Post-embryonic development of the K-strategic nematode *Talanema baqrii* (Khan, Jairajpuri and Ahmad 1989) Imran Abolafia and Ahmad, 2021: an analysis of structural evolution and stability

Zarrin Imran, Wasim Ahmad

Nematode Biodiversity Research Laboratory, Department of Zoology, Aligarh Muslim University, Aligarh, India

Abstract: Dorylaims are k-strategist, have slow growth rate, significant taxonomic diversity and play key role in soil-food webs. Their post-embryonic development has rarely been documented and that too mainly with reference to odontostyle development. Temporal sampling of cattle manure for two years from green house yielded abundant population of *Labronema baqrii* representing both adult and all juvenile stages. Here we present the morphological and morphometric data of ninety six juveniles and forty adult specimens which are useful in determining the adaptive change, evolution, reliability and stability of weighted taxonomic characters. Juveniles of *L. baqrii* exhibit a continuum of character development. Changes were observed in the nature of the guiding ring; *i.e* single to double, increase in the robustness of odontostyle, increase in percentage of expanded part of pharynx, shift in DN and S1N1 and a posterior shift in primordial midpoint position from J1→J4 to adult which represents evolutionary modification in the weighted taxonomic character rather than the developmental plasticity. In absence of fossil records their developmental study helps in understanding the successional change (from J1→J4 to adult) in their structure.

Introduction: Nematode exhibit great diversity in spite of having a conserved body plan with a cylindrical body . They acquire diverse morphological combinations which are important in species identification. k-strategic dorylaims with long generation time are considered as sentinels of climatic variation due to their prompt response to environmental changes and difficult to maintain in laboratory conditions, which make their complete developmental study challenging (Bongers 1990). The post-embryonic development of dorylaims has rarely been documented, however it can make the comparative study and serial changes in traits of functional morphology of extant and fossil nematodes more sound (Poinar 2011). Poinar et al. (2008) demonstrates the similarity in the body organization of 450 million year old fossilized nematodes with their extant descendants. In absence of fossil records of dorylaims study of morphological and morphometric variations are of great significance for studying the processes underlying evolutionary radiation and in determining the reliability and stability of taxonomic characters (Cai et al. 2020). Thus, in present study we choose *Talanema baqrii* Imran et al. 2021 a nematodes of the order Dorylaimida for studying the complete post embryonic development pattern in this group. Herein, morphological and morphometric variation documented for the examined populations and variation as well as stability of characters in relation to post-embryonic development was interpreted in the context of evolutionary relationships.

Materials and methods:

1. Sample collection: The study was conducted in Aligarh, having humid subtropical climate, with a total precipitation of about 802 mm and average temperature between 34 ℃ in summer to 11 ℃ in winter. Composite samples from a cattle manure heap were collected for two years, from the green house of the Department of Zoology, Aligarh Muslim University, Aligarh, Uttar Pradesh, India (27.907197° N 78.075412° E). For study, specimens were chosen as to reflect the maximum morphological diversity as well as all the possible successional changes in juveniles.

2. Nematode extraction and mounting Done by standard methods (Cobb's 1918; Seinhorst 1959; de Maeseneer and d'Herde 1963).

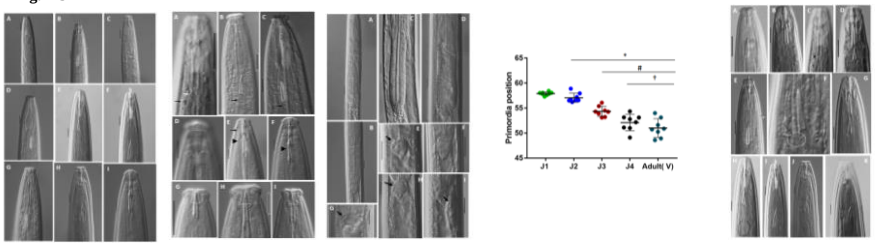
3. Statistical analysis was conducted by one-way ANOVA followed by post-hoc Twkey test using the program SPSS 16.0 and origin 6.1, p was considered significant below 0.05. Graph pad prism 7.1 used to make scatter plot graphs.

Results:

***Variability in the morphology of juveniles* (Figures 1-5)**

The study of post embryonic development of *T. baqrii* revealed significant variation in the morphology of lip region, lip region diameter and height; shape and length of the odontostyle and odontophore; nature of the guiding ring; pharynx; primordial length and position, and the morphology of caudal region during successive stages. The variation in juvenile and adult stages are important for the taxonomic study of this group in particular and other related genera in general. This study also accentuates the stability and extent of variability of the important taxonomic characters during postembryonic development.

Fig. 1-5



Morphometric ratios of juveniles

	J1	J2	J3	J4	Adult	Adult♀	Adult♂	F	P
odontostyle (length×100/body)	2.27 ± 0.23^{a}	2.26 ± 0.22^{ab}	2.02 ± 0. 19^{b}	1.76 ± 0.08^{c}	1.54±0.14^{c}	-	-	27.41	0.0001
odontostyle (length /width)	9.51 ± 0.51^{b}	8.96 ± 0.54^{ab}	8.13 ± 0.24^{a}	8.1 ± 0.73^{ab}	7.4±0.53^{b}	-	-	5.331	0.001
odontostyle (apertutre/ length)	21.27 ± 1.05^{d}	27.7 ± 1.68^{c}	29.88 ± 1.92^{c}	32.76 ± 1.31^{b}	36.32±2.47^{a}	-	-	72.40	0.0001
odontostyle (length/lip width)	1.01±0.03^{c}	1.09±0.07^{bc}	1.14±0.11^{b}	1.29±0.06^{a}	1.37±0.07^{a}	-	-	35.54	0.0001
functional/ replacement	0.78±0.02^{b}	0.79±0.01^{b}	0.81±0.06^{b}	0.91±0.02^{a}	-	-	-	16.58	0.0001
a	19.7±1.45^{d}	22.87±1.79^{c}	23.8±0.89^{bc}	25.92±1.9^{a}	25.67±2.04^{ab}	-	-	25.74	0.0001
b	2.78 ± 0.13^{d}	3.04 ± 0.14^{c}	3.43 ± 0.14^{b}	3.67 ± 0.22^{b}	4.39±0.31^{a}	-	-	91.73	0.0001
c	17.53 ± 0.97^{a}	23.37 ± 3.2^{d}	31.13 ± 1.20^{c}	39.19 ± 3.01^{b}	-	51.74±5.64^{a}	54.75±4.12^{a}	191.7	0.0001
c'	1.82 ± 0.09^{a}	1.50 ± 0.16^{c}	1.200 ± 0.09^{b}	1.06 ± 0.08^{bc}	-	1.05±0.06^{bc}	0.77±0.08^{c}	160.8	0.0001

Discussion and conclusion: In the present study on the morphological and morphometry variations in *T. baqrii*, and the statistical analysis of the data in adults did not reveal any significant variation in most of its taxonomic characters although large number of specimens were studied. However, minor variations were observed in shape and size of cardia, dorsal cellular mass, uterine egg number, genital branch length and tail shape. The morphology of lip region, odontostyle, guiding ring, pharynx and tail shape of fourth stage juveniles resembles most with the adults though first stage juveniles showed distinctly perceptible variation. Our understanding of nematode diversity in the context of post embryonic development is very limited and further detailed studies are certainly needed to generate a relevant data of the notable ontogenic changes for the elucidation of evolutionary relationship.

References: Cai R, Prior T, Lawson B, Cantalapiedra-Navarrete C, Palomares-Rius EJ, Castillo P, Archidona-Yuste A. 2020. An integrative taxonomic study of the needle nematode complex *Longidorus goodeyi* Hooper, 1961 (Nematoda: Longidoridae) with description of a new species. Eur J Plant Pathol. 1-23. https://doi.org/10.1007/s10658-020-02055-0

Imran Z. Abolafia J. Ahmad W. 2021. Taxonomic studies on *Talanema* Andrássy, 1991 and elucidating relationship of *Labronema-Talanema* species complex based on molecular and morphological studies. Zoologischer Anzeiger 291:103-113. https://doi.org/10.1016/j.jcz.2021.02.003