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SYSTEMATIC STUDIES ON A NEW SPECIES OF CESTODE PARASITE OF GENUS *MONIEZIA* (BLANCHARD 1891) OF *OVIS BHARAL*

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ABSTRACT

The most important anoplocephalan genus that infests domestic animals is *Moniezia*. *Moniezia* a genus of tapeworms that are parasitic in mammals, including sheep, goat and cattle.Present investigation deals with systematic observation of new species of the genus *Moniezia* (Blanchard 1891) *khultabadensis* collected from intestine of *Ovis bharal* at Khultabad Dist. Aurangabad M.S. India. It differs from all known species of the genus due to simple scolex, medium and distinctly marked off from the strobila, squarish in shape with four large suckers; neck medium, wide, broad anteriorly and narrow posteriorly; mature segment broader; double set of reproductive organ; testes small, 145-150 in numbers; cirrus pouch medium, oval; thin cirrus, short, curved, coiled contained within the cirrus pouch. Similarly found that the vas deferens was thin, long, slightly curved; ovary small, bilobed, ootype small and oval. Post ovarian vitelline gland which is oval in shape. Genital pores were large, oval in shape; and inter proglottidal gland was small and oval.

Keywords: *Cestode, Khultabad, Moniezia, Ovis bharal, Systematic Study*

INTRODUCTION

Adult tapeworms parasitic in domestic herbivorous animals, exclusively belong to family Anoplocephalidae and are common in many countries. Yamaguti (1959) has recognized 23 species under

seven genera in these hosts. Anoplocephaline cestodes have been conclusively shown to adversely affect the growth, production and resistance of the animals. The genus *Moniezia* was established by Blanchard, 1891. Skrjabin and Schulz (1937) divided this genus in to three subgenera as follows:

1] Inter proglottid glands grouped in rosettes- - - - - - - - - *Moniezia.*

2] Inter proglottid glands arranged linearly (Some times absent) - - - - - - -*Blanchariezia.*

3] Inter proglottid glands absent- - - - - - - - - - - - - - - - - -*Baeriezia.*

The present worm agrees in all characters with subgenus *Blanchariezia* (Skrjabin and Schulz (1937) having two species as *M. (B.) benedeni* (*Moniez*, 1879), Skrjabin *et al.*, Schulz 1937 and *M. (B.) pallida* Monning, 1926. After that two more species were added by Shinde et. al 1985 from the host *Ovis bharal* as *M. (B.) aurangabadensis* and *M. (B.) bharalae* at Aurangabad, M.S. India. Later on Patil *et al.*, in 1997 described *Moniezia* (*B.*) *warananagarensis* from *capra hircus*. Kalse *et al.*, in 1999 described *Moniezia* (*B.*) *murhari* from *capra hircus*. In 2004, five species were added in the genus *Moniezia* as *Moniezia* (*B.*) *caprai (*Pokale *et al.*, in 2004*)* from *Capra hircus; Moniezia* (*B.*) *shindei* (Pawar *et al.*, in 2004) from *Ovis bharal; Moniezia* (*B.*) *hircusae* (Tat *et al.*, in 2004) from *Capra hircus; M.(B.) rajalaensis (*Borde *et al.*, 2004*)* from *Capra hircus* and *Moniezia* (*B.*) *aishvaryee* (Shelke *et al.*, in 2004) from *Ovis aries.*

Later on Nanware,2010 added Three new species in this genus i.e. *M.(B.) caprae, M.(B.) maharashtrae* and *M.(B.) kalavati* from *Capra hircus.* Kasar *et al.*, 2010 added *M. madhukarae* from *Capra hircus.* Shaikh *et al.*, 2011 added *M.*

(B.) mansurae from *Capra hircus*. Then *M.(B.) govindae* is added by Padwal *et al.,* 2011 from *Capra hircus*. Humbe *et al.,* 2011 added two species i.e. *M.(B.) babai* from *Capra hircus* and *M.(B.) ovisae* from *Ovis bharal.* Later *M(B) orientalis and M.(B)interproglotinna* were added by Shinde *et al.,* 2013. Then Makne,2013 added *M. (B) parbhaniensis*. *M(B) nagaonensis* was added by Suryawanshi & Kalse 2015. Kalim Shaikh 2015 recovered *M(B) marathwadensis*. Then *M(B) caprae* added by Kalse 2017 and *M(B) madhavae* by Jadhav and kale 2018. Recently *M(B) Jadhavae* was described by Pendharkar K.D. 2021

MATERIALS AND METHODS

Twenty four worms were collected from the intestine of a sheep *Ovis bharal* (Linnaeus, 1758) at Khultabad dist. Aurangabad, M. S. India. Standard protocols were followed for Taxonomic study. These cestodes were preserved in 4% formalin and stained with Harris haematoxylin, passed through various alcoholic grades, cleared in xylene, mounted in D.P.X. and drawings were made with the aid of camera lucida. All measurements were given in millimetres.

RESULTS

Description (Based on 24 specimens)

The scolex is simple, medium in size distinctly marked off from the strobila, almost squarish in shape with four large suckers, without rostellum and measures 0.93 (0.90-0.96) in length and 0.88 (0.90-0.86) in width. The suckers are large, oval, overlapping to each other, situated almost in the anterior region of the scolex and measure 0.026 (0.020-0.032) in length and 0.024 (0.020-0.028) in breadth. Neck is medium, wide, broad anteriorly and narrow posteriorly and measures 0.63 (0.61-0.65) in length and 0.42 (0.43-0.39) in width. Mature segments broader than long, crespedote with either concave or convex lateral margins, 4 to 5 times broader than long with double set of reproductive organs. Lateral margin measures 0.057 (0.62-0.52) in length and 5.475 (5.52-5.43) in width. The testes are small in size oval in shape 145-150 in numbers, scattered all over the segment in single field situated in posterior 2/3rd region of the segment and measures 0.035 in diameter. The longitudinal excretory canal is thin narrow and 0.98 (0.96-0.1) in length and 0.087 (0.089-0.085) in width. The cirrus pouch is medium in size, oval in shape, slightly obliquely placed extend up to longitudinal excretory canals situated 1/3rd anterior to the segment and measures 0.32 (0.34-0.30) in length and 0.09 (0.08-0.1) in width. Cirrus thin, short, curved slightly, coiled, contained within the cirrus pouch and measures 0.61 (0.60-0.62) in length and 0.17 (0.19-0.15) in width.

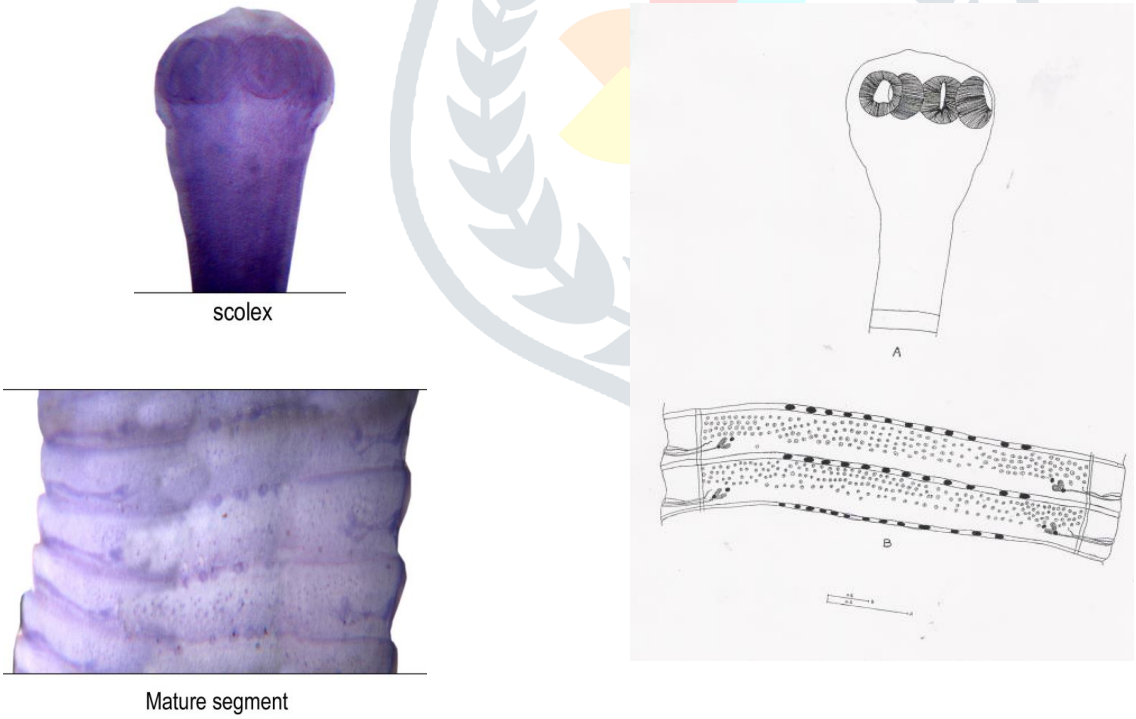

Figure 1: Microphotograph and camera Lucida diagram of *Moniezia (B.) khultabadensis* Sp.Nov.

The vas deferens is thin, long, slightly curved, runs obliquely and measures 0.21 (0.24-0.18) in length and 0.04 (0.03-0.05) in width. The ovary is small bilobed shape, situated either in the centre or mostly just at posterior to the middle of the segments. The vagina is thin, longer, posterior to the cirrus pouch and measures 0.175 (0.170-0.180) in length and 0.122 (0.120-0.124) in breadth. Ootype is small, oval and measures 0.11 in diameter. The vitelline glands are post ovarian, medium in size, oval in shape and measures 0.140 (0.120-0.160) in length and 0.078 (0.070-0.086) in breadth. Genital pores are large in size, oval in shape, placed just anterior to the middle of the lateral margin of the segments, bilateral in

position and measures 0.23 (0.20-0.26) in length and 0.20 (0.18-0.22) in breadth. Inter proglottidal glands small, oval, arranged either in transverse row , 13 pairs in the centre of the segments, leaving space on both the side and measures 0.080 (0.070-0.090) in length and 0.085 (0.080-0.090) in width.

DISCUSSION

The genus *Moniezia* was erected by Blanchard in 1891. The worm under discussion is having scolex simple, medium, distinctly marked off from the strobila, squarish in shape with four large suckers, Neck medium, wide, broad anteriorly and narrow posteriorly, Mature segment broader than long, double set of reproductive organ, testes small, 145-150 in numbers. Cirrus pouch medium, oval, Cirrus thin, short, curved, coiled contained within the cirrus pouch, Vas deferens thin, long, slightly curved, ovary small, bilobed, ootype small, oval. Vitelline gland was post ovarian and oval in shape. Genital pores were large, oval in shape. Inter proglottidal gland was small and oval.

The present species comes closer to all the known species of the genus *Moniezia* in general topography of organ but differs due to some characters from following species.

1.The present cestode differs from *Moniezia* (*B.*) *benedeni* Moniez (1879) Skrjabin *et al.,* Schulz (1937) due to numerous proglottids, which is broader than long, testes are 500 in numbers, arranged in two groups, cirrus sac short and wide, vas deferens with 2-3 coils, ovary with acini, lies in the center of the segments. Egg well developed interproglottidal glands linear and close to the posterior margin of the segments, arranged transversely and reported from the horse in Africa.

2.The present tapeworm differs from *Moniezia* (*B.*) *pallida* Monning, (1926) in having squarish mature segment, testes oval to rounded, 100-200 in numbers. Interproglottidal glands varies in size, cirrus pouch cylindrical, vagina runs anterior to cirrus pouch, and reported from horse in South Africa.

3.The present worm showing differences from *Moniezia* (*B.*) *aurangabadensis* Shinde *et al.,* (1985) which is having the scolex quadrangular. Testes 1100-1200 in numbers, vas deferens coiled, cirrus pouch cylindrical, and small, ovary bilobed each lobe with acini, interproglottidal glands 12-15 in numbers and reported from *Ovis bharal* in India.

4.The present cestode parasite differs from *Moniezia* (*B.*) *bharalae* Shinde *et al.,* (1985) which is having testes rounded, 190-200 in numbers. Vas deferens short, fusiform genital pores bilateral, sub marginal, ovary bilobed interproglottidal glands arranged in two rows. Small in size 38-44 in numbers cirrus pouch small, oval obliquely placed, vitelline gland absent, vagina anterior to cirrus pouch and reported from *Ovis bharal* in India.

5.The present species differs from *Moniezia* (*B.*) *warananagarensis* Patil *et al.,* (1997) which is having scolex large, testes 300-320 in number distributed throughout the proglottids in single field ovary bilobed with 13-15 short blunt acini, interproglottid glands medium in size and 56 in numbers, cirrus pouch small, oval, vitelline gland elongated obliquely placed.

6.The present tapeworm differs from *Moniezia* (*B.*) *murhari* Kalse *et al.,* (1999). Which is having the scolex is squarish, testes 405-415 in numbers, cirrus pouch elongated in the anterior region of the segments, ovary inverted, horse shoe shaped with short blunt acini. Interproglottid glands are rounded and 63 in numbers.

7.The present form differs from *Moniezia* (*B.*) *caprai* Pokale *et al.,* (2004), due to scolex medium and squarish in shape, testes follicular, 255-260 in numbers, ovary horse shoe shaped. Interproglottid glands 15 to 17 pairs in numbers, cirrus pouch flask shaped.

8.The present tapeworm showing differences from *Moniezia* (*B.*) *shindei* Pawar *et al.,* (2004), Which is having large scolex, mature proglottids craspedote, testes are 190-200 in numbers, scattered all over, interproglottid glands 76 in numbers and medium in size, vitelline gland large, vagina small in size, reported from *Ovis bharal* in India.

9.The present cestode differs from *Moniezia* (*B.*) *hircusae* Tat *et al.,* (2004), in having scolex large, immature segment big, craspedote. Testes 168 in numbers. Scattered in a single field, ovary large, single mass. In anterior half of the segment, cirrus pouch short, interproglottid glands 14-15 in number, vitelline gland oval to rounded.

10. It differs from *Moniezia (B) rajalaensis* Borde et. al.,(2004) in having globular holdfast organ, testes 250-260 in numbers, ovary horse shoe shaped and inter proglottid glands 31-32 in numbers.

11. The present tapeworm differs from *Moniezia* (*B.*) *aishvaryae* Shelke *et al.,* (2004) which is having testes small and 255-265 in number, ovary large mass, cirrus pouch spindle shaped. Vitelline glands quadrangular in shape, interproglottid gland are 42-44 in numbers, and reported from *Ovis aries* in India.

12. The present species differs from *M. (B.) caprae* Nanware (2010) in having scolex large, broad anteriorly and narrow posteriorly, neck short, mature proglottids three and half times broader than long, testes oval to rounded, 170 in numbers and inter-proglottid glands 40 in numbers.

13. It differs from *M. (B.) maharashtrae* Nanware, (2010) due to scolex oval, neck broader than long, mature proglottids four and half times broader than long, testes 116 in numbers and inter-proglottid glands 38 in numbers.

14. The present worm showing differences from *Moniezia (B.) kalawati* Nanware (2010) which is having squarish scolex oval shaped cirrus pouch, testes small distributed throughout the segment, 172 in number ovary single mass with irregular margin, and 54 interproglottidal glands in the inter segmental region, either single or paired, irregularly arranged in the central width of the segment and leaving space on each lateral side.

15. The present cestode differs from *Moniezia (B.) madhukarae* Kasar *et al.,* (2010) in having the scolex simple, elongated, long neck, mature segments five to six times broader than long, testes medium in size, oval scattered posterior to segment, 210-240 in numbers, cirrus pouch oval, vagina posterior to cirrus pouch, ovary butterfly shaped, vitteline gland post ovarian.
16. The present form differs from *M. (B.) mansurae* Shaikh *et al.,* (2011) in having the scolex is small, globular with musculature, suckers are slightly overlapping to each other, mature proglottids are broader than long, testes small, rounded and 160-170 in numbers. The cirrus pouch is large elongated and broader at opening ovary compact some what oval, vitelline gland is oval, compact and genital pore large in size, elongated coarse like and belly shaped and marginal. The vas deferens is thin straight tube.
17. It differs from *Moniezia (B) govindae* Padwal *et al.,* (2011) in having scolex large, globular, testes 100-140 in numbers, medium, scattered throughout proglottids, ovary compact, nut shaped and inter proglottidal glands 40-42 in numbers.
18. The Present cestode differs from *Moniezia (B) babai* Humbe *et al.,* (2011) in having scolex globular, elongated, testes 190- 220 in numbers, cirrus pouch oval and ovary compact, rounded.
19. The present tapeworm differs from *M.(B.) ovisae* Humbe *et al.,* (2011) in having testes 155- 165 in numbers, cirrus pouch oval and Ovary compact.
20. It differs from *M(B) interproglottina* Shinde *et al.,* (2012) in having scolex rectrangular, suckers are oval to rounded, arranged in two groups, mature proglottids square, testes small rounded and 40-45 in numbers. The cirrus pouch is cylindrical, ovary bilobed inverted u shaped vitelline gland is oval, compact, genital pore marginal, vas deferens is thin coiled tube and the interproglottid gland are arranged in two rows, 25 in each row.
21. The worm differs from M(B) *orientalis* Shinde *et al.,* (2013) in having scolex is simple oval, muscular, suckers are oval to rounded, arranged in two groups, mature proglottids are four to five times broader than long. Testes small, rounded and 35-40 in numbers. The cirrus pouch is cylindrical, ovary bean shaped vitelline gland is oval, compact and genital pore marginal. The vas deferens is thin straight tube, the interproglottid glands are arranged in two rows, 16-18 in numbers (8-9 in each row)
22. The worm under discussion differ from *M(B) parbhaniensis* Makne, 2013 in the shape of scolex (quadrangular vs. squarish), in the number of testes 196-200 vs 240-246, in the shape of ovary is inverted and bilobed, interproglottid gland14-30 in numbers.
23. It differ from *M(B) nagaonesis* Kalse (2015) , in the number of testes are 196-200,ovary bilobed inverted cup shaped. Interproglottidal gland are14-37 in numbers.
24. The present worm differ from *M(B) marathwadensis* Shaikh, 2015 due to scolex is simple almost quadrangular, it bear four rounded suckers, placed in corners, neck long, slightly narrow than scolex, mature segment broader than long. Testes small oval 125-130 in numbers, cirrus pouch large elongated, vas deferens curved, ovary compact, vagina thin tube posterior to cirrus pouch. Interproglottidal gland 50-52 in numbers.
25. Present worm differ from *M(B) bhalchandrai* Kalse *et al.* (2016) scolexmediun and quadrangular in shape and foue medium sucker. Mature segments rectangular in shape, testes are medium oval in shape 196-200 in number. Ovary medium and cup shaped, cirrus pouch large in size, vas deferens thin and seminal receptaculumia large, interproglottidal glands are 13-14 in number.
26. It differ from *M(B) caprae* Kale 2017 having scolex triangular in shape. Neck is long, testes 40-50 in numbers, cirrus coiled, protruded within pouch. Cirrus pouch having anterior margin of segments, vas deferens, ovary bilobed, medium in the segment, vagina thin tube.
27. Present worm differ from *M(B) madhavae* Jadhav and Kale, (2018) due to scolex is quadrangular it consist of four sucker which medium and oval. Double set of reproductive organ, testes are medium in size oval which is45-60 in number. Cirrus pouch near the anteriormargin of the segement. The ovary is bilobedmedium ,vigina thin tubeandreceptaculumseminis is oval in shape. The interproglottidal gland 40-42 in numbers.
28. Present worm differ from *M(B) jadhavae* Pendharkar (2021) in having scolex simple almost quadrangular bearing four suckers placed at the corner. Mature segment broader then long, double set of reproductive organ, testes small, oval 80-90 in numbers. Ovary compact with blunt acini.

After above discussion on morphological and characters, the Cestode is same at generic level but the species are different and these differentiating characters are valid enough to erect a new species for the Cestode and hence the name *M.(B) khultabadensis* n.sp. is proposed in the honour of the locality.

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