The Biologist (Lima), 2026, vol. 24 (1), XX-XX.

DOI: https://doi.org/10.62430/rtb20262412168

COMMENTARY / COMENTARIO

THE XII INTERNATIONAL CONGRESS OF NEOTROPICAL PARASITOLOGY: THE CHALLENGES OF PARASITOLOGY IN THE FACE OF CLIMATE CHANGE AND ENVIRONMENTAL IMPACTS

XII CONGRESO INTERNACIONAL DE PARASITOLOGÍA NEOTROPICAL: LOS DESAFÍOS DE LA PARASITOLOGÍA ANTE EL CAMBIO CLIMÁTICO Y SUS IMPACTOS AMBIENTALES

José Iannacone[1,2], María Amparo Rodríguez-Santiago[1,2,3,4,5,*], Zully María Hernández-Russo[6], Vanessa Abdallah-Kozlowiski[7], Rodney Kozlowiski de Azevedo[8] & Lorena Alvariño[2]

[1] Grupo de Investigación “One Health”, Laboratorio de Zoología, Facultad de Ciencias Biológicas, Universidad Ricardo Palma, Lima, Perú.

[2] Grupo de Investigación en Sostenibilidad Ambiental (GISA), Facultad de Ciencias Naturales y Matemática, Universidad Nacional Federico Villarreal, Lima, Perú.

[3] Instituto de Ciencias del Mar y Limnología, Estación “El Carmen”, Universidad Nacional Autónoma de México, Ciudad del Carmen, Campeche, México.

[4] Secretaría de Ciencia, Humanidades, Tecnología e Innovación, Ciudad de México, México.

[5] Núcleo Académico Básico, Centro de Investigación de Ciencias Ambientales, Universidad Autónoma del Carmen, Ciudad del Carmen, Campeche, México.

[6] CENUR Litoral Norte, Universidad de la República, Salto, Uruguay.

[7] Universidade Federal de Alagoas, Brasil,

[8] Prodema - UFS, Brasil.

*Corresponding author: marodriguezsa@secihti.mx

Iannacone *et al*.

Running Head: Neotropical parasitology and environmental change

José Iannacone: https://orcid.org/0000-0003-3699-4732

María Amparo Rodríguez-Santiago: https://orcid.org/0000-0003-0616-237X

Zully María Hernández-Ruso: https://orcid.org/0000-0003-0136-6330

Vanessa Abdallah-Kozlowiski: https://orcid.org/0000-0001-6539-6091

Rodney Kozlowiski de Azevedo: https://orcid.org/0000-0002-0471-6079

Lorena Alvariño: https://orcid.org/0000-0003-1544-511X

ABSTRACT

The XIII International Congress of Neotropical Parasitology (COPANEO 2025) was held from October 20 to 24, 2025, in the city of Maceió, state of Alagoas, Brazil, under the theme "The challenges of parasitology in the face of climate change and environmental impacts". The event brought together more than 600 researchers, lecturers, and students from 22 countries across the Americas, Europe, and the Caribbean. The scientific program included eight specialized symposia, organized according to their edition: the I Symposium on Neotropical Acanthocephalans, the II Symposium on Intestinal Parasitism and the II Symposium on Neotropical Phytosanitary, followed by the III One Health Symposium, the III Symposium on Leishmaniasis in the Neotropics, the III Neotropical Symposium on Chagas Disease, and the III Symposium on Dirofilariasis and Angiostrongylosis in the Neotropics, culminating with the VI Symposium on Neotropical Ichthyoparasitology. In addition, six theoretical and theoretical–practical short courses were offered, along with 32 keynote lectures delivered by specialists from countries such as Peru, Brazil, Uruguay, Colombia, and Spain, and 26 participants in round-table discussions. Overall, 22 thematic areas were

addressed from an interdisciplinary and One Health perspective, fostering scientific exchange and strengthening international collaboration networks in the context of global environmental change.
Keywords: Neotropical parasitology – COPANEO 2025 – One Health – climate change – environmental impacts.

RESUMEN

El XIII Congreso Internacional de Parasitología Neotropical (COPANEO 2025) se celebró del 20 al 24 de octubre de 2025 en Maceió, en el estado de Alagoas, Brasil, bajo el lema "Los desafíos de la parasitología ante el cambio climático y sus impactos ambientales". El evento reunió a más de 600 investigadores, profesores y estudiantes de 22 países de América, Europa y el Caribe. El programa científico incluyó ocho simposios especializados, organizados según su edición: el I Simposio sobre Acantocéfalos Neotropicales, el II Simposio sobre Parasitismo Intestinal y el II Simposio sobre Fitosanidad Neotropical, seguidos por el III Simposio Una Salud, el III Simposio sobre Leishmaniasis en el Neotrópico, el III Simposio Neotropical sobre Enfermedad de Chagas y el III Simposio sobre Dirofilariasis y Angiostrongilosis en el Neotrópico, culminando con el VI Simposio sobre Ictioparasitología Neotropical. Además, se ofrecieron seis cursos cortos teóricos y teórico-prácticos, junto con 32 conferencias magistrales impartidas por especialistas de países como Perú, Brasil, Uruguay, Colombia y España, así como 26 mesas redondas con 26 participantes. En total, se abordaron 22 áreas temáticas desde una perspectiva interdisciplinaria y de Una Salud, fomentando el intercambio científico y fortaleciendo las redes de colaboración internacional en el contexto del cambio ambiental global.
Palabras clave: Parasitología neotropical – COPANEO 2025 – Una Salud – cambio climático – impactos ambientales

INTRODUCTION

Neotropical parasitology currently faces complex challenges arising from environmental transformations, climate change, the intensification of anthropogenic activities, and the emergence and re-emergence of parasitic diseases of medical, veterinary, and ecological relevance. In this context, the

study of parasite–host–environment interactions plays a central role in understanding the processes that regulate biodiversity, ecosystem health, and public health risks (Abdallah *et al*., 2025). The XIII International Congress of Neotropical Parasitology (COPANEO - 2025) has established itself as an academic forum for interdisciplinary analysis and discussion of these issues, integrating perspectives from human, animal, and environmental parasitology within the One Health approach. Through specialized symposia, keynote lectures, round-table discussions, and short courses, the congress promoted the exchange of knowledge, experiences, and methodologies among researchers from different regions and research fields. In this framework, the thematic areas addressed during COPANEO 2025 reflect the diversity and dynamism of contemporary parasitology, as well as its relevance in addressing current and future challenges related to global environmental change, biodiversity conservation, and the health of human and animal populations (Abdallah *et al*., 2025).

Thematic Areas

In this context, the 22 thematic areas addressed during COPANEO 2025 highlight the breadth, diversity, and integrative nature of contemporary neotropical parasitology. These range from fundamental approaches such as epidemiology, host-parasite models, biochemistry, molecular biology, immunology, pathology, and parasitic ecology to applied perspectives in human, veterinary, and wildlife parasitology. Likewise, key areas of high relevance to public and environmental health were included, such as enteroparasitoses, emerging parasitic zoonoses, cysticercosis and hydatidosis, Chagas disease, leishmaniasis, malaria, toxoplasmosis, dirofilariasis, and angiostrongyliasis, all of which are of regional and global importance. Additionally, studies on parasitoses in wildlife, companion animals, and livestock were integrated, along with contributions in ichthyoparasitology, aquaculture health, ectoparasites and vectors, helminths including acanthocephalans, and biological control. The thematic program was further complemented by areas including integrative taxonomy, legislation and education, phytoparasitology, phytonematodes, free-living helminths and related invertebrates, clinical case reports, and an open category that encouraged emerging or interdisciplinary research. Taken together, these thematic areas reflect the diversity, dynamism, and relevance of

neotropical parasitology in addressing current and future challenges associated with climate change, environmental impacts, biodiversity conservation, and human, animal, and environmental health.

1. Epidemiology and Host-Parasite Models

This thematic area brought together studies focused on transmission dynamics, infection patterns, and host-parasite interactions at both population and ecosystem levels. Contributions analyzed classical epidemiological parameters such as prevalence, intensity, abundance, and aggregation across different host species and environmental gradients. Particular attention was given to spatial distribution, seasonal variation, and the influence of anthropogenic factors, including habitat modification, urban expansion, and climate variability, on parasite persistence and emergence. Several works incorporated quantitative and predictive models to evaluate risk scenarios, threshold transmission levels, and density-dependent effects in multi-host systems. These models provided insights into spillover and spillback processes at wildlife-domestic-human interfaces, reinforcing the importance of integrative approaches for anticipating disease outbreaks. Overall, this area emphasized the value of combining field data, ecological theory, and epidemiological modeling to improve surveillance strategies and inform evidence-based control policies under changing environmental conditions.

2. Biochemistry and Molecular Biology

Research in this section highlighted the growing consolidation of molecular and biochemical methodologies within neotropical parasitology. Studies applied DNA sequencing, phylogenetic analyses, and molecular markers to characterize parasite populations, resolve taxonomic ambiguities, and detect cryptic species complexes. The use of mitochondrial and ribosomal gene regions was particularly prominent in supporting integrative taxonomy and clarifying evolutionary relationships among protozoans, helminths, and arthropod vectors. In addition to taxonomic applications, several contributions investigated metabolic pathways, enzymatic activity, and gene expression associated with virulence, adaptation, and drug resistance. Protein characterization and recombinant molecule analyses were also explored for their diagnostic and therapeutic potential. This thematic area demonstrated how molecular and biochemical tools enhance our understanding of parasite biology,

evolution, and epidemiology, while providing essential support for genomic surveillance and the development of innovative control strategies.

3. Immunology and Pathology

The Immunology and Pathology area addressed host immune responses and tissue alterations resulting from parasitic infections in humans and animals. Studies examined inflammatory cascades, cellular infiltration patterns, cytokine expression, and mechanisms of immune evasion employed by parasites to ensure survival and persistence. Histopathological analyses revealed organ-specific lesions, particularly in cardiovascular, pulmonary, hepatic, and gastrointestinal systems, and correlated these findings with parasite burden and disease severity. Some contributions evaluated potential immunological biomarkers and recombinant proteins with diagnostic or prognostic applications. Collectively, this area strengthened the understanding of immunopathogenesis and highlighted its relevance in bridging basic research and clinical practice. The insights generated contribute to the identification of novel therapeutic targets and improved strategies for disease management.

4. Biology and Ecology of Parasitic Infections

This thematic area emphasized the ecological foundations of parasitic infections, focusing on life-cycle strategies, host specificity, trophic transmission pathways, and environmental determinants of parasite community structure. Research explored infracommunity composition, co-infection dynamics, and the influence of ecological gradients on parasite diversity and abundance. Several studies underscored the importance of parasites as integral components of ecosystem functioning, influencing host population regulation and contributing to food web complexity. Environmental drivers such as habitat degradation, pollution, and climate variability were discussed as factors shaping parasite distribution patterns and infection dynamics. Overall, this area reinforced the ecological perspective of parasitology, positioning parasites not merely as pathogens but as key actors in the maintenance of biodiversity and in assessing ecosystem health.

5. Enteroparasitosis in Public Health: Advances and Perspectives

This section addressed intestinal parasitic infections affecting human populations, particularly in vulnerable communities characterized by limited sanitation infrastructure and socioeconomic challenges. Contributions included epidemiological surveys, risk factor assessments, and comparative evaluations of diagnostic techniques. Protozoan infections such as *Giardia* and *Blastocystis*, along with soil-transmitted helminths, were frequently reported. Studies highlighted environmental contamination, water quality, hygiene practices, and occupational exposure as significant determinants of infection. Persistent transmission in rural and peri-urban settings was discussed, emphasizing the ongoing public health burden of neglected intestinal parasitoses. The area underscored the need for integrated intervention strategies that combine improved sanitation, health education, community participation, and strengthened epidemiological surveillance systems to reduce transmission and mitigate long-term health impacts.

6. Emerging Parasitic Zoonoses

Factors influencing the emergence of parasitic zoonoses are associated with environmental and climatic changes, increased human contact with domestic animals and wildlife, failures in control measures, changes in etiological agents leading to antiparasitic resistance, and the phenomenon of globalization, among others (Jones *et al*., 2008; Hoberg & Brooks, 2015; Carlson *et al.,* 2022). This represents a major challenge for public, animal, and environmental health, and therefore requires a One Health (Una Salud) approach for effective control (WHO, 2017; Destoumieux-Garzón *et al.*, 2018). In this section, studies were presented on parasitic entities caused by protozoans, trematodes, and nematodes infecting human hosts, domestic animals, and wildlife, dispersed in the environment and with potential zoonotic impact. Diverse transmission cycles were addressed. Notably, close contact between children and dogs under certain environmental conditions was associated with the identification of zoonotic parasites such as *Strongyloides stercoralis* (Bavay, 1876), *Giardia* spp., and *Blastocystis*, as well as opportunistic zoonotic parasites including *Cryptosporidium* spp., *Microsporidium* spp., and *Cystoisospora* spp. Likewise, the presence of geohelminths such as *Ascaris*

lumbricoides Linnaeus, 1758, *Toxocara* sp., and *Taenia* sp. eggs was also reported, highlighting soil as a significant transmission route and a public health risk, particularly under poor sanitary conditions. The detection of *Ancylostoma caninum* (Ercolani, 1859) Hall, 1913 in puppies, its pathogenicity, and the associated risk of cutaneous larva migrans in humans were also described. Studies related to occupational hygiene practices and food safety reported *Blastocystis hominis* Brumpt, 1912 as a zoonotic pathogen with high prevalence among workers in slaughterhouses, as well as the characterization of allergens of *Anisakis pegreffii* Campana-Rouget & Biocca, 1955 from marine intermediate hosts of commercial importance. Regarding vector-borne parasitic zoonoses, the epidemiological profile of human pulmonary dirofilariasis in a region of Brazil was presented, along with the characterization of populations of *Aelurostrongylus abstrusus* (Railliet, 1898) and *Angiostrongylus* spp., the latter associated with cases of eosinophilic meningitis in humans. Concerning biodiversity-related contributions, the presence of *Strongyloides* sp., *Trichuris* sp., and *Uncinaria*-type eggs was recorded at the interface between wild and domestic carnivores in a region of Peru, as well as the diversity of digenean parasites in bivalves from northwestern Mexico. Finally, a review of human oral myiasis cases was included, emphasizing the importance of early diagnosis and appropriate intervention measures.

As concluding actions, emphasis was placed on improving basic sanitation, promoting responsible animal ownership, strengthening health education particularly among food handlers and vulnerable populations—and enhancing genomic surveillance and parasitic species characterization. Strategies for the control of parasitic zoonoses under the One Health approach (WHO, 2017; Ryan *et al*., 2019; WHO, 2020; Hernández-Ruso *et al.*, 2025).

7. Cysticercosis and Hydatidosis

This thematic area addressed studies on the taeniasis/cysticercosis complex and echinococcosis in Latin America, focusing on three main axes:

Epidemiology and social factors. In high-Andean regions of Peru and in indigenous communities in Colombia, porcine cysticercosis was associated with deficiencies in animal husbandry practices in rural households, and intestinal parasitism was identified as a public health problem with high morbidity, particularly among vulnerable populations. Regarding echinococcosis, parasitic infection and associated factors were evaluated in domestic dogs from an Andean region of Peru.

Diagnosis and treatment. Available therapeutic guidelines for the management of neurocysticercosis were reviewed.

Wildlife. The detection of *Taenia* metacestodes in captive Brazilian deer was reported.

In conclusion, given that these diseases are considered neglected zoonoses, continuous surveillance in domestic animals, wildlife, and human populations is required for effective control under a One Health approach (Garcia *et al.*, 2020; WHO, 2021).

8. Chagas Disease

This section focused on studies conducted mainly in Brazil, Mexico, and Colombia, structured around four key axes:

Epidemiology and transmission routes. Changes in transmission pathways were highlighted, particularly the relevance of oral transmission associated with acute Chagas disease. Additionally, the presence of anti-*Trypanosoma cruzi* Chagas, 1909 antibodies in dogs was reported, evidencing zoonotic circulation in this population.

Entomology and ecology. Morphological and molecular characterization of triatomines and their role in the transmission of *T. cruzi* and *T. rangeli* Tejera, 1920 were presented, including the use of light traps for vector capture and assessments of local population perceptions of vectors.

Diagnosis. Recombinant cruzi pain protein was evaluated, demonstrating its potential as an effective tool to support Chagas disease diagnosis.

Treatment and quality of life. Results of studies on inhibitors of the enzyme trypanothione synthetase were presented as potential new therapeutic alternatives, along with research on the parasite glucose transporter. Another study concluded that chagasic cardiomyopathy can significantly and comprehensively affect patients' quality of life.

In summary, Chagas disease remains a neglected zoonosis and a major public health problem in Latin America. The changing epidemiological profile, particularly oral transmission, highlights the need to adapt health policies and to continue research on diagnosis and treatment (PAHO, 2023).

9. Leishmaniasis

The studies presented on leishmaniasis were grouped into the following aspects:

Epidemiology and public health. Clinical profiles of leishmaniasis in different regions of Brazil were analyzed, along with associated socio-environmental risk factors.

Veterinary medicine. An overview of screening and confirmatory diagnostic tests for canine visceral leishmaniasis was provided. In another study, *Leishmania infantum* Nicolle, 1908, was identified in vaginal and preputial mucosa of dogs, suggesting the possibility of sexual transmission in addition to vector transmission and reinforcing the role of dogs as reservoirs. Additionally, the presence of *Leishmania* spp. was evaluated in cats with clinical suspicion of leishmaniasis using different sample types and diagnostic techniques.

Ecology. A bioclimatic suitability model was presented to identify risk areas based on the presence of sandflies and rodents.

Treatment. New therapeutic strategies were explored, including drug repositioning, nanotechnology-based approaches, combination therapies, and immunomodulatory strategies. Pharmacological research focused on reducing toxicity, increasing drug efficacy, and addressing resistance.

In this context, public health strategies aimed at mitigating vector proliferation and reducing population exposure, together with targeted health education actions, are essential. Overall, the research presented reinforces a One Health (Una Salud) approach, integrating environmental surveillance, pharmaceutical innovation, and reservoir control (Alvar et al., 2012; PAHO, 2022).

10. Malaria and Toxoplasmosis

Studies on these parasitic diseases focused primarily on the following topics:

Toxoplasmosis. Gestational toxoplasmosis was addressed through epidemiological profiling in different regions of Brazil. Additionally, a review explored the association between *Toxoplasma gondii* infection and the development of schizophrenia.

Malaria. Clinical and epidemiological profiles were described in different regions of Brazil. One study addressed the clinical management of malaria in Amazonian indigenous populations under conditions of immunological coinfection. An experimental trial investigated the effect of testosterone on *Plasmodium berghei* Vincke & Lips, 1948 infection. Finally, a review examined current treatments, their limitations, and artemisinin resistance associated with mutations in *P. falciparum* (Welch, 1897).

Overall, notification of gestational toxoplasmosis cases requires continuous surveillance and health education actions. Malaria, in turn, remains one of the major global public health challenges, with high morbidity and mortality, particularly in tropical and subtropical regions (Nikiema *et al.*, 2025).

11. Parasitic infections in wildlife

The wildlife section showed broad participation, with approximately 70-80 contributions addressing parasite diversity in Neotropical vertebrates from ecological, health-related, and wildlife-human-domestic animal interface perspectives.

Overall, studies characterizing parasitic communities (helminths and protozoans) in mammals and birds predominated, combining necropsy and coprological analyses and, in several cases, morphological and/or molecular confirmation tools. A notable example was the first report of *Sarcocystis jamaicensis* Verma, von Dohlen, Mowery, Scott, Rosenthal, Dubey, & Lindsay in Colombia, with morphological and genetic confirmation and the implication of *Didelphis* as an intermediate host.

In addition, contributions examined helminth infracommunities in opossums (*Didelphis marsupialis* Linnaeus, 1758) from the Brazilian Amazon, reinforcing their relevance as synanthropic hosts and their potential links to public health depending on the taxa recorded.

Another important line of research integrated surveillance of wildlife under anthropogenic pressure and conservation contexts, including reports and analyses of parasitic infections in carnivores with a pathological emphasis. Particularly noteworthy were studies on *Dioctophyma renale* (Goeze, 1782) Collet-Meygret, 1802 infection in monitored wild carnivores, including descriptions of macroscopic lesions and diagnostic considerations.

In parallel, ex situ management scenarios were documented, including sanitary assessments of birds under quarantine that showed high positivity rates for helminths and coccidia, underscoring the need for isolation measures and continuous monitoring to reduce risks in conservation settings.

Finally, contributions on ectoparasitism in bats were presented, based on extensive sampling efforts (e.g., hundreds of captured individuals) and analyses of seasonal variation, providing evidence of host–parasite–environment patterns across heterogeneous landscapes.

In summary, this thematic area consolidated an integrative perspective in which wildlife parasitology is linked not only to biodiversity and the ecology of interactions but also to health surveillance, conservation, and risk assessment at the One Health interface, highlighting novel findings, range and record expansions, and applied approaches for monitoring populations and environments.

12. Parasitic Infections in Companion Animals: Current Status

The studies presented in this thematic area focused primarily on prevalence, diagnosis, and clinical reporting of parasites in domestic animals, mainly dogs and cats, as well as in certain aquatic species of sanitary relevance.

The diversity of gastrointestinal parasites was analyzed in dogs frequenting public spaces in Brazil, Paraguay, and Peru, as well as in dogs and cats treated in veterinary hospitals and various Brazilian communities. Additionally, seroprevalence of hemoparasites in canine populations was evaluated.

Among notable clinical reports, a vestibular lesion in a dog associated with otitis media complicated by myiasis was described; the occurrence of nematodes of the family Physalopteridae in cats; the presence of zoonotic-potential larvae of *Hysterothylacium* sp. in the toadfish [*Batrachoides surinamensis* (Bloch & Schneider, 1801)]; and the detection of *Myxobolus* sp. in *Sphoeroides testudineus* (Linnaeus, 1758).

Regarding diagnostics, emphasis was placed on identifying effective, precise techniques for detecting specific parasites in these hosts. Comparative analyses assessed the sensitivity of different coproparasitological methods for detecting *Ancylostoma*, *Platynosomum fastosum* Kossack, 1910, *Toxocara*, and *Cystoisospora* spp.

Additionally, results from canine leishmaniasis monitoring at a Control Center in Brazil were reported. Two studies analyzed the relationships among responsible pet ownership, risk factors, and tutors' educational levels, highlighting the social dimension of parasite control.

13. Parasitic Infections in Production Animals: New Perspectives

Contributions in this thematic area were structured around diverse approaches integrating therapeutic innovation, animal health management, and epidemiological surveillance.

Nanotechnology was highlighted as a promising therapeutic strategy, along with the use of phytotherapeutic agents in response to increasing resistance to conventional treatments, including the application of pyroligneous palm extract for the management of equine cutaneous habronemiasis.

Within poultry and apiculture health, sanitary conditions and their relationship with parasite burden in laying hens and broilers were analyzed. The presence of microsporidia of the genus *Nosema* spp. associated with the tribes Meliponini and Apini (*Apis mellifera* Linnaeus, 1758) was also evaluated, underscoring its impact on productivity and apicultural sustainability.

Among relevant reports, *Eimeria bareilly* Gill, Chhabra & Lall, 1963 was recorded in buffaloes from northeastern Brazil, *Ascaris suum* Goeze, 1782, in pigs, *Cryptosporidium* spp. in freshwater fish viscera, and the mite *Leptus alberti* Sanchez-Quilindo, Pizo-Barona & Benavides Montaño, 2024, in rural apicultural systems.

In cattle, several studies addressed the molecular identification of hemoparasites, detection of specific IgG antibodies against *Neospora caninum* Dubey, Lunde, Carpenter & Speer, 1988 seroprevalence of antibodies against *Fasciola hepatica* Linnaeus, 1758, and comparisons between direct diagnosis in bile content and fecal samples for detecting trematode eggs. Additionally, the frequency of carcass and viscera condemnation in slaughterhouses due to parasitic diseases was analyzed, emphasizing the economic impact of these infections in production systems.

14.-Ichthyoparasitology

The ichthyoparasitology thematic area was one of the most representative components of the congress, with approximately 90-100 contributions, highlighting the relevance and consolidation of this research field within neotropical parasitology. The studies focused on parasites associated with freshwater, estuarine, and marine fishes, including both wild species and those of commercial and aquaculture importance.

The contributions covered a wide range of parasitic groups, including protozoans, myxozoans, helminths, and parasitic crustaceans, addressing patterns of prevalence, abundance, and diversity, as well as host–parasite interactions. Several studies emphasized spatial and temporal variation in parasitic communities and their relationships with environmental conditions and anthropogenic pressures.

In addition, multiple works highlighted the value of fish parasites as bioindicators of ecosystem health, providing insights into the ecological status of aquatic environments. Applied aspects related to aquaculture health, fisheries management, and the occurrence of parasites with zoonotic potential were also discussed, underscoring their relevance to public health and food safety.

Overall, the ichthyoparasitology contributions reflect a dynamic and expanding field, with significant advances in biodiversity assessment, aquatic ecosystem ecology, and the integration of the One Health approach in continental and marine systems (Gay & Verrez-Bagnis, 2023).

15.-Ectoparasites and Vectors

This area brought together research focused on arthropods of medical and veterinary importance, including mosquitoes, sandflies, triatomines, ticks, mites, and other hematophagous ectoparasites. Studies addressed taxonomy, geographic distribution, seasonal abundance, and vector behavior across different neotropical ecosystems. The effects of climate change, urbanization, and habitat fragmentation on range expansion and modifications in transmission patterns were thoroughly discussed.

Additionally, analyses of insecticide resistance and selective pressures associated with the intensive use of chemicals in vector control programs were presented. The evaluation of vectorial capacity, biological competence, and parasite load in vectors was a central focus, alongside the application of molecular tools for species identification and pathogen detection.

Overall, this section highlighted the importance of integrated entomological surveillance and continuous ecological monitoring as fundamental pillars for the prevention and control of vector-borne diseases under the One Health framework.

16. Antiparasitic Drugs: Efficacy and Control

Contributions within this thematic area addressed the evaluation of the therapeutic efficacy of antiparasitic drugs in humans and animals, as well as the analysis of emerging resistance across different parasite groups. Experimental *in vivo* and *in vitro* assays were presented comparing conventional active compounds with new molecules or pharmacological combinations.

A central focus was the identification of molecular mechanisms associated with resistance, including specific mutations and alterations in metabolic pathways. Alternative strategies were also discussed, such as integrated control, drug rotation, rational use of antiparasitics, and approaches based on biological or phytotherapeutic control.

This area underscored the urgent need to strengthen resistance surveillance, promote responsible use policies, and foster translational research aimed at developing new molecules and sustainable control strategies.

17. Legislation and Education

This section integrates reflections on regulatory frameworks related to parasite control, public health, and animal health within the Latin American context. Sanitary policies, official surveillance programs, and regulations linked to zoonotic and vector-borne disease management were discussed.

In parallel, innovative experiences in parasitology education were presented, including clinical simulation, gamified teaching strategies, interactive educational materials, and community outreach

initiatives. The importance of scientific literacy and community engagement was emphasized to improve risk perception and strengthen prevention strategies.

The combination of regulation, education, and social participation was recognized as an essential component for the sustainability of control strategies and the consolidation of the One Health approach.

18. Phytonematodes, Free-Living Helminths, and Related Invertebrates

Research in this area included taxonomic, morphological, and ecological studies on plant-parasitic nematodes, free-living helminths, and other soil-associated invertebrates. New distribution records and diversity analyses were reported in agricultural systems and conserved ecosystems.

Investigations highlighted the role of nematodes as indicators of soil quality and as agents influencing agricultural productivity. Interactions between phytonematodes and agricultural practices were discussed, along with their impact on economically important crops.

This area demonstrated the relevance of integrating soil parasitology into sustainable management programs and strategies for terrestrial ecosystem conservation.

19. Aquaculture Health

Contributions in aquaculture health addressed parasites affecting farmed fish and other cultured organisms in intensive and semi-intensive systems. Productive impacts associated with infections by protozoans, helminths, and parasitic crustaceans were analyzed, including outbreaks under high-density conditions.

Prevention strategies, biosecurity measures, sanitary monitoring, and environmental management approaches aimed at reducing parasite burdens in aquaculture systems were discussed. Studies on

treatment resistance and the need for standardized diagnostic and control protocols were also presented.

This section emphasized the importance of continuous monitoring in aquaculture systems and the integration of sustainable practices that ensure productivity without compromising environmental health.

20. Phytoparasitology

This area included research on plant parasites of agricultural and ecological relevance. Topics addressed taxonomic identification, biology, geographic distribution, and integrated management strategies. Studies emphasized the economic impact of these parasites on commercial crops and small-scale farming systems, highlighting the need for preventive approaches based on crop rotation, biological control, and sustainable soil management. Phytoparasitology was presented as a key component of food security and plant biodiversity conservation in tropical regions.

21. Clinical Case Reports

This section presented human and veterinary clinical case reports that provided relevant diagnostic, therapeutic, and epidemiological information. Atypical clinical manifestations, coinfections, and diagnostic challenges in endemic settings were described. These reports contributed to applied knowledge by documenting rare or emerging presentations and expanding understanding of clinical variability in parasitic infections. The section highlighted the value of detailed clinical documentation as a tool for medical practice and epidemiological surveillance.

22. Open Category

The Open Category was consolidated as a strategic space within COPANEO 2025 to integrate contributions that, due to their emerging, interdisciplinary, or cross-cutting nature, did not strictly fit within the traditional thematic areas. This session provided visibility to recent trends in neotropical parasitology and promoted dialogue among research lines connecting human health, animal health, ecology, biotechnology, education, and environmental management under an integrative framework. The works presented in this category collectively reflected the dynamism of the congress and its capacity to incorporate evolving issues, novel methodologies, and approaches applied to local contexts. In particular, the relevance of multi-scale perspectives was evident, ranging from molecular and physiological processes to population and landscape-level patterns as well as the integration of modern tools (e.g., advanced diagnostics, spatial analyses, surveillance approaches, and data platforms) to strengthen research and inform decision-making.

This category also facilitated the inclusion of innovation-oriented proposals, such as applied research experiences, pilot studies, methodological developments, comparative analyses, and projects with strong outreach or knowledge-transfer components. In several cases, emphasis was placed on translating parasitological knowledge into concrete actions through science communication strategies, health education, local capacity building, and interinstitutional collaboration.

In summary, the Open Category provided thematic flexibility and breadth to the program, allowing the incorporation of emerging and interdisciplinary research that complements the overall panorama of COPANEO 2025. Its contribution reinforces the integrative character of contemporary neotropical parasitology and its relevance in addressing current challenges related to global change, biodiversity conservation, human, animal, and environmental health.

Conclusions and projections

The XIII International Congress of Neotropical Parasitology (COPANEO 2025) highlighted the scientific relevance, diversity, and integrative nature of contemporary neotropical parasitology amid accelerated environmental change. The breadth of thematic areas addressed during the congress reflected the dynamic interactions among parasites, hosts, and ecosystems, underscoring the

importance of interdisciplinary approaches that link human, animal, and environmental health under the One Health framework.

Discussions and contributions presented throughout the congress emphasized the need to strengthen long-term monitoring programs, advance integrative taxonomic and molecular approaches, and improve the understanding of parasitic dynamics in response to climate change and anthropogenic pressures. Particular emphasis was placed on the role of parasitology as a tool for environmental assessment, biodiversity conservation, and the prevention and control of parasitic diseases of public health and veterinary importance.

Future perspectives arising from COPANEO 2025 point to the consolidation of international research networks, increased collaboration between basic and applied sciences, and the active participation of early-career researchers and students. These efforts will be essential to address emerging challenges, promote sustainable management of natural and productive ecosystems, and translate scientific knowledge into effective strategies for health, conservation, and social well-being. In this sense, COPANEO continues to consolidate its role as a key platform for advancing neotropical parasitology and strengthening collaborative responses to global environmental challenges.

Author contributions: CRediT (Contributor Roles Taxonomy)

JI = José Iannacone

MARS = María Amparo Rodríguez-Santiago

ZMHR = Zully María Hernández-Russo

VAK= Vanessa Abdallah-Kozlowiski

RKA= Rodney Kozlowiski de Azevedo

LA= Lorena Alvariño

Conceptualization: JI, MARS**,** ZMHR

Data curation: JI, MARS, ZMHR, LA

Formal analysis: MARS, ZMHR, LA, JI

Funding acquisition: JI, VAK, RKA, MARS

Investigation: JI, MARS, ZMHR

Methodology: MARS, ZMHR, LA, JI

Project administration: JI, VAK, RKA, MARS

Resources: JI, VAK, RKA, MARS

Software: VAK, RKA, MARS

Supervision: JI, MARS

Validation: JI, VAK, RKA, MARS

Visualization: JI, LA

Writing – original draft: JI, MARS, ZMHR

Writing – review & editing: JI, MARS, ZMHR

ACKNOWLEDGMENTS

We extend our deepest gratitude to all the people and institutions that made the XIII International Congress of Neotropical Parasitology (COPANEO 2025) possible. We acknowledge the Universidade Federal de Alagoas (UFAL), Maceió campus, as the host institution of the event, as well as the organizing committee, scientific committee, symposium coordinators, keynote speakers, editors, participants, sponsors, and collaborating institutions, whose commitment helped consolidate this meeting as a space for academic exchange, international collaboration, and the strengthening of neotropical parasitology. In particular, we recognize the valuable support of the staff composed of students and young collaborators: Esmeralda G. Aznar Chulin, Alexia Gianne de C. Feitosa, Júlia Martini Falkenberg, Thuelly Juvêncio de Rocha, Brenda Madruga Rosa, Rayza de Cássia B. da Silva

Santos, Sarah Letícia Paiva Oliveira, Rebeca Leite Silva, Wallas Benevides Barbosa de Sousa, María Fernanda Barros Gouveia Diniz, Lilibeth Cupil Ruíz, Celso Rubén Canche Tun and Deysi Medrano Domínguez. Their participation was fundamental to the organization, logistics, and successful development of the congress.

BIBLIOGRAPHIC REFERENCES

Abdallah, V.D., Kozlowiski-de Azevedo, R., Iannacone, J.A., Rodríguez-Santiago, M.A., Canche-Tun, C.R., Ávila, E., & Alvariño-Flores, L. (Eds.). (2025). ABSTRACT BOOK del XIII Congreso Internacional de Parasitología Neotropical (XIII COPANEO), I Simposio de Acantocefalos del Neotrópico, II Simposio de Parasitismo Intestinal, III Simposio Neotropical de la Enfermedad de Chagas, III Simposio de Fitosanidad Neotropical, III Simposio de Leishmaniasis en el Neotrópico, III Simposio de Dirofilariasis y Angistrongylosis en el Neotrópico, III Simposio One Health-Una Salud, VI Simposio de Ictiparasitología Neotropical, COPANEO 2025, formato presencial "Los desafíos de la parasitología ante el cambio climático y los Impactos Ambientales" del 20 de octubre al 24 de Octubre del 2025, Maceío, Alagoas, Brasil. *The Biologist (Lima)*, *23*, Suplemento 9: S1-S588.

Alvar, J., Vélez, I.D., Bern, C., Herrero, M., Desjeux, P., Cano, J., Jannin, J., & den Boer, M. (2012). Leishmaniasis worldwide and global estimates of its incidence. *PLoS ONE 7,* e35671.

Carlson, C.J., Albery, G.F., Merow, C., Trisos, C.H., Zipfel, C.M., Eskew, E.A., Olival, K.J., Ross, N., & Bansal, S. (2022). Climate change increases cross-species viral transmission risk. *Nature, 607*(7919), 555-562.

Destoumieux-Garzón, D., Mavingui, P., Boetsch, G., Boissier, J., Darriet, F., Duboz, P., Fritsch, C., Giraudoux, P., Le Roux, F., Morand, S., Paillard, C., Pontier, D., Sueur, C., & Voituron, Y. (2018). The one health concept: 10 years old and a long road ahead. *Frontiers in Veterinary Science*, *5*, 14.

Garcia, H.H., Nash, T.E., & Del Brutto, O.H. (2020). Clinical symptoms, diagnosis, and treatment of neurocysticercosis. *The Lancet Neurology, 19*, 653–666.

Gay, M., & Verrez-Bagnis, V. (2023). Fish parasites and associated risks. Verrez-Bagnis, V. (Eds.). *Current Challenges for the Aquatic Products Processing Industry*, pp. 147-186. John Wiley & Sons

Hernández-Ruso Z.M., Rodríguez-Santiago M.A., Iannacone J., Giraldo-Forero J.C., & Da Silva, R.J. (2025). Building academic bridges: integration of countries for the teaching of parasitic zoonoses under a One Health framework. *The Biologist (Lima), 23*, 379-386.

Hoberg, E.P., & Brooks, D.R. (2015). Evolution in action: climate change, biodiversity dynamics and emerging infectious disease. *Philosophical Transactions of the Royal Society B: Biological Sciences, 370*(1665), 20130553.

Jones, K.E., Patel, N.G., Levy, M.A., Storeygard, A., Balk, D., Gittleman, J.L., & Daszak, P. (2008). Global Trends in Emerging Infectious Diseases. *Nature, 452*, 990-994.

Nikiema, S., Soulama, I., Ampofo, G.D., Nikiema, M., Zouré, A.A., Sombié, S., Sawadogo, S., Ouedraogo, N., Sermé, S.S., Sawadogo, H., Ily, R., Tibiri, G.Y.N., Zouré, D.O.A., Yanogo, N. J., Kaboré, F.C.A., Tchekounou, C., Zida, A., Tao, I., Ouedraogo, O., & Zongo, D. (2025). Influence of genetic factors of humans, mosquitoes and parasites, on the evolution of *Plasmodium falciparum* infections, malaria transmission, and genetic control methods: a review of the literature. *BMC Medical Genomics*, *18*, 1–15.

PAHO – Pan American Health Organization. (2022). *Leishmaniasis: Epidemiological Report of the Americas.* PAHO.

PAHO – Pan American Health Organization. (2023). *Chagas disease in the Americas: epidemiological update.* PAHO.

Ryan, U., Hijjawi, N., Feng, Y., & Xiao, L. (2019). Giardia: an under-reported foodborne parasite. *International Journal for Parasitology, 49*, 1–11.

WHO – World Health Organization. (2017). *One Health.* WHO.

WHO – World Health Organization. (2020). *Soil-transmitted helminth infections*. WHO.

WHO – World Health Organization. (2021). *Taeniasis/cysticercosis*. WHO.

Received June 1, 2026.

Accepted June 22, 2026.