

STUDY OF MOSQUITOES FROM THE PERSPECTIVE OF SCIENCE AND RELIGION AS A SOURCE OF EDUCATIONAL VALUES

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ABSTRACT

Studies on mosquitoes have generally focused on biological and health aspects, particularly their role as disease vectors, thereby overlooking the educational and reflective dimensions of this object of study. However, from a holistic educational perspective, natural phenomena, including small organisms such as mosquitoes, can be interpreted as sources of values and learning. This study aims to identify and analyze the educational values embedded in studies on mosquitoes through a Systematic Literature Review (SLR) approach. The research method involved searching for relevant academic articles and scholarly sources published within a specific time frame through scientific databases, which were then selected using clearly defined inclusion and exclusion criteria. The selected data were analyzed using thematic analysis to identify patterns and categories of educational values. The results indicate that studies on mosquitoes contain several key educational values, namely intellectual humility, ecological responsibility, perseverance and adaptability, spiritual awareness and monotheism, as well as scientific ethics and empathy. These findings affirm that mosquitoes not only have scientific significance but are also relevant as pedagogical media in character education and value-based learning. This study concludes that the SLR approach is effective in uncovering the educational value dimensions of scientific literature and opens opportunities for integrating scientific inquiry with humanistic and spiritual values in educational practice.

Keywords: Islamic Education; Environmental Education, Educational Values

INTRODUCTION

Mosquitoes (Culicidae) are among the most extensively studied organisms in biology due to their role in the transmission of vector-borne diseases such as dengue fever, malaria, and filariasis, as well as their complex ecological behaviors reflecting specific biological adaptations to their environment (Hawkes, 2022; Johnson et al., 2024). Scientific research on mosquitoes has identified over 3,500 species and their diverse biological and ecological traits, demonstrating that the relationship between mosquitoes and humans and the environment is not simply a biological phenomenon but also directly impacts societal well-being through public health and ecosystem dynamics (Hawkes, 2022). Furthermore, bioecological studies of mosquitoes indicate that understanding the life cycle, habitat, and behavior of species such as *Aedes aegypti* can strengthen vector control efforts through public education, thus also having implications for shaping individual attitudes and behaviors toward the environment (Muhamat et al., 2023).

However, scientific studies on mosquitoes have traditionally focused on biological and epidemiological aspects, while the potential of mosquitoes as a source of character education has not received adequate academic attention. In the context of education, an integrated learning approach between science and values or religion has proven effective in strengthening students' character. Research has shown that science learning combined with Islamic or religious values can foster a more holistic affective, cognitive, and psychomotor dimension (Rafika, 2025; Sofi et al., 2024). This research on the integration of science and religious education recommends that natural phenomena should be interpreted as more than just scientific facts, but as a vehicle for instilling values of faith, morality, and ethics in students.

In the realm of religion, particularly Islam, natural phenomena, including the existence of mosquitoes, can be interpreted as part of God's wise creation. This religious interpretation of these tiny creatures emphasizes that every creation, no matter how small, contains moral and spiritual lessons relevant to human life. Several studies have shown that natural phenomena, such as living creatures, can be used as "verses of wisdom" that guide humans to reflect on divine power and wisdom and their responsibilities as caliphs on earth (Sofi et al., 2024). Although there is not much literature that specifically examines mosquitoes from a religious perspective, this kind of theological idea is worth exploring to enrich the context of values education.

The problem arises because the gap between factual scientific knowledge about mosquitoes and the understanding of religious values and character education is still lacking synergy in educational literature and learning practices. An interdisciplinary approach that combines scientific studies of mosquitoes with religious and educational values is not only theoretically important but also strategic in developing students who are not only intellectually intelligent but also morally and spiritually mature. This aligns with the need for holistic education, which positions scientific understanding not only as an accumulation of facts but also as a vehicle for internalizing values that foster critical, environmentally conscious, religious, and responsible attitudes in everyday life (Sofi et al., 2024; Rafika, 2025).

From an educational perspective, mosquitoes are positioned not only as objects of biological study or health threats, but also as reflective media for internalizing cognitive, affective, and spiritual educational values. Pedagogically, this approach aligns with the holistic education paradigm, which views natural phenomena as meaningful learning resources that connect scientific knowledge with student character development (Sofi et al., 2024). Biological studies of mosquitoes, including their life cycle, adaptation mechanisms, and environmental resilience, can be interpreted as a means to instill the values of perseverance, fighting spirit, and adaptability, which are relevant to 21st-century character education.

Furthermore, in the context of science education, mosquitoes can serve as a concrete example of how seemingly small living creatures possess highly complex biological systems, thus encouraging students to develop intellectual humility and an awareness of the limitations of human knowledge. This value is crucial in education, as research shows that science learning that emphasizes reflection on values can foster students' scientific attitudes, curiosity, and ethical responsibility towards the environment (Rafika, 2025). Thus, the study of mosquitoes goes beyond conceptual mastery but contributes to the formation of an ethical scientific perspective.

From a religious perspective, particularly Islam, the mosquito, as mentioned in the Quran (Surah Al-Baqarah: 26), conveys the educational message that all creation, no matter how small, has value and wisdom. The educational value that can be drawn from this perspective is the strengthening of monotheism, an awareness of God's greatness, and an attitude of not belittling other creatures.

Research on the integration of religion and science confirms that interpreting Kauniyah verses can shape a reflective and contextual, rather than dogmatic, religious attitude (Febril, 2023; Sofi et al., 2024). In this context, mosquitoes serve as a pedagogical symbol for teaching the value of respect for life and human responsibility as caliphs in maintaining the balance of nature.

Critically, formal education has tended to separate science learning from value formation, thus narrowing biological phenomena like mosquitoes into mere cognitive material or health issues. However, educational research shows that students more easily develop deep understanding and positive attitudes when learning is linked to values, real-life contexts, and spiritual dimensions (Zahro et al., 2025). The absence of this integrative approach has the potential to render science learning mechanistic and less meaningful for student character development.

Although small, mosquitoes play a complex biological role in ecosystems and in the dynamics of disease transmission, such as dengue fever, malaria, and filariasis. Mosquito biology demonstrates that size or "small" status is not an indicator of a living creature's value or impact on the environment (Purwatiningsih et al., 2025). This lesson teaches a respect for all life, both large and small, as each has its own ecological role. Mosquitoes thrive in diverse conditions, adapting to changing temperatures and environments. These adaptation mechanisms demonstrate that living things continually evolve and strive to survive in various situations, teaching humans not to give up easily in the face of challenges. Mosquito presence often increases in dirty environments or those with standing water. This teaches humans that cleanliness is not just a habit, but also a preventative measure against greater health risks. Maintaining a clean environment helps prevent the proliferation of mosquitoes and the diseases they carry. From a religious perspective, especially Islam, mosquitoes can be viewed as part of God's creation, providing the important lesson that all living creatures—no matter how small—reflect the greatness of the Creator and are meaningful in human life (Putri, 2025). This approach encourages humans to reflect on the purpose of life and the relationship between humans and other creatures.

Learning about mosquitoes in the context of biology education also has the potential to develop scientific ethics and responsibility, where students not only learn facts but also apply knowledge for the social and environmental good. Ethics in science learning aims to produce responsible scientists and citizens, not just intellectually intelligent ones (Salsadita et al., 2024; Khairatunnisa & Zulyusri, 2023).

Therefore, the study of mosquitoes as a source of educational values has strategic urgency in addressing contemporary educational needs, namely to shape scientific, religious, and character-based individuals. The integration of science, religion, and education studies in understanding mosquitoes not only enriches academic discourse but also offers a pedagogical framework capable of fostering values of environmental responsibility, spiritual awareness, empathy, and scientific ethics. Thus, mosquitoes can be positioned as a multidimensional learning object that supports national education goals and strengthens the profile of students with character. This research proposes to explore mosquitoes as a multidimensional learning resource that is not only relevant to science and public health studies but also as a medium for strengthening value education and spiritual meaning in the context of formal education. This approach is expected to be a new contribution to the interdisciplinary study of science, religion, and education, and help develop more meaningful and contextual learning models.

RESEARCH METHODS

This study uses a Systematic Literature Review (SLR) approach to comprehensively and systematically examine relevant research findings on mosquitoes from a scientific and religious perspective, as well as their implications for educational values. The SLR method was chosen because it provides a transparent, replicable, and evidence-based synthesis of knowledge, making it suitable for use in conceptual and interdisciplinary research (Kitchenham & Charters, 2007; Page et al., 2021).

The first stage of the study involved formulating research questions focused on: (1) how mosquitoes are discussed in scientific research from a scientific perspective; (2) how mosquitoes are interpreted from a religious perspective, particularly as a source of value reflection; and (3) what educational values can be derived from mosquito studies from a scientific and religious perspective. These questions served as the basis for determining a systematic literature search and selection strategy.

The second stage involved a literature search strategy, which was conducted by searching reputable scientific databases such as Scopus, Web of Science, Google Scholar, PubMed, and DOAJ, as well as accredited national journals. The keywords used included a combination of the following terms: mosquito, biology of mosquitoes, Islam and science, religious perspective of nature, science education values, and integration of science and religion, both in English and Indonesian. The search was limited to articles published within the last 10 years (2015–2025) to ensure the novelty and relevance of the studies (Page et al., 2021).

The third stage was literature selection using inclusion and exclusion criteria. Inclusion criteria included: (1) research articles or conceptual studies discussing mosquitoes from a scientific, religious, or educational perspective; (2) articles published in peer-reviewed scientific journals; and (3) articles containing implications for values, ethics, or education. Exclusion criteria included popular non-scientific articles, reports without a clear methodology, and publications irrelevant to the focus of the integration of science, religion, and education. The selection process involved a step-by-step screening of titles, abstracts, and full text to ensure the quality of the analyzed literature (Kitchenham & Charters, 2007).

The fourth stage is data extraction and analysis, where each selected article is analyzed using content analysis and thematic synthesis techniques. The extracted data includes the research focus, methodological approach, key findings, and implicit and explicit educational values. The analysis results are then classified into three main themes: mosquito studies from a scientific perspective, mosquito studies from a religious perspective, and implications for educational values. This process is conducted critically to identify research gaps and potential integration between fields (Braun & Clarke, 2021).

The final stage is the synthesis and reporting of the results, which are structured in a narrative-analytical manner, emphasizing the conceptual relationships between science, religion, and education. This synthesis not only summarizes the literature findings but also interprets the educational significance of mosquito studies as a source of holistic educational value. Reporting of SLR results adheres to the principles of transparency and process traceability as recommended in the PRISMA guidelines to ensure the validity and reliability of the research (Page et al., 2021).

RESULTS AND DISCUSSION

Based on the results of the SLR of international and national literature in the period 2015–2025, it was found that studies on mosquitoes can be classified into three main domains: (1) science studies (biology, ecology, and health), (2) religious and philosophical studies, and (3) education and values studies. However, the literature shows that these three domains generally develop separately. Science studies tend to be technical and instrumental, religious studies are normative-reflective, while education studies often only use mosquitoes as a context for cognitive learning (Hawkes, 2022; Febril, 2023; Zahro' et al., 2025). The results of the SLR indicate an epistemological gap, namely the lack of a conceptual framework that explicitly positions mosquitoes as a source of integrative educational values. This study, through critical synthesis, seeks to fill this gap.

Mosquito Study Results from a Scientific Perspective: Overlooked Complexities

Scientific literature consistently demonstrates that mosquitoes are organisms with a high level of biological complexity. Molecular biology and ecological research demonstrate that mosquitoes possess sophisticated sensory systems, extreme adaptability, and remarkable reproductive efficiency (Hawkes, 2022; Johnson et al., 2024). From a critical thinking perspective, these findings challenge the common assumption that small creatures are synonymous with simplicity and insignificance.

Molecular biology and neurobiology research reveal that mosquitoes possess a highly sophisticated sensory system. Mosquitoes are able to detect the presence of a host through the integration of carbon dioxide, body heat, humidity, and certain chemical compounds, processed by olfactory receptors and a complex nervous system. Johnson et al. (2024) explain that this mechanism involves specific neural networks and gene expression that enable mosquitoes to precisely distinguish targets. These findings demonstrate that mosquito behavior is not random, but rather the result of a high level of biological coordination developed through a long evolutionary process.

Furthermore, mosquitoes demonstrate extreme adaptability to environmental changes. Ecological and population genetic studies reveal that mosquitoes are capable of adapting their life cycles, reproductive patterns, and insecticide resistance in a relatively short time. These adaptations allow mosquitoes to survive in a wide variety of environments, from natural ecosystems to urban

areas impacted by human activity (Hawkes, 2022). From a scientific perspective, this adaptive ability indicates high biological flexibility and the efficiency of natural selection mechanisms.

Mosquito reproductive efficiency is also an important indicator of their biological complexity. Female mosquitoes are capable of producing large numbers of eggs and utilizing very minimal water habitats for reproduction. This reproductive strategy demonstrates biological optimization that allows the species to persist despite significant environmental pressures, such as climate change and human intervention (Johnson et al., 2024). Thus, mosquitoes can be understood as biologically "efficient" and adaptive organisms, rather than simply annoying pests.

From a critical thinking perspective, these scientific findings fundamentally challenge the common assumption that small creatures are synonymous with simplicity and insignificance. The reductionist view that assesses a creature's value based on its physical size or direct benefit to humans has proven inconsistent with scientific reality. Instead, mosquitoes demonstrate that the complexity of life is not always visible but rather lies in its internal systems and functions. Therefore, the study of mosquitoes encourages a more reflective, humble scientific attitude, and an appreciation for the complexity of nature as part of meaningful science learning. Analytically, the SLR results show that mosquitoes are often positioned anthropocentrically as "human enemies" due to their role as disease vectors. However, from a systems ecology perspective, mosquitoes are part of a complex web of life and serve as indicators of environmental degradation, such as poor sanitation and ecosystem imbalances caused by human activities (Muhamat et al., 2023). In other words, the mosquito problem is not merely a biological one, but a reflection of human ecological and ethical crises.

Scientific findings about mosquitoes as highly adaptive organisms responsive to environmental changes embody a strong sense of environmental responsibility. Ecological literature shows that increases in mosquito populations are often directly correlated with environmental degradation caused by human activities, such as poor sanitation, inadequate waste management, and changes in land use (Hawkes, 2022). In the context of science education, this understanding emphasizes that environmental and health issues are inextricably linked to human behavior, therefore, science learning needs to be directed toward fostering ecological awareness and collective responsibility for the environment.

Furthermore, the study of mosquitoes reinforces causal reasoning in science education. The presence and distribution of mosquitoes do not occur randomly, but rather are the result of a series of interconnected causes, such as microclimate changes, stagnant water, and human interactions with the environment. Science education research indicates that understanding causal relationships is an essential foundation for developing students' scientific literacy and scientific thinking skills (National Research Council, 2012). By studying mosquitoes as a case study, students can learn that every natural phenomenon has underlying causes that can be scientifically and rationally explored.

Furthermore, these findings also encourage the development of systems thinking, namely the ability to understand phenomena as part of an interconnected system. Mosquitoes cannot be understood separately from their ecosystem, as their existence is intertwined with biological, environmental, social, and even economic factors. This systems thinking approach is increasingly emphasized in modern science education because it helps students understand the complexity of real-world problems and avoids simplistic, linear thinking (Assaraf & Orion, 2010; Sterman, 2018). In this context, mosquitoes serve as a concrete example of how one small component in a system can impact the entire living system.

Critically, educational literature reveals that science learning that only emphasizes memorization of concepts without linking them to the values of responsibility, cause and effect, and systems tends to fail to shape students' ethical awareness. Yet, global challenges such as climate change and environmentally-based diseases demand a generation capable of system-based thinking and taking responsibility for the consequences of their actions (Sterman, 2018). Therefore, integrating mosquito studies into modern science education is not only academically relevant but also strategic in shaping students' character to be environmentally conscious, critical, and sustainability-oriented.

Thus, the values of environmental responsibility, cause-and-effect awareness, and systemic thinking embodied in mosquito studies make this phenomenon highly relevant as a contextual learning resource in science education. Mosquitoes are no longer understood simply as pests or disease vectors, but rather as a pedagogical entry point for building a holistic, reflective, and valuable scientific understanding.

Results of Mosquito Studies in a Religious Perspective: Small Creatures as Mediums of Truth

A Systematic Literature Review (SLR) of religious literature, particularly Islamic studies, shows that mosquitoes hold strong and significant symbolic significance in theological and educational discourse. The mention of mosquitoes in the Quran, particularly in Surah Al-Baqarah verse 26, is not understood simply as a biological description, but as a symbolic medium for conveying profound epistemological and moral messages. This verse emphasizes that God does not hesitate to use parables with even the smallest creatures as a means of conveying truth and learning for humans (Bendaharo et al., 2024).

Contemporary exegetical studies interpret the mosquito in this verse as a critique of human thinking, which often measures the value of truth based on physical size, status, or subjective perception. Putri (2025) explains that some people's rejection of the mosquito parable reflects an arrogant epistemological attitude, namely a tendency to underestimate sources of knowledge considered trivial or unimportant. In contrast, believers are positioned as those capable of grasping the wisdom behind this small symbol, because they judge truth based on its meaning and message, not its outward form.

From the perspective of Islamic critical thinking, this verse also affirms the principle of ontological equality of all creation before God. Mosquitoes, though small and often considered a nuisance, still have value and function within the cosmic order. Islamic theological literature indicates that this approach encourages humans to develop a humble attitude (*tawadhu'*) in viewing nature, while simultaneously recognizing the limitations of human reason in assessing the greatness of God's creation (Bendaharo et al., 2024). Thus, the mosquito serves as a pedagogical symbol that dismantles intellectual arrogance and directs humans toward a reflective attitude.

Furthermore, the SLR study also shows that the interpretation of the mosquito in the Quran has direct implications for values education. Putri (2025) asserts that this verse can serve as a conceptual basis for character education, particularly in instilling the values of humility, open-mindedness, and respect for knowledge from all sources. In the context of modern education, this message is relevant for developing students who are not trapped by hierarchical biases, but capable of critical and reflective thinking in assessing information and life's phenomena.

Analytical, the symbolism of the mosquito in the Quran demonstrates a harmony between religious approaches and modern science. While science proves that mosquitoes possess high biological complexity, religion provides a framework of meaning, emphasizing that this complexity is a sign of God's greatness and a means of learning for humans. The integration of these two perspectives reinforces the view that science and religion are not in conflict, but rather complement each other in shaping a holistic understanding of reality and educational value.

Thus, the results of the SLR on religious literature confirm that the mosquito is not simply a biological object or rhetorical symbol, but rather an educational tool rich in theological wisdom and pedagogical value. This interpretation expands the function of religious studies beyond simply understanding the text to fostering critical, ethical, and transformative awareness in education.

A critical analysis of this literature demonstrates an epistemological correspondence between revelation and modern science. While the Quran uses the mosquito as a metaphor, science reveals the creature's extraordinary complexity. This indicates that religion does not negate science but rather provides a framework of values and meaning for empirical knowledge (Febri, 2023).

A critical analysis of religious and scientific literature reveals a strong epistemological correspondence between revelation and modern science, particularly in the study of mosquitoes. When the Qur'an uses the mosquito as a metaphor in Surah Al-Baqarah: 26, the revelation's approach is not intended to explain technical biological details, but rather to affirm the epistemological principle that truth and wisdom can be present in any object, even the smallest living creature. In the development of modern science, mosquitoes have become the object of intensive research, revealing their extraordinary biological, ecological, and genetic complexity, thus reinforcing the symbolic relevance previously affirmed by revelation (Febri, 2023).

From a philosophical perspective, this correspondence demonstrates that revelation and science operate in different yet complementary domains. Science works through empirical observation, experimentation, and rational verification to uncover how natural phenomena operate. Conversely, revelation provides a normative and meaningful framework that explains why these phenomena are worthy of reflection and their implications for human life. In the context of mosquitoes, science reveals their complex sensory structures, extreme adaptability, and ecological role, while religion directs

humans to interpret these findings as signs of God's greatness and a means of ethical reflection (Febril, 2023).

Critically, the literature shows that the conflict between religion and science often stems not from the substance of either, but from a reductionist approach to understanding one or the other. When revelation is narrowly understood as a substitute for science, or science is positioned as negating spiritual meaning, the epistemological dialogue is interrupted. However, the study of mosquitoes demonstrates that the symbolism of revelation and scientific findings can reinforce each other. The biological complexity of mosquitoes, newly revealed through modern technology, challenges the assumption that Qur'anic imagery is simplistic or merely metaphorical, devoid of empirical relevance.

Furthermore, this epistemological correspondence has important implications for education, particularly in building an integrative paradigm between science and religion. Education that separates empirical knowledge from values and meaning risks producing students who are technically intelligent but lack ethical reflection. Conversely, integrating the perspectives of revelation and science in the study of mosquitoes can foster a holistic way of thinking, where students not only understand biological facts but also internalize the values of humility, intellectual openness, and an awareness of human limitations in understanding creation as a whole (Febril, 2023).

Thus, a critical analysis of the literature shows that religion does not negate science but rather provides a framework of values and meaning for empirical knowledge. The mosquito, a small, often underestimated object, actually becomes a meeting point for dialogue between revelation and modern science. This finding strengthens the argument that the integration of science and religion is not only possible but also necessary for building a meaningful, reflective education oriented toward the development of the whole person.

The mosquito becomes a vehicle for educating the values of monotheism, intellectual humility, and respect for God's creation, which are crucial for the formation of a rational and reflective religious character.

Mosquitoes can be understood as a contextual and relevant means of educating the value of monotheism in religious character formation. From an Islamic perspective, monotheism is not merely a verbal acknowledgment of the oneness of God, but rather an intellectual and spiritual awareness that all creation is subject to divine order and will. Modern scientific studies that reveal the biological complexity of mosquitoes—from their sensory systems and adaptive mechanisms to their ecological roles—provide an empirical basis for rational reflection on monotheism. This phenomenon aligns with the concept of *ayat kauniyah*, the signs of God's greatness that can be read through the universe (Febril, 2023). Thus, mosquitoes become a concrete medium for integrating faith and reason in education.

In addition to the value of monotheism, the study of mosquitoes also fosters intellectual humility. Humans tend to measure the value of an object based on its size, immediate utility, or subjective comfort. However, scientific research shows that small creatures like mosquitoes possess highly complex and efficient life systems. In the study of Islamic interpretation and educational philosophy, belittling God's creation is seen as a form of epistemological arrogance that hinders the development of profound knowledge (Putri, 2025). Therefore, mosquitoes can serve as a pedagogical example to teach that human limitations in understanding creation require humility, openness, and continuous learning.

Furthermore, mosquitoes also embody the value of respect for all of God's creation. Islamic education and environmental ethics literature emphasizes that humans are positioned as caliphs entrusted with maintaining the balance of nature, not as absolute rulers free to exploit other creatures. Although often perceived as pests or health threats, mosquitoes still serve a specific ecological function in the food chain and ecosystem balance (Bendaharo et al., 2024). This awareness is crucial for developing a non-reductionist perspective on nature, where each creature is valued based on its role in the living system.

Educational Values Resulting from Mosquito Studies

Based on a thematic analysis of the selected literature, this study identified the following educational values: (1) Intellectual humility The complexity of mosquitoes demonstrates the limitations of human knowledge and the importance of humility in learning (Hawkes, 2022). (2) Ecological responsibility The close relationship between mosquitoes and human behavior teaches that environmental damage is a consequence of human choices (Muhamat et al., 2023). (3) Perseverance and adaptability The resilience of mosquitoes in extreme conditions can be interpreted

as a pedagogical example of resilience. (4) Spiritual awareness and monotheism Mosquitoes, as a principle of unity, affirm that all creation has value in God's plan (Putri, 2025). (5) Scientific ethics and empathy Mosquito studies teach that knowledge must be directed toward the common good, not merely technical mastery (Febril, 2023).

Based on a thematic analysis of the selected literature, this study identified several educational values that can be constructed from mosquito studies, from scientific, ecological, and spiritual perspectives. These values demonstrate that objects previously perceived as small and harmful creatures actually hold profound reflective potential in an educational context.

First, the value of intellectual humility is reflected in the biological and ecological complexity of mosquitoes, which continues to be a subject of research. Hawkes (2022) emphasized that despite rapid scientific progress, humans remain limited in fully understanding living systems, including organisms as small as mosquitoes. Awareness of these limitations fosters humility in the learning process and prevents humans from becoming epistemologically arrogant. In an educational context, this value is crucial for developing students who are open to correction, dialogue, and continuous learning.

Second, the study of mosquitoes also fosters the value of ecological responsibility. The close relationship between mosquito populations and environmental changes and human behavior demonstrates that the increasing risk of disease is not simply a natural phenomenon, but rather a consequence of human choices and actions. Muhamat et al. (2023) demonstrated that environmental degradation, unsustainable urbanization, and poor ecosystem management directly contribute to mosquito proliferation. Therefore, education needs to instill an awareness that humans have a moral responsibility to maintain environmental balance for the sake of shared survival.

Third, the values of perseverance and adaptability can be understood from the mosquito's ability to survive and adapt to various extreme conditions. This resilience, although often viewed negatively, can be reinterpreted pedagogically as a symbol of resilience and adaptability in facing life's challenges. In education, this value is relevant for shaping the character of students who are resilient, innovative, and resilient in the face of rapid social and ecological change.

Fourth, from a religious perspective, the mosquito can be understood as a *kaunyah* verse containing a spiritual message and the value of monotheism. Putri (2025) asserts that the existence of mosquitoes confirms the view that all creation, no matter how small, has a role and meaning in God's plan. This understanding fosters spiritual awareness that the value of a creature is not determined solely by its pragmatic benefit to humans, but by its place in the cosmic order intended by God. Tawhid-based education thus not only teaches knowledge but also fosters a sense of reverence for creation.

Fifth, the scientific study of mosquitoes also contains the values of scientific ethics and empathy. Febril (2023) emphasized that research on mosquitoes, particularly in the fields of health and biology, should not stop at technical mastery, but rather be directed towards the welfare of humanity and the sustainability of life. This value teaches that science must be conducted with moral responsibility, empathy for human suffering, and concern for the social and ecological impacts of its application.

Overall, these findings demonstrate that mosquito studies can be used as a reflective medium in education to integrate cognitive, affective, ethical, and spiritual dimensions. With this approach, education is oriented not only toward the transfer of knowledge but also toward the development of character and holistic awareness in students.

CONCLUSIONS

Based on a thematic analysis of selected literature, this study concludes that the study of mosquitoes is not only relevant in the realms of biology and health but also holds profound educational significance. Mosquitoes can be positioned as a pedagogical medium that represents various holistic educational values, encompassing intellectual, ecological, ethical, and spiritual dimensions. The results show that the complexity of mosquitoes emphasizes the importance of intellectual humility in the learning process, while also reminding us of the limitations of human knowledge. Furthermore, the relationship between mosquitoes, the environment, and human behavior conveys a strong message of ecological responsibility, emphasizing that environmental damage is a consequence of human choices. The mosquito's resilience and adaptability can also be interpreted as a pedagogical example of perseverance and resilience in facing life's challenges. Furthermore, from a spiritual perspective, mosquitoes are understood as a verse of *Kaunyah* (the principle of unity) that affirms

the value of monotheism and an awareness of God's wisdom in creation. Meanwhile, the scientific study of mosquitoes demands the application of scientific ethics and empathy, so that knowledge does not stop at technical mastery but is directed towards the well-being and sustainability of life. Thus, this study confirms that integrating scientific studies and educational values into discussions about mosquitoes has the potential to enrich educational paradigms that are more reflective, humanistic, and transformative. These findings are expected to form the basis for developing educational approaches that focus not only on cognition but also on character development and the moral-spiritual awareness of students.

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