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Original Research Paper

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BIOSYSTEMATIC AND BIOCHEMICAL EVALUATION OF HELMINTH FAUNA IN SHEEP AND GOAT FROM TRIBAL DISTRICT NANDURBAR,(M.S.),INDIA

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ABSTRACT

Helminths exhibit a wide range of morphological adaptations that enable them to thrive as parasites within their hosts. These adaptations are crucial for understanding the pathogenesis of helminth infections. The morphology of these parasites is essential for understanding their structure of adaptation in anatomical niche. Common cestode in sheep and goats, has a characteristic scolex with four suckers and a stobila composed of numerous segments, each containing reproductive organs. Nematodes are common in sheep and goats, They have a complex life cycle involving multiple larval stages, which are essential for their survival and transmission. Helminths are multicellular parasites that have evolved complex life cycles and biochemical strategies to infect and survive within their hosts. Effective control of these helminth infections requires accurate identification of the causative parasites. Traditionally, identification relies on morphological characterization, examining features such as body shape, size, and the presence of specific structures. Coupled with modern biochemical investigations, a more complete understanding of parasite biology, host-parasite interactions and potential intervention strategies can be achieved. In present study will helpful to get information about which specific kind bio molecule of perform specific role in it's operational area, protein specificity, role of specific carbohydrates, lipid content over biomolecules. However further aims to integrate both morphological and biochemical insights into the common helminth parasites affecting sheep and goats from trible district Nandurbar of Maharashra State, India

KEYWORDS : Biosystematic, Biochemical, Helminths, Sheep, Goat, Nandurbar

INTRODUCTION

Parasitology is a rapidly evolving field, in a state of constant development. The growing need to explore innovative methods and adopt new approaches to combat emerging diseases and the associated losses to the farming community is undeniable. Addressing this monumental challenge is far too complex for a single researcher or individual. There is a critical necessity to reach a consensus among specialists in the field of Parasitology and related disciplines. Parasitism is a natural aspect of life for a wide range of organisms, and parasitic diseases represent a significant public health concern, resulting in morbidity and mortality in tropical regions, particularly in socio-economically disadvantaged societies. Infections transmitted through food, water, and soil are estimated to affect nearly half of the global population. Zoonotic diseases (those that can be transmitted between animals and humans) of parasitic origin contribute substantially to this statistic by influencing human health and imposing substantial losses on both public health and economic sectors.Gastrointestinal parasites in sheep and goats can, in certain instances, lead to substantial losses. These losses vary from decreased feed conversion in weakened animals to fatality. Both goats and sheep harbor a variety of gastrointestinal parasites, many of which are shared between the two species. The most notable of these include cestodes (tapeworms), nematodes (roundworms), and trematodes (flukes). Helminth infections, particularly those affecting the gastrointestinal tract, are a major health challenge that significantly restricts livestock productivity, especially in dairy animals. Despite the considerable production losses, which may amount to millions of rupees, this issue is often overlooked due to its chronic and subtle nature. The varying agro-climatic conditions, animal husbandry practices, and pasture management strategies greatly influence the prevalence and severity of parasitic diseases in tribal district Nandurbar.

Environmental factors, including climate, season, and rainfall, are pivotal in the development of gastrointestinal helminth infections. Due to these environmental influences, the nature of helminthic infections in different livestock species has been studied by several researchers from specific regions across the country. With this in mind, a study was initiated to assess the prevalence of helminths in sheep and goats under the prevailing climatic conditions in the tribal district Nandurbar of Maharashtra. Sheep and goat farming, along with the wool industry, represents a significant source of livelihood. Wool serves as a protective covering for animals. It is an effective insulator, preventing heat loss, and thus protects them from temperature fluctuations. When wool is thick and greasy, it also shields the skin from rain by preventing moisture from penetrating. The Merino sheep is the primary breed known for wool production. Goat hair, on the other hand, is used for various domestic applications, such as making garments, ropes, threads, and blankets. Raw hides and skins are primarily used in leather production. Goat skin yields some of the finest leathers, including velours, suede, and chamois, which are used in clothing, and chevreau for premium leather goods. However, several factors can negatively impact the quality of meat, milk, skin, fibers, and other valuable products from ruminants. The main contributors to this are viral, bacterial, fungal, and parasitic infections.

Gastrointestinal parasitism can reduce wool growth, as well as the length and diameter of the fibers. Wool may become brittle due to the lack of sulfur-containing amino acids, which are vital for wool protein synthesis. These infections also disrupt bone mineral metabolism, impairing the absorption of calcium and phosphorus, which in turn affects skeletal growth and reduces the quality of bone structure and its mineralization. Helminth infections, particularly gastrointestinal parasitism, represent one of the major health challenges that significantly hinder animal productivity in dairy livestock. Despite the substantial production losses that could amount to millions of rupees, this issue remains largely neglected due to its chronic and subtle nature. Furthermore, factors such as varying agro-climatic conditions and animal husbandry practices further contribute to the severity of the problem. Further in this investigation Helminths i.e. cestodes, trematodes and nematodes of sheep and goats shows to be useful as model parasites for the study of animal invasions and environmental global change. The present work also helpful to focusing the taxonomy, effect of ecological factors on helminthic infection, biochemistry (host-parasite relationship) of sheep and goats in tribal district Nandurbar.(M.S.) India.

MATEREAL AND METHODES

Biosystematic Study

For the taxonomical study of helminth parasites, the intestine of sheep and goats were collected from slaughter houses from different places of tribal district Nandurbar of Maharashtra state during two annual cycles.

The intestines were dissected, observed thoroughly and recorded the data of helminth parasites, infected and normal hosts examined. The cestode and trematodes were preserved in hot 4 % formalin where as nematodes were preserved in 10 % glycerol. Borax carmine and Haematoxylin stain were used for Trematodes and Cestodes identification. The worms were passed through various alcoholic grades i.e. 30 %, 50 %, 70 %, 90 % and 100 % cleared in xylene and mounted in DPX. The nematodes were mounted in glycerin and glycerin jelly.

Biochemical Study

Small pieces of infected, non-infected intestine and parasites were collected for glycogen estimation. Estimation of glycogen content in a particular parasite was initiated here by Kemp et.al. (1954) method. The protein content in the cestode parasites was estimated by Gornell et.al., (1949) method. The lipid content in cestode parasites and host intestines was estimated by Folch et..al. 1957 method.

Geographical Research Area

Biosystematic Study

Biosystematics is merely a service science to other biological studies. Taxonomy is a basic tool for describing and explaining biological diversity. It also acts as historical framework for bio control, biogeography, ecology and evolution. Taxonomic data is challenging to handle. Some of the taxonomic data types include photographs of living specimens, dissection, observation, specimen data, original descriptions, identification keys and geographical areas.

The present investigation deals with the taxonomy of helminth parasites of sheep and goats from includes Moniezia Sp.,

Eucestoda	Wardle, McLeod and Radinovsky, 1974.
Anoplocephalidea	Wardle, McLeod and Radinovsky, 1974
Anoplocephalidae	Cholodkovsky, 1902
Moniezia	Blanchard 1891

Moniezia Sp.

Introduction

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----------Blanchariezia. (Some times absent)
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 From the host Ovis bharal of tribal district Nandurbar

Description

Twenty one cestode parasites were collected from the intestine of Capra hircus at Nawapur Dist. Nandurbar (M.S.) India during the period of June, 2023 to May, 2025.

These cestodes are preserved in hot 4% formalin and nine specimens are stained with Harris haematoxylin and Borax carmine, passed through various alcoholic grades, cleared in xylene, mounted in D.P.X.

All the cestodes are long consisting scolex, immature, mature and gravid proglottids. The scolex is large, oval, globular, well marked off from strobila and measures 0.59 (0.45-0.41) in length and 0.51 (0.49-0.58) in width. Suckers are large, oval to rounded, overlapping to each other and measures 0.22 (0.20-0.25) in length and 0.22 (0.19-0.21) in width. The neck is long and measures 0.56 (0.54-0.52) in length and 0.39 (0.32-0.45) in width.

The mature proglottids are four times broader than long, with double set of reproductive organs and measures 1.29 (1.22-1.66) in length and 3.85 (3.63-4.08) in width. The testes are small, oval to rounded, 98 to 130 in numbers and measures 0.04(0.03 - 0.04) in length and 0.06 (0.05-0.06) in width. The cirrus pouch is small oval, elongated and measures 0.24 (0.23-0.25) in length and 0.11 (0.07-0.14) in width. The cirrus is thin tube, curved, present within the cirrus pouch and measures 0.22 (0.21-0.24) in length and 0.02 (0.1-0.02) in width. The vas deferens is thin tube, slightly curved and measure 0.18 (0.15-0.19) in length and 0.02 (0.01-0.02) in width.

Vagina and cirrus pouch open into a common pore known as genital pore, which is small in size, oval in shape, marginal and measures 0.05 (0.03-0.07) in length and 0.003 (0.001-0.02) in width. The vagina is thin, coiled tube, slightly curved, arise from posterior to cirrus pouch, forms receptaculum seminis and measures 0.82 (0.78-0.88) in length and 0.02 (0.02-0.03) in width. Receptaculum seminis is coiled tube, open into ootype and measures 0.24(0.22-0.25) in length and 0.02(0.01-0.03) in width. Ootype is oval, medium in size and measures 0.10 in diameter. From the ootype, ovarian lobe are started, ovary is compact, nut shaped and measures 0.22(0.26-0.27) in length and 0.75(0.45-1.08) in width. The vitelline gland is oval, compact and measures 0.14(0.11-0.14) in length and 0.10(0.09-0.11) in width. The inter-proglottid glands are oval to rounded, arranged in pairs, 18 in each pair.

Digenea	Van Beneden, 1858
Paramphistomidae	Fischoeder, 1901
Paramphistominae	Fischoeder, 1901
Cotylophoron	Stiles et Goldberger, 1910

Cotylophoron cotylophorum (Fischoeder, 1901) (Stiles et Goldberger, 1910)

Description

Ten immature and twenty mature specimens of this form were collected from the intestine and stomach of Capra hircus (L.) from Shahada tribal district Nandurbar.(M.S.) India.during June, 2023 - May, 2024. These trematodes are preserved in hot 4% formalin and seven specimens are stained with Harris haematoxylin and Borax carmine, passed through various alcoholic grades, cleared in xylene, mounted in D.P.X.

The body is elongated, small, non-spinose, blunt anteriorly

and rounded posteriorly and measures 3.39 (3.21 – 3.56) in length and 0.86 (0. 57-1.15) in width. The oral sucker is subterminal, oval, small and measures 0.325 (0.287-0.363) in length and 0.25 (0.22-0.28) in width. The ventral sucker or acetabulum is large, oval to rounded lies at posterior side of body muscular and measures, 0.73 (0.64-0.83) in length and 0.65 (0.56-0.75) in width. Pre- pharynx is absent. Pharynx is muscular, oval, immediately behind oral suckers and measures 0.06 (0.05-0.07) in length and 0.19 (0.18-0.20) in width. Oesophagus is large, behind pharynx opens into intestine and measures 0.14 (0.13 – 0.15) in length and 0.07 (0.06-0.08) in width Intestinal caeca broad, runs along side of the body and terminate in front of acetabulum. The genital pore is oval and measures 0.045 in diameter

The testes are oval, lobate, lies below the ovary. The anterior testis is larger than posterior one, measures 0.31. (029-0.32) in length and 0.13 (0.10-0.16) in width and lies at 0.83 mm from posterior extremity. The posterior testis measures 0.30 (0.29-0.31) in length and 0.13 (0.09-0.16) in width and lies at 0.56 mm from posterior extremity. The cirrus pouch is oval, lies at intestinal bifurcation and measures 0.12 (0.11-0.13) in length and 0.06 (0.04-0.07) in width. The cirrus is thin tube and measures 0.10(0.09-0.11) and 0.01(0.007-0.015) in width. The vas deferens and vas efferentia is present. The ovary is compact, oval, lying in between anterior and posterior testis, it measures 0.18 (0.17-0.19) in length and 0.13 (0.10-0.15) in width. Mehilis gland is long and measures 0.21(0.18-0.24) in length and 0.10(0.09-0.12) in width. The vagina is long tube forms receptaculum seminis and reaches to the ootype. Vitellaria extending in lateral margin.

DISCUSSION

The present form comes closer to Cotylophoron cotylophorum (Fischoeder, 1901) Stiles et Goldberger,1910 in having body is elongated, pre-pharynx absent, muscular pharynx, oesophagus and intestine well developed, acetabulum large, lies at the posterior side of the body, but the same differs from it in the following characters. Position of testes (Lies posterior to the ovary vs. Lies anterior to the ovary) Shape of testes (Nut shaped, oval vs. Oval to rounded) Host (Capra hircus vs. Ovis bharal)Locality (India vs. East Africa) As the characters are minor, it is redescribed here as Cotylophoron cotylophorum (Fischoeder, 1901) Stiles et Goldberger, 1910. The present form is collected from Capra hircus from tribal district Nandurbar.(M.S.) India.

Introduction

Tapeworms (Cestodes) live in the intestines of their hosts and feed on the nutrients found in the host's gastrointestinal tract. Their metabolism relies heavily on the availability of rich nourishment in the gut, which supports their development and growth. Studies, both metabolic and in vitro, suggest that a complex nutritional relationship exists between the parasite and its host. Some cestodes are even capable of fixing CO2, demonstrating how efficiently they use the waste metabolic products from the host's intestinal mucosa. Others absorb nutrients directly from the mucosal wall, further highlighting the adaptability of these parasites.

For over 150 years, scientists have known that parasitic worms contain polysaccharides, as first observed by Bernard (1859) and Foster (1865). Later work by Weinland (1901) showed that the metabolism of intestinal worms is largely characterized by carbohydrate fermentation. This, along with research from other pioneers, such as Von Brand (1970), made it clear that many endoparasites have a well-defined carbohydrate metabolism.

Biochemical Study

There is an extensive body of literature detailing the carbohydrate distribution in parasitic worms, with studies by Weinland (1901), Schulte (1971), Von Brand (1934), Salisbury & Anderson (1939), Daugherty & Taylor (1956), and others. However, many of these early studies relied on non-specific chemical methods, which often resulted in higher carbohydrate values compared to more precise enzymatic methods (such as glucose oxidase). The variation in findings can be attributed to differences in analytical techniques. For example, Fairbairn (1958) and Lopez-George & Monteolive (1965) reported widely differing glucose concentrations in Moniezia expansa. More reliable data has been obtained through paper chromatography.

The glycogen content in various helminths varies considerably, influenced by their environment, and no clear pattern has emerged regarding the nutritional needs of different species. For example, the glucose concentration in Taenia taeniaeformi tissues can increase by as much as 100-200 mg/100 mg when incubated in a glucose-rich medium (Von Brand et al., 1964). Interestingly, glucose uptake is inhibited when worms are incubated in sodium-free saline, suggesting that the increased glucose in the tissue might result from glycogen breakdown (Von Brand & Gibbs, 1966). In contrast, glucose is not evenly distributed along the strobila of Hymenolepis diminuta (Goodchild, 1961), although the reasons for this distribution are still unclear.From the literature, it is evident that carbohydrates play a crucial role in the metabolism of cestodes compared to other parasitic worms, which exhibit diverse growth patterns. While these carbohydrates are absorbed exogenously, the mechanisms behind this process remain largely unknown. Cestodes like Hymenolepis diminuta (Phifer 1960a,b,c; Fisher, 1965), Taenia taeniaeformis (Von Brand et al., 1964), and Calliobothrium verticillatum (Fisher, 1966), as well as the Acanthocephalan Polymorphus minutus (Crompton & Lockwood, 1968), have been shown to absorb glucose against concentration gradients. Furthermore, typical inhibitors of active transport, such as phloridzin, significantly reduce glucose uptake in cestodes (Phifer, 1960a; Lauris, 1961; Von Brand et al., 1964). In Taenia taeniaeformis, glucose absorption requires sodium, which parallels the sodium pump mechanism found in vertebrate tissues (Von Brand et al., 1964; Von Brand & Gibbs, 1966). The glucose content in cestodes is also influenced by their stage in the life cycle (Rubica, 1967). In some cestodes, the growth and development are rapid in the first 12-24 hours, followed by a slower rate even when glucose concentration remains high. For example, in Hymenolepis diminuta, glucose content increases from 15% of dry weight in 5-7 day-old worms to 37% in 13-16 day-old specimens (Mettric & Cannon, 1970). Additionally, glucose uptake is significantly more efficient when CO2 is present in the surrounding environment, further emphasizing the dynamic metabolic processes of these parasites.

CONCLUSION

The study on the biosystematic and biochemical evaluation of helminth fauna in sheep and goats from the tribal district of Nandurbar (M.S.), India, provides significant insights into taxonomy and biochemical characteristics of gastrointestinal helminths in sheep and goat. The research highlights the critical role of helminthic infections in limiting livestock productivity, particularly affecting wool, milk, and meat production. The findings underscore the importance of understanding the ecological and environmental factors that influence parasitic infestations, especially in regions with varying agro-climatic conditions like Nandurbar.Through detailed taxonomic analysis, the study identifies key species of cestodes and nematodes infecting sheep and goats, such as Moniezia sp. and Cotylophoron cotylophorum. The morphological characterization of these parasites, including the structure of the scolex, proglottids, and reproductive organs, provides valuable data for accurate species identification and understanding host-parasite interactions. Biochemical analysis further sheds light on the metabolic adaptations of these parasites, particularly in relation to

glycogen, protein, and lipid content, offering a more holistic view of their survival strategies within the host.Given the impact of helminth infections on livestock health and economic productivity, the study calls for enhanced awareness and effective management strategies for parasitic control. This research also emphasizes the need for integrated biosystematic and biochemical approaches in parasitology to foster better control measures and improve livestock welfare, particularly in tribal and rural areas of Maharashtra, India.

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