84±2.02 <sup>b</sup>	31.58±1.91 <sup>b</sup>	17.87±2.96 <sup>a</sup>	28.89±2.84 <sup>b</sup>
H	7.74±0.07 <sup>b</sup>	6.78±0.31 <sup>b</sup>	5.10±0.09 <sup>a</sup>	7.66±0.38 <sup>b</sup>
LD	3.86±0.09 <sup>ab</sup>	4.19±0.12 <sup>b</sup>	2.96±0.23 <sup>a</sup>	3.89±0.34 <sup>ab</sup>
OW	2.92±0.08 <sup>b</sup>	3.07±0.07 <sup>b</sup>	2.09±0.13 <sup>a</sup>	2.34±0.15 <sup>b</sup>
SH	4.34±0.07 <sup>b</sup>	3.95±0.16 <sup>ab</sup>	3.39±0.14 <sup>a</sup>	4.49±0.15 <sup>b</sup>
PE	0.38±0.02 <sup>bc</sup>	0.40±0.02 <sup>c</sup>	0.20±0.02 <sup>a</sup>	0.33±0.02 <sup>ac</sup>
WS	28.64±2.51 <sup>b</sup>	22.42±1.43 <sup>ab</sup>	14.67±1.82 <sup>a</sup>	22.41±2.28 <sup>ab</sup>
NOW	6.22±0.22 <sup>a</sup>	5.89±1.16 <sup>a</sup>	7.23±0.34 <sup>b</sup>	7.62±0.22 <sup>b</sup>

Mean in the same column with different superscript differ significantly (p>0.05)

Table 1d: Mean morpholmetric analysis of collected *M. tuberculata* from the five major markets in Makurdi, Benue State in December, 2016

Parameters	Markets				
	NBMKT	WUMKT	WDMKT	RWMKT	MDMKT
TW	65.78±2.54 <sup>c</sup>	33.20±3.84 <sup>a</sup>	58.16±3.42 <sup>bc</sup>	34.61±3.63 <sup>a</sup>	48.98±12.97 <sup>b</sup>
WF	41.06±2.08 <sup>c</sup>	19.67±2.56 <sup>a</sup>	34.57±1.19 <sup>b</sup>	20.15±2.42 <sup>a</sup>	29.09±7.02 <sup>b</sup>
H	8.26±0.31 <sup>d</sup>	7.07±0.08 <sup>c</sup>	8.01±0.18 <sup>d</sup>	6.27±0.08 <sup>b</sup>	5.31±0.51 <sup>a</sup>
LD	6.27±0.01 <sup>d</sup>	4.55±0.22 <sup>c</sup>	4.57±0.13 <sup>c</sup>	3.78±0.20 <sup>b</sup>	2.06±0.51 <sup>ab</sup>
OW	3.10±0.07 <sup>c</sup>	1.94±0.12 <sup>b</sup>	2.67±0.12 <sup>c</sup>	2.04±0.12 <sup>b</sup>	1.15±0.15 <sup>a</sup>
SH	4.86±0.15 <sup>bc</sup>	4.41±0.14 <sup>ab</sup>	4.95±0.10 <sup>c</sup>	4.52±0.12 <sup>abc</sup>	4.11±0.35 <sup>a</sup>
PE	0.42±0.02 <sup>c</sup>	0.24±0.01 <sup>ab</sup>	0.36±0.02 <sup>c</sup>	0.26±0.02 <sup>b</sup>	0.18±0.01 <sup>a</sup>
WS	27.72±1.48 <sup>b</sup>	16.54±1.68 <sup>a</sup>	25.18±1.66 <sup>b</sup>	15.44±1.54 <sup>a</sup>	22.05±6.13 <sup>ab</sup>
NOW	6.89±0.15 <sup>a</sup>	8.77±0.35 <sup>c</sup>	7.53±0.21 <sup>ab</sup>	8.63±0.30 <sup>c</sup>	8.45±0.72 <sup>bc</sup>

Mean in the same column with different superscript differ significantly (p>0.05)

Results of the percentage abundance of *M. tuberculata* collected during the study period (September to December, 2016) are presented in Figure 1 While results of the percentage abundance of *M. tuberculata* collected from the five major markets in Benue State Nigeria are presented in Figure 2. The highest percentage *M. tuberculata* (36.89%) was recorded in the month of October,

2016 while the lowest (14.29%) was recorded in the month of November, 2016 (Figure 1).

The highest percentage *M. tuberculata* (31.90%) was recorded in Wadata market, Makurdi, Benue State, Nigeria while the lowest (12.89%) was recorded in North bank market Makurdi, Benue State, Nigeria.

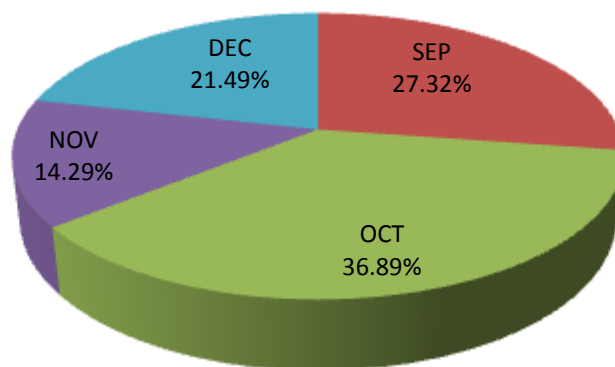


Figure 1: Percentage abundance of *M. tuberculata* during the study period (September to December, 2016) in Makurdi, Benue State Nigeria

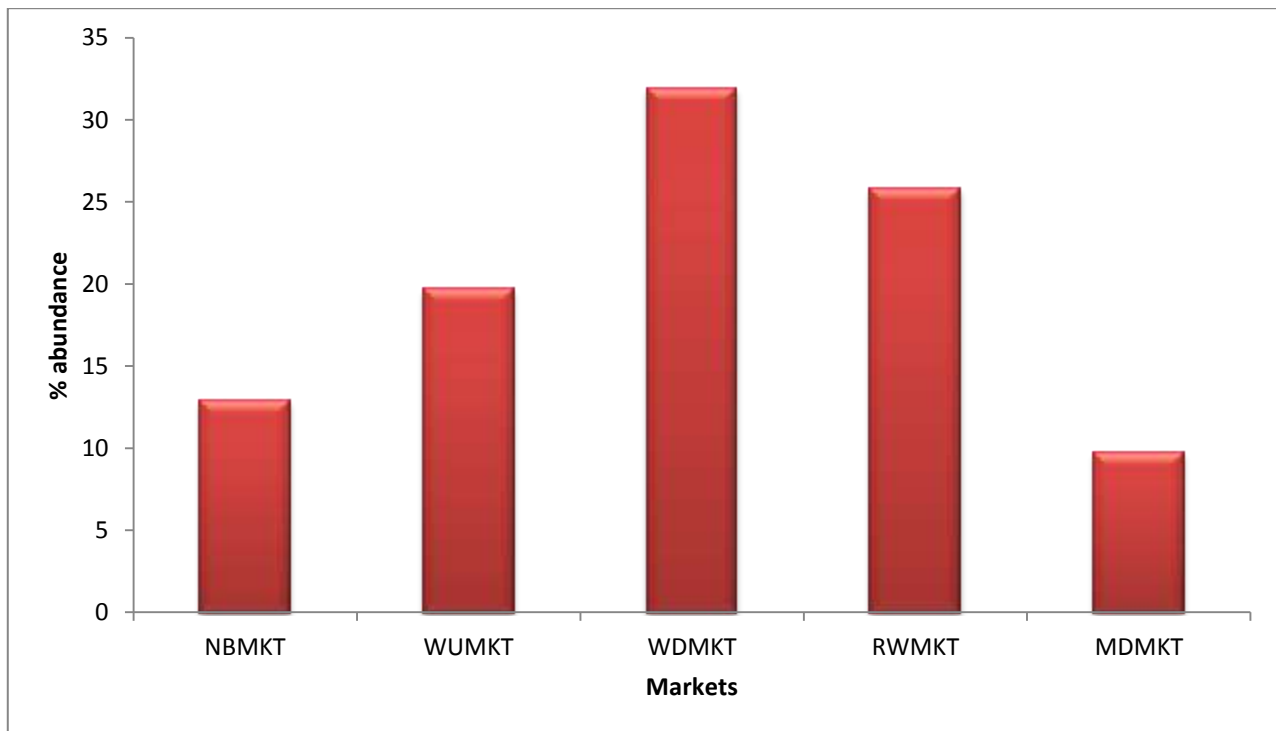


Figure 2: Percentage abundance of *M. tuberculata* from the five major markets in Makurdi, Benue State Nigeria

## DISCUSSION

In consonance with the findings made in the present work, Hussein *et al.*, (2011) recorded 13 freshwater snail species (9 families) from Qena Governorate, Upper Egypt among which was *M. tuberculata*. Supian and Ikhwanuddin (2002) reported that *M. tuberculata* is the commonest and most wide-ranging member of the family Thiaridae, found in almost any kind of freshwater. Peak in the population of *M. tuberculata* recorded during October, 2016 in the present work is in agreement with Hussein *et al.*, (2011) who reported that this species showed a maximum cohort of small-sized individuals in October, 2009 and Supian and Ikhwanuddin (2002) who reported that *M. tuberculata* is the commonest and most wide-ranging member of the family Thiaridae, found in almost any kind of freshwater. According to Pointier *et al.*, (1993), maximum reproduction of this species took place between in June and November in France. Flores and Zaffaralla (2012) also cited Thiaridae as the most persistent and abundant macroinvertebrate family. Contreras-Arquieta (1998) reported that members of Thiaridae are quick colonizers, tolerant to habitat diversity and variability due to a very strong and thick shell; many forms are parthenogenetic females capable of multiplication in a short time, viviparous, operculate and have average longevity of five years.

The highest percentage *M. tuberculata* recorded in October, 2016 in Makurdi, Benue State, Nigeria also corresponds with reported work of Diab (1993) who reported higher snail abundance in rainy season and low in dry season in Beheira Province. The presently recorded low percentage *M. tuberculata* in the month of November agrees with El-Kady *et al.*, (2000) who also recorded lowest number of snails during the months of dry season (January and February) in Sinai Peninsula. Strzelec and Królczyk (2004) indicated that many gastropod species are tolerant to most physico-chemical parameters and their occurrence is affected by the quality of bottom sediments and abundance of vegetation and reported that the most suitable substrate for snails in rivers is a sandy bottom covered with thin layer of organic silt. Vincent *et al.*, (1982) suggested that gastropod variability may be explained by

The abundance of *M. tuberculata* from the freshwater bodies of Benue State, Nigeria could be attributed to the favoured environmental conditions prevailing in the water bodies including abiotic and biotic components. Garg *et al.*, (2009) also attributed the richness of molluscs observed in Ramsagar dam to the cumulative effect of alkaline nature of water, high calcium contents and the presence of macrophytic vegetation.

## CONCLUSION

Freshwater molluscs play a massive role in nature and help in the assessment of ecological status of the water bodies. Being herbivores, they form the lower strata of aquatic trophic linkages and perform many other ecological activities. Hence, studies concerning their diversity, distribution and ecology become imperative. The results of the present study indicated that *M. tuberculata* were most available in October. This species can be considered as

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- bioindicators of pollution as it was found to respond prominently to nutrient inputs, discharge of sewage and excreta produced by animals and humans. Findings of the present work shall be utilized by future researchers and ecologists as supplementary information in public and veterinary health sciences, ecotoxicology, water quality assessment and river management studies.
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