Serviço Público Federal

MINISTÉRIO DA EDUCAÇÃO
UNIVERSIDADE FEDERAL DA INTEGRAÇÃO LATINO-AMERICANA
SISTEMA INTEGRADO DE PATRIMÔNIO, ADMINISTRAÇÃO E CONTRATOS

PROCESSO 23422.006295/2024-48

ELETRÔNICO

Cadastrado em 28/03/2024

Processo disponível para recebimento com código de barras/QR Code

Nome(s) do Interessado(s):	E-mail:	Identificador:
JORGE LUIS MARIA RUIZ		2242052

Tipo do Processo:
AFASTAMENTO PARA PÓS-DOUTORADO

Assunto do Processo:
NÃO DEFINIDO

Assunto Detalhado:
SOLICITAÇÃO DE AFASTAMENTO PÓS DOUTORADO NO PAÍS - JORGE LUIS MARIA RUIZ - DE 03/06/2024 A 03/06/2025

Unidade de Origem:
DEPARTAMENTO ADMINISTRATIVO DO INSTITUTO LATINO-AMERICANO DE CIÊNCIAS DA VIDA E DA NATUREZA (10.01.06.03.04.01)

Criado Por:
LIGIA DA FRE WINKERT

Observação:

MOVIMENTAÇÕES ASSOCIADAS

Data	Destino
28/03/2024	CENTRO INTERDISCIPLINAR DE CIÊNCIAS DA VIDA (10.01.06.03.04.03)
01/04/2024	CONSELHO DO INSTITUTO LATINO-AMERICANO DE CIÊNCIAS DA VIDA E DA NATUREZA (10.01.06.03)
18/04/2024	DEPARTAMENTO DE DESENVOLVIMENTO PROFISSIONAL E PESSOAL (10.01.05.23.03)
23/04/2024	PRÓ-REITORIA DE GESTÃO DE PESSOAS (10.01.05.23)
30/04/2024	DIVISÃO DE CADASTRO (10.01.05.23.02.01)
15/05/2024	INSTITUTO LATINO-AMERICANO DE CIÊNCIAS DA VIDA E DA NATUREZA (10.01.06.03.04)
22/05/2024	DEPARTAMENTO DE DESENVOLVIMENTO PROFISSIONAL E PESSOAL (10.01.05.23.03)
05/06/2024	PRÓ-REITORIA DE GESTÃO DE PESSOAS (10.01.05.23)
11/06/2024	DIVISÃO DE CADASTRO (10.01.05.23.02.01)
31/07/2024	DEPARTAMENTO ADMINISTRATIVO DO INSTITUTO LATINO-AMERICANO DE CIÊNCIAS DA VIDA E DA NATUREZA (10.01.06.03.04.01)
26/02/2025	CENTRO INTERDISCIPLINAR DE CIÊNCIAS DA VIDA (10.01.06.03.04.03)
30/04/2025	DEPARTAMENTO ADMINISTRATIVO DO INSTITUTO LATINO-AMERICANO DE CIÊNCIAS DA VIDA E DA NATUREZA (10.01.06.03.04.01)
22/08/2025	CENTRO INTERDISCIPLINAR DE CIÊNCIAS DA VIDA (10.01.06.03.04.03)

Data	Destino
10/09/2025	CONSELHO DO INSTITUTO LATINO-AMERICANO DE CIÊNCIAS DA VIDA E DA NATUREZA (10.01.06.03)

Para visualizar este processo, entre no **Portal Público** em https://sig.unila.edu.br/public e acesse a Consulta de Processos.

Visualizar no Portal Público

RELATÓRIO FINAL DE ATIVIDADES: AFASTAMENTO DOCENTE
(PÓS-GRADUAÇÃO *STRICTO SENSU* / PÓS-DOUTORADO)

Orientações:

- O(a) servidor(a) deverá entregar relatório final e a documentação comprobatória até 30 (trinta) dias da data de retorno às atividades;
- Os documentos comprobatórios necessários para prestação de contas estão mencionados no Item "Documentos Necessários para Finalização do Processo e Termo de Compromisso" constante neste modelo de relatório.
- O relatório deverá ser assinado digitalmente pelo(a) servidor(a) interessado(a) e supervisor(a) do Pós-Doutorado, se for o caso;
- O relatório final será submetido à aprovação no Consuni;
- O relatório deve conter o detalhamento de todas as atividades desenvolvidas durante o programa de pós-graduação ou pós-doutorado, conforme plano de atividades entregue juntamente com a solicitação de afastamento, e das ocorrências que afetaram o seu desenvolvimento com as devidas justificativas, bem como os documento(s) institucional(is) comprobatório(s) da efetiva participação.. No caso do pós-doutorado, devido às características distintas das atividades que podem ser realizadas, a ciência/anuência do supervisor servirá como comprovação;
- O processo deve conter todos os relatórios parciais necessários para o período, devidamente aprovados, semestralmente;
- Qualquer alteração no curso do afastamento deve ter sido informado imediatamente à chefia imediata, ao Departamento Administrativo do Instituto e à PROGEPE/DDPP para que fosse possível fornecer as devidas orientações, conforme a situação. As trocas de e-mails e os procedimentos realizados devem estar junto ao processo para análise e aprovação dos relatórios;
- Documentos em língua estrangeira deverão apresentar tradução, constando identificação do responsável;
- Após a aprovação do relatório final, o processo deverá ser enviado ao DDPP para análise e finalização do processo;
- A não entrega do relatório final à aprovação pelo CONSUNI poderá implicar em ressarcimento total do período usufruído.

Relatório nº :	2	**Ano:**	2025
Servidor(a): Jorge Luis Maria Ruiz			
Processo nº: 23422.006295/2024-48			
Afastamento: ( ) Mestrado ( ) Doutorado (X) Pós-Doutorado			
(X) Relatório Final	**Referente aos meses: 06-12**		

Atividades: (alinhamento entre as atividades planejadas e realizadas, disciplinas cursadas, cursos, eventos científicos, exame de qualificação, alterações, ocorrências, etc..)

05/12/2024 – 05/04/02025 Foi avaliada a indução de morte celular pelo marcador Anexina/PI.

05/12/2024 – 05/04/02025 Foi determinada a função mitocondrial pelo uso de sondas especificas.

05/12/2024 – 05/04/02025 Foram realizados experimentos de migração celular e marcação de vias de sinalização comuns as linhagens celulares utilizadas.

06/04/2025 – 23/07/2025 Com os resultados obtidos, serão submetidos artigos científicos para cada um dos compostos avaliados, dado que correspondem a espécies químicas diferentes.
Artigo publicado: https://doi.org/10.1016/j.toxicon.2025.108469

Resolução	***Stricto Sensu* e Pós-doutorado**
Nº 035/2021*	Artigos 16, 17 e 18

*O conteúdo dos relatórios, documentos comprobatórios, os encaminhamentos, aprovações e disseminações deverão atender ao disposto na Resolução Consun 35/2021.
*Disponível na página do DDPP: Desenvolvimento Profissional e Pessoal

DOCUMENTOS NECESSÁRIOS PARA FINALIZAÇÃO DO PROCESSO E TERMO DE COMPROMISSO

Além dos relatórios parciais (semestrais) devidamente aprovados e deste relatório final, os documentos necessários para finalização do processo são: Ata de Defesa, Diploma e Cópia ou o link de acesso ao trabalho (dissertação de mestrado, tese de doutorado ou documento do estágio pós-doutoral) no repositório institucional (se for o caso).

Caso já possua o(s) documento(s) mencionados e tenha juntado ao processo, desconsidere.

Documentos pendentes de entrega para finalização do processo:

Assinale os documentos pendentes para finalização do processo e respectivo termo de compromisso de entrega.

( ) **Ata de Defesa**. **Termo de Compromisso:** Comprometo-me a apresentar ao Departamento de Desenvolvimento Profissional e Pessoal – DDPP a Ata de Defesa do Programa *Stricto Sensu* no qual cursei, imediatamente após sua realização. Previsão da data de defesa: _____. (Assinale caso não tenha sido entregue ou caso já possua o diploma).

( ) **Diploma. Termo de Compromisso:** Após a entrega da Ata de Defesa ao DDPP, comprometo-me a anexar ao processo o termo de compromisso de entrega do Diploma (modelo disponível na página do DDPP), no prazo máximo de 12 meses após a data de defesa da dissertação ou da tese. (Assinale caso não tenha sido entregue).

(X) **Cópia ou o link de acesso ao repositório institucional do trabalho final aprovado.** Termo de Compromisso: Comprometo-me a apresentar ao DDPP a cópia ou o link de acesso ao trabalho no repositório institucional (dissertação de mestrado, tese de doutorado ou documento do estágio pós-doutoral), imediatamente após a entrega do documento. (Assinale caso não tenha sido entregue ou informado).

No caso de Afastamento fora do País (realizado em instituição estrangeira). Documentos pendentes de entrega para finalização do processo:

Assinale apenas os documentos pendentes, no caso de Programa *Stricto Sensu* realizado em instituição estrangeira.

Informe os documentos pendentes para finalização do processo e respectivo termo de compromisso de entrega.

( ) **Documento comprobatório do reconhecimento do Diploma. Termo de Compromisso:** Comprometo-me a apresentar ao DDPP o documento comprobatório do reconhecimento do Diploma do Programa *Stricto Sensu*, no prazo máximo de 12 meses, a contar da data de expedição do diploma.

( ) **Diploma revalidado. Termo de Compromisso:** Comprometo-me a apresentar ao DDPP o Diploma revalidado, no prazo máximo de 12 meses, a contar a partir da data do pedido de reconhecimento do diploma.

APROVAÇÃO DO RELATÓRIO FINAL*

***Relatório final: Aprovação pelo Consuni. (O servidor deverá entregar relatório final e a documentação comprobatória até 30 (trinta) dias da data de retorno às atividades).**

***Deverá ser incluído nos autos a ata de aprovação do relatório pela instância cabível.**

- O relatório final deverá ser submetido ao CONSUNI, por meio de sua Secretaria, para que o/a presidente deste colegiado faça a designação de relator para fazer a relatoria do processo de afastamento que deverá ser aprovada pelo CONSUNI.
- O/a relator/a do processo deve ser:
  - docente com nível de qualificação no mínimo equivalente ao do curso sendo realizado;
  - Para avaliação dos relatórios semestral e final, assim como a relatoria do processo, referentes a afastamento para realização de estágio pós-doutoral, poderão ser feitos por docentes com titulação mínima de doutorado.

Após a inserção da documentação necessária e aprovações pelas devidas instâncias, o processo deverá ser encaminhado ao DDPP/PROGEPE.

Ressarcimento: Resolução nº35/2021, Art. 22.

O relatório deverá ser assinado digitalmente pelo(a) servidor(a) interessado(a).

RELATÓRIO - AFASTAMENTO STRICTO SENSU / PÓS-DOUTORADO Nº 2/2025 - DAILACVN/ILACVN

(Nº do Protocolo: NÃO PROTOCOLADO)

(Assinado digitalmente em 22/08/2025 12:51)
LIGIA DA FRE WINKERT
CHEFE DE DEPARTAMENTO - TITULAR
DAILACVN (10.01.06.03.04.01)
Matrícula: ###502#3

*Visualize o documento original em https://sig.unila.edu.br/documentos/ informando seu número: **2**, ano: **2025**, tipo: **RELATÓRIO - AFASTAMENTO STRICTO SENSU / PÓS-DOUTORADO**, data de emissão: **22/08/2025** e o código de verificação: **62512237e9***

MINISTÉRIO DA EDUCAÇÃO
UNIVERSIDADE FEDERAL DA INTEGRAÇÃO LATINO-AMERICANA
DEPARTAMENTO ADMINISTRATIVO DO INSTITUTO LATINO-AMERICANO DE CIÊNCIAS DA VIDA E DA NATUREZA

DESPACHO Nº 242/2025/DAILACVN/ILACVN

Nº do Protocolo: NÃO PROTOCOLADO

Foz Do Iguaçu-PR, 22 de agosto de 2025.

PARA CICV

Encaminha-se o presente processo com a inserção do relatório final do afastamento para Pós Doutorado do Professor **JORGE LUIS MARIA RUIZ**, para relatoria por docente da área e aprovação no âmbito do CICV.

Após, retornar o processo para aprovação no Consuni ILACVN.
atenciosamente,

(Assinado digitalmente em 22/08/2025 12:51)
LIGIA DA FRE WINKERT
CHEFE DE DEPARTAMENTO - TITULAR
DAILACVN (10.01.06.03.04.01)
Matrícula: ###502#3

Processo Associado: 23422.006295/2024-48

Visualize o documento original em https://sig.unila.edu.br/public/documentos/index.jsp informando seu número: **242**, ano: **2025**, tipo: **DESPACHO**, data de emissão: **22/08/2025** e o código de verificação: **863bc3a861**

Ministério da Educação
Universidade Federal da Integração Latino-Americana
ILACVN – INSTITUTO DE CIÊNCIAS DA VIDA E DA NATUREZA
Centro Interdisciplinar de Ciências da Vida – ILACVN

Processo: 23422.006295/2024-48
Assunto: Afastamento para Pós-Doutorado no país
Interessado: Jorge Luís Maria Ruiz
Relator: Michel Rodrigo Zambrano Passarini

1. HISTÓRICO

28/03/2024– Abertura do processo. Anexado formulário de solicitação da docente com as informações sobre o afastamento: Nome do programa: Pós-graduação em Biossistemas; Instituição: Universidade Federal do ABC - Santo André/SP. Data de início e término: 01/06/2024 à 03/06/2025. Foi anexado os devidos documentos para abertura do processo: Edital 19/2023 /Progepe; Carta convite da Instituição; ata de reunião de área aprovando a saída do professor para Estágio Pós-doutoral (aprovada em 15/03/2024) e indicação de 03 (três) docentes da área de Biologia para assumir os componentes curriculares nos semestres de afastamento; entre outros.
16/04/2024 – Aprovação *ad referendum* CONSUNI ILACVN
22/04/2024 – Envio do cronograma das atividades previstas no Estágio Pós-doutoral sendo adicionada ao processo e deferimento da solicitação pelo DDPP (Departamento de Desenvolvimento Profissional e Pessoal).
24/04/2024 – publicação da portaria de afastamento, no período de 03/06/2024 a 03/06/2025 (PORTARIA Nº 471/2024/PROGEPE).
15/05/2024 – anexado ao processo, modificação na data do afastamento (por motivos pessoais) para 22/06/2024 a 21/06/2025
06/06/2024 – publicada a alteração da Portaria nº 471/2024/PROGEPE com a nova data para o afastamento (PORTARIA Nº 589/2024/PROGEPE)
24/01/2025 – solicitação do relatório parcial das atividades, referente ao período de jul/24 a jan/25 pelo Departamento Administrativo do ILACVN
13/02/2025 – envio do relatório parcial por e-mail ao Departamento Administrativo do ILACVN e anexado ao processo em 25/02/2025.
08/04/2025 – Solicitada relatoria.
13/05/2025 – aprovado relatório parcial – CONSUNI/ILACVN
20/08/2025 – enviado relatório final para Instituto.
22/08/2025 – solicitação relatoria referente ao período de fev/25 a jul/25 – relatório final

2. FUNDAMENTOS DO PEDIDO

Conforme RESOLUÇÃO Nº 35, DE 16 DE NOVEMBRO DE 2021, durante o período de afastamento, o servidor terá suas atividades acadêmicas acompanhadas pela unidade de lotação, devendo seus relatórios serem aparentados em reunião do Conselho do Instituto por meio de avaliação da coordenação do Centro Interdisciplinar onde o servidor se encontra alocado, por relator previamente

indicado para esse fim, visando assegurar o alinhamento dessas atividades ao planejado, bem como o recebimento, a aprovação e a disseminação dos relatórios semestrais e final, e após será submetido à homologação do CONSUNI.

3. CONSIDERAÇÕES

Considerando:
- Resolução CONSUN 35/2021
- Art. 18. O/a servidor/a deverá entregar relatório final até 30 (trinta) dias após o seu retorno às atividades.
§1º O relatório final deve conter o detalhamento das atividades desenvolvidas durante a execução do programa de pós-graduação stricto sensu (mestrado, doutorado) ou do pós- doutorado, conforme plano de atividades entregue juntamente com a solicitação de afastamento, e das ocorrências que afetaram o seu desenvolvimento, bem como o documento institucional comprobatório da conclusão do curso ou estágio, ou do motivo para a sua não conclusão, nos termos do § 1º. do Artigo 20 do Decreto nº 9.991/2019.
§3º No caso do pós-doutorado, devido às características distintas das atividades que podem ser realizadas, a ciência/anuência do supervisor servirá como documento institucional comprobatório da conclusão do estágio.
- As atividades relacionadas ao afastamento foram descritas no relatório final bem como os resultados obtidos foram publicados em periódico de relevância científica na área de atuação do docente.

4. PARECER CONCLUSIVO

(x) Aprovar

( ) Aprovar com alteração

( ) Não aprovar

5. SUGESTÕES E OBSERVAÇÕES

Foz do Iguaçu, 27 de agosto de 2025.

.....
Relator

RELATORIA Nº 2/2025 - CICV/ILACVN

(Nº do Protocolo: NÃO PROTOCOLADO)

(Assinado digitalmente em 10/09/2025 11:29)
LIGIA DA FRE WINKERT
CHEFE DE DEPARTAMENTO - TITULAR
DAILACVN (10.01.06.03.04.01)
Matrícula: ###502#3

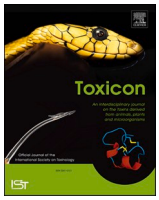
*Visualize o documento original em https://sig.unila.edu.br/documentos/ informando seu número: **2**, ano: **2025**, tipo: **RELATORIA**, data de emissão: **10/09/2025** e o código de verificação: **1cdf035fe6***

Toxicon 265 (2025) 108469

Contents lists available at ScienceDirect

Toxicon

journal homepage: www.elsevier.com/locate/toxicon



Cytotoxic activity of the crude venom from *Odontomachus affinis* ants is mediated by thiol oxidation and mitochondrial dysfunction

Jorge Luis Maria Ruiz [a,b], Vyctória dos Santos Ramos [a], Débora Cristina de Oliveira Gonçalves [c], Thamires Regine Corga da Silva Angelo [c], Priscila dos Santos Pazini [a], Ricardo José Soares Torquato [d], Wagner Alves de Souza Júdice [e], Antonio Miranda [f], Edgar Julian Paredes-Gamero [d,g], Maria Santina de Castro Morini [c,*], Tiago Rodrigues [a,e,**]

[a] Centro de Ciências Naturais e Humanas, Universidade Federal do ABC (UFABC), Santo André, SP, Brazil
[b] Instituto Latino Americano de Ciências da Vida e da Natureza, Universidade Federal da Integração Latino-Americana (UNILA), Foz do Iguaçu, PR, Brazil
[c] Núcleo de Ciências Ambientais, Universidade de Mogi das Cruzes (UMC), Mogi das Cruzes, SP, Brazil
[d] Departamento de Bioquímica, Universidade Federal de São Paulo, (UNIFESP), São Paulo, SP, Brazil
[e] Centro Interdisciplinar de Investigação Bioquímica, Universidade de Mogi das Cruzes (UMC), Mogi das Cruzes, SP, Brazil
[f] Departamento de Biofísica, Universidade Federal de São Paulo, (UNIFESP), São Paulo, SP, Brazil
[g] Faculdade de Ciências Farmacêuticas, Alimentos e Nutrição, Universidade Federal de Mato Grosso do Sul, Campo Grande, Mato Grosso, Brazil

ARTICLE INFO

Handling editor: Denise Tambourgi

Keywords:
Ant
Cell death
Formicidae
Gland venom
Bioactivity
Mitochondria

ABSTRACT

Animal toxins, including ant venoms, contain numerous compounds with potential biomedical and therapeutic applications. Ant venoms are mostly composed by peptides and proteins that might elicit inflammatory responses and cytotoxicity. The venom of *Odontomachus affinis*, a predatory ant species endemic to Brazil, is still poorly studied. Here, we evaluated the cytotoxic activity of the venom extracted from *O. affinis* glands and investigated the underlying mechanisms. Glands from 826 ants were dissected, followed by venom extraction and characterization by UV–vis and fluorescence spectroscopy and also by chromatography/mass spectroscopy. Cell viability was determined by MTT and trypan blue assays and the type of cell death by flow cytometry using annexin V-FITC/PI. Plasma membrane integrity was evaluated by LDH release. Mitochondrial bioenergetics were evaluated by the estimation of mitochondrial O_2 consumption and transmembrane potential. Also, protein thiol groups and reduced glutathione (GSH) were evaluated by spectroscopy. The crude extract of *O. affinis* exhibited a structured absorbance band in the UV region with maximal absorbance at 280 nm and a fluorescence emission band at 350–360 nm region. The chromatogram revealed at least 11 different molecules in its composition. *Odontomachus affinis* venom exhibited a concentration-dependent cytotoxicity in hepatoma and leukemia tumor cells, which was also observed in normal blood cells. Also, venom had the ability to affect mitochondria, increasing O_2 consumption. The mechanistic investigation conducted in leukemia cells revealed that venom induced-cell death was accompanied by plasma membrane permeabilization and oxidation of protein thiol groups and glutathione, which was associated with the dissipation of mitochondrial potential. Thus, *O. affinis* crude venom exhibits cytotoxic activity by triggering of mitochondrial permeabilization, affecting mitochondrial bioenergetics and cellular redox state. This study contributes to the comprehension of the mechanisms of toxicity of *O. affinis* venom and also prospects its potential as a source for novel bioactive molecules.

* Corresponding author. Núcleo de Ciências Ambientais, Universidade de Mogi das Cruzes, UMC, Av. Dr. Candido Xavier de Almeida e Souza, 200, Mogi das Cruzes, SP, CEP 08780-911, Brazil.
** Corresponding author. Centro de Ciências Naturais e Humanas, Universidade Federal do ABC, UFABC. Avenida dos Estados, 5001. Bloco A, Torre 3, Sala 623, CEP 09210-580, Santo André, SP, Brazil.
E-mail addresses: morini@umc.br (M.S.C. Morini), tiago.rodrigues@ufabc.edu.br (T. Rodrigues).

https://doi.org/10.1016/j.toxicon.2025.108469
Received 27 January 2025; Received in revised form 26 May 2025; Accepted 25 June 2025
Available online 28 June 2025

1. Introduction

Arthropoda is one of the largest reservoirs of bioactive substances worldwide, due to the high diversity and dominance of the species in diverse habitats (Suranse et al., 2018). In this Phylum, there is a wide range of venom types and inoculation mechanisms (Herzig et al., 2019; Senji Laxme et al., 2019; Walker, 2020). Some types of venoms are extensively studied, but studies about ant venoms are scarce. Ants (Hymenoptera: Formicidae) are one of the most diverse and abundant groups of animals in the Earth but the venom of the few ant species have been studied (Bolton, 2024; Fox and Adams, 2022; Schultheiss et al., 2022; Touchard et al., 2016). In general, the venom of ants presents a wide diversity of compounds, including salts, sugars, formic acid, biogenic amines, alkaloids, free amino acids, hydrocarbons, peptides, and proteins (Touchard et al., 2016). Such chemical complexity may result in local or systemic toxicity when inoculated (Serrão et al., 2015; Touchard et al., 2016), which action is triggered for the defense of the colony.

Ponerinae is the third largest subfamily of ants with 50 genera and 1277 species, with a wide geographical distribution in tropical and subtropical regions of the world (Bolton, 2024). These ants are primarily predatory, exhibiting a diverse diet and possessing a functional sting located at the apex of the abdomen. They are typically classified according to their foraging microhabitats as either epigaeic—active on the ground surface or low vegetation—or cryptobiotic, foraging within soil, leaf litter, or decaying wood. However, many species occupy intermediate ecological niches (Sorger, 2011; Hanisch et al., 2020). The venoms produced by these ants have been identified as a rich source of peptides (Agarwal et al., 2022; Aili et al., 2016; Palma, 2006). This subfamily includes the genus *Odontomachus*, comprising 74 species worldwide (Bolton, 2024), which exhibit distinct morphological adaptations such as exceptionally strong mandibular muscles that power their characteristic fast and powerful mandible strikes (Sorger, 2011). In Brazil, there are 17 species that inhabit forest areas, pastures, urban areas, and urban green areas (Bolton, 2024). Their colonies are made up of monomorphic workers with specialized hunting habits, which combine the use of their powerful mandible and the aid of their sting (Baccaro et al., 2015; De la Mora et al., 2008).

The effects of *Odontomachus* ant venom have been reported as insecticidal, antimicrobial and antitumor activities (Touchard et al., 2016), and in the natural environment as ants use it for predation and defense (Touchard et al., 2024). Recent studies have proposed that ant venoms might be used to regulate programmed cell death in cancer therapy (Mirzaei et al., 2021; Oliveira et al., 2023). Thus, the exploitation of ant venom represents a promising opportunity for the discovery of novel therapeutic agents (Herzig et al., 2020; von Reumont et al., 2022). However, there are still gaps in knowledge about the composition and the biological effects of their venoms. Only few species of *Odontomachus* have been studied, such as *O. monticola* (Kazuma et al., 2017; Tani et al., 2019), and six peptides exhibited similarity to pilosulin. For *O. bauri* (Silva et al., 2015), proteolytic enzymes were described and for *O. haematodus* (Touchard et al., 2015) 105 linear peptides were found, without structural variation among the different castes (i.e., nurses, foragers, and queens). In addition to these species, there are: *O. mayi*, *O. scalpus* and *O. hastatus*, all of which have Ponericins that are multi-functional cytotoxic peptides acting on the cell membranes (Lv S et al., 2022), with effects on insects, vertebrate pain, and cytotoxicity (Touchard et al., 2024).

Odontomachus affinis is a species distributed in South America, occurring in Brazil, Colombia and Guyana, but only its distribution and ethological characteristics have been studied, especially in relation to biology and ecology. This species is a large (about 1.0 cm long), generalist and epigeic predatory ant (Brandão et al., 2009), with dark coloration, carnivorous and nocturnal habits, living exclusively in the soil (Raimundo et al., 2009). Considering the lack of information on the possible biological effects of the venom, this study evaluated the cytotoxic activity crude of venom extracted from the glands of *O. affinis* ants in a human chronic leukemia tumor cell line, compared to normal circulating blood cells.

2. Materials and methods

2.1. Ant collection

Specimens (n = 826) of *O. affinis* (Fig. 1A) were collected from nests (n = 10) in an area of Atlantic Forest (S 23°29′22″; O 46°11′55″), located in the municipality of Mogi das Cruzes, São Paulo, Brazil. The specimens were collected in the afternoon and placed in plastic jars. These jars were placed on ice to make the ants less aggressive and then taken to the Myrmecology Laboratory at the University of Mogi das Cruzes for gland extraction.

2.2. Extraction of *O. affinis* venom and protein quantification

The glands from 826 ants were pinched out with entomological forceps and placed in an aqueous solution containing 30 % (v/v) acetonitrile and 0.2 % (v/v) trifluoroacetic acid. Glands were homogenized by using a Potter-Elvehjen and centrifuged at 7000×*g* for 10 min. All procedures were executed at 4 °C. The supernatant was considered as crude venom and the debris and empty venom sacs were discarded. The protein concentration in the crude venom was quantified by the Biuret assay, based on an analytical curve of bovine serum albumin (Skilleter et al., 1985). The samples were lyophilized and kept at −80 °C.

2.3. Crude extract characterization

Electronic absorption spectra of the venom were acquired in a photodiode spectrophotometer MultiSpec-1501 (Shimadzu Scientific Instruments Inc., Columbia, MD), using 10 mm optical quartz cuvettes, model 104-QS (Hellma, Germany) from 200 to 800 nm, with 1.0 nm interval. Fluorescence was recorded in a Hitachi F2500 fluorescence spectrophotometer (Tokyo, Japan) with excitation at 280 nm and the emission was scanned from 290 to 800 nm, with 1.0 nm interval, using a 10 mm optical quartz cuvette, model 101-QS (Hellma, Germany). To verify the presence of molecules in crude venom a preliminary test was carried out by Liquid Chromatography-Electrospray Ionization Mass Spectrometry (LC/ESI-MS) analysis. LC/ESI-MS data were obtained on a mass spectrometer model 3100 coupled to a liquid chromatograph model Alliance 2695 both from Waters (Milford, MA, USA) using a Waters Nova-Pak C18 (2,1 × 150 mm, 60 Å, 3,5 μm) column. Solvent A was 0.1 % TFA in water, and solvent B was 90 % acetonitrile in solvent A. The gradient was 5–95 % B for 30 min, flowrate at 0,3 mL/min and molecules were detected at 220 nm. Mass measurements were performed in a positive mode with the mass range between 200 and 2000 m/z. To estimate the size of the peptides, present in the venom extract, we calculated the monoisotopic mass (in Daltons) for each detected ion based on its mass-to-charge ratio (m/z) and charge state (z). The following formula was used:

$$\textbf{Monoisotopic mass} = (\mathbf{m} / \mathbf{z} \times \mathbf{z}) - (\mathbf{z} \times \mathbf{1.00728})$$

This calculation accounts for the mass of the protons added during ionization (1.00728 Da per charge). Only ions for which the charge state could be inferred or assigned (typically z = +1 or +2) were used in this analysis. Entries where charge could not be determined were excluded from the calculation.

2.4. Cell culture

Human chronic myeloid leukemia type (K562 ATCC: CCL-243) (obtained from the American Type Culture Collection (Mannasa, VA, USA), Rat hepatoma cells (HTC) and K562 cells were obtained from the BCRJ (Rio de Janeiro Cell Bank, Brazil). Peripheral mononuclear blood cells

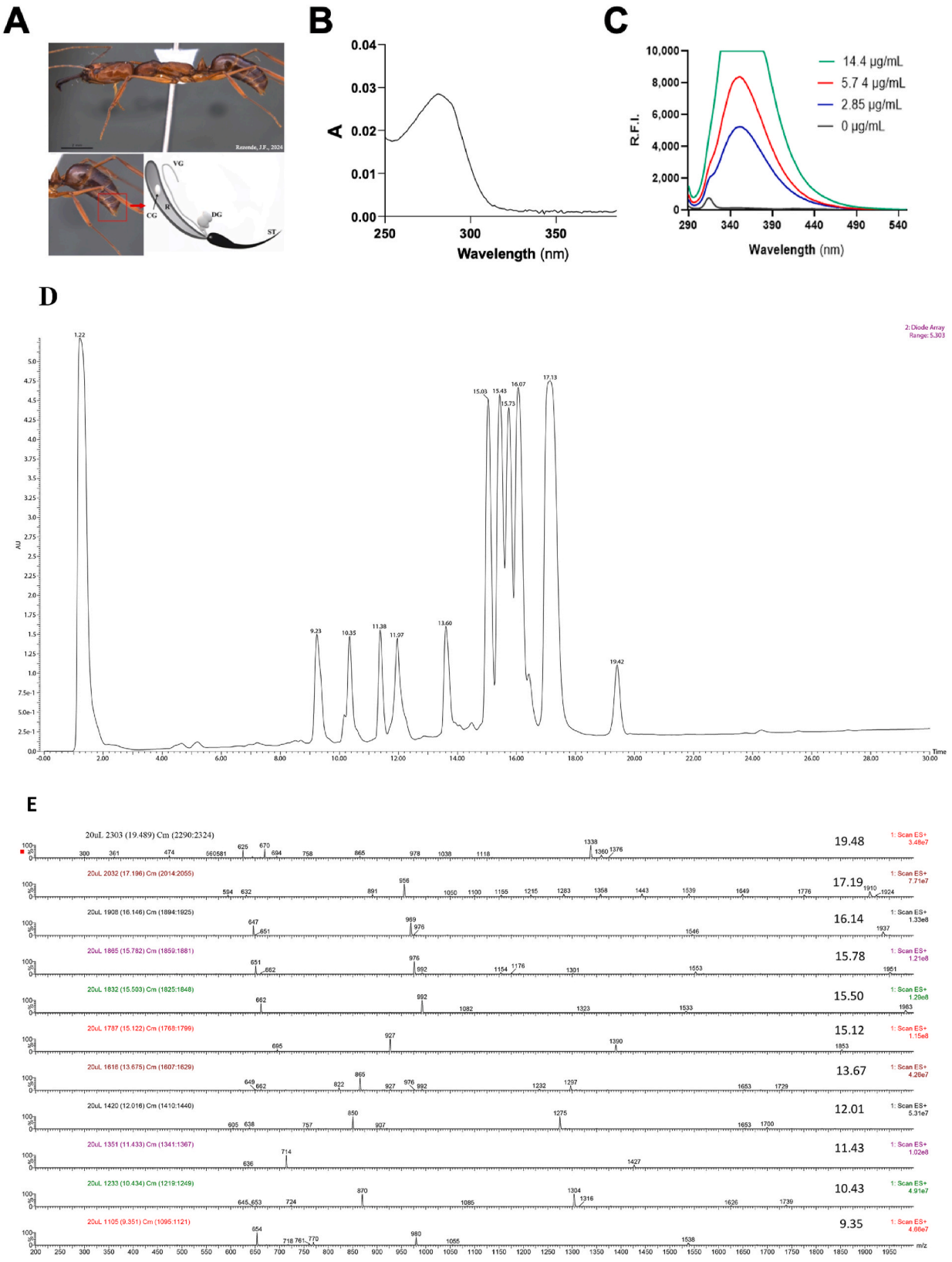


Fig. 1. Characterization of the crude venom extracted from the glands of *O. affinis*. (A) Representative images of *O. affinis* and representation of the venom apparatus, showing the convoluted gland (CG), the sting (ST), which is the inoculating device, connected to the Dufour's glands (DG), the venom glands (VG) and the reservoir (R). (B) UV–vis electronic absorption spectra of the venom at 5.7 µg/mL. (C) Emission fluorescence spectra of increasing concentrations of the venom after excitation at 275 nm. (D) High pressure liquid chromatographic (HPLC) separation with detection at 280 nm using a diode array detector (DAD). (E) Identification of the mass-to-charge ratio (m/z) of the peptides contained in the venom by mass spectrometry.

(PMBC) were freshly isolated from circulating blood of volunteer donors. K562 and PMBC were cultured in suspensions in RPMI 1640 medium (Sigma Chem. Co., St. Louis, MO, USA) and HTC cells was cultured in DMEM medium (Sigma Chem. Co., St. Louis, MO, USA), supplemented with 10 % (v/v) fetal bovine serum (FBS, South America origin) (Thermo Fisher Scientific, USA), 2 mM glutamine, 100 U/mL penicillin, 100 μg/mL streptomycin, and 25 mM HEPES, pH 7.2, maintained at 37 °C and 5 % CO_2 in a cell incubator.

2.5. Cytotoxicity assays

The cytotoxicity assays were performed in K562 (chronic myeloid leukemia) and HTC (hepatoma) cell lines and also in peripheral blood mononuclear cells (PBMC) by MTT (3-(4,5-dimethylthiazol-2-yl)-2-5 diphenyl tetrazolium bromide) reduction (MTT), a metabolic viability assay, and by trypan blue, a dye exclusion test MTT assay was performed as described elsewhere (Ferraz et al., 2018; Mosmann, 1983). Briefly, cells (1×10^5/mL) were incubated for 24h in a 96 well microplate in the presence of different concentrations of venom (5 μg/mL to 2 mg/mL). Then, 0.25 mg/mL MTT was added followed by 4 h incubation and at the end of the incubation period 100 μL of a solution containing 10 % SDS (w/v) and 0.01 M HCl was added to dissolve the formazan crystals. The absorbance was read after 12 h using an Asys Expert Plus Microplate Reader (Biochrom Ltd. Profile, UK) at 570 nm. Trypan blue dye exclusion assay was performed only in K562 cells (1×10^5/mL) incubated with different concentrations of venom in a 24 well microplate for 24 h. After the incubation period, 0.016 % trypan blue was added to cells suspension and cells were counted using a Neubauer chamber. Data were expressed as a percentage of viable cells compared to the control group considered as 100 %. The half maximal effective concentration (EC_{50}) was calculated from a variable slope curve-fitting using Prism 8.0 software (GraphPad, San Diego, CA).

2.6. LDH release

K562 cells (1×10^5/mL) were incubated with the venom for 24 h, followed by centrifugation at 700×*g* for 10 min. Subsequently, 20 μL of the supernatant was added to 1 mL of the working reagent (buffered solution at pH 7.5 containing 0.6 mM sodium pyruvate, 15.5 mM sodium azide, and NADH) in a cuvette at 37 °C using LDH Liquiform kit (Labtest, MG, Brazil). Absorbance was measured initially and after 1, 2, 3, 4, and 5 min at 340 nm in the Shimadzu UV1800 UV–visible spectrophotometer (Tokyo, Japan). To calculate LDH amount, the average of the differences between readings was determined, and this average absorbance was multiplied by a factor (according to the manufacture, factor = 8095), yielding the LDH value in U/L. Triton X-100 (0.2 %) was used as positive control.

2.7. Cell death analysis

To detect apoptosis/necrosis a double staining assay employing annexin V-fluorescein isothiocyanate (FITC)/propidium iodide (PI) was used. K562 cells (1×10^5/mL) were incubated with different concentrations of venom for 24h, centrifuged and resuspended in binding buffer (0.01 M HEPES, 0.14 M NaCl and 2.5 mM $CaCl_2$, pH 7.4). Then, the cells were transferred to polypropylene tubes containing 5 μL Annexin V-FITC and 5 μL PI and maintained protected from light, at room temperature, for 15 min. The analysis was performed using a BD FACS Canto II flow cytometer (BD Biosciences, USA) and 10,000 events were collected per sample.

2.8. Mitochondrial membrane potential (ΔΨ)

The ΔΨ was estimated in digitonin-permeabilized K562 cells quantifying changes in fluorescence of rhodamine 123 at 37 °C in a Hitachi F2500 fluorescence spectrophotometer (Tokio, Japan) at 505/535 nm excitation/emission wavelength pair with a slit width of 10/10 nm. Briefly, K562 cells (1×10^6) were incubated in buffer containing 250 mM sucrose, 2 mM KH_2PO_4, 10 mM HEPES-KOH, 0.5 mM EGTA, 0.5 % BSA, and 5 mmol/L $MgCl_2$, pH 7.2, and then permeabilized with 0.004 % (w/v) digitonin. The establishment of ΔΨ was induced by 5 mM potassium succinate followed by the addition of the venom and its complete dissipation was obtained by the addition of 2.0 μM CCCP.

2.9. Protein thiol content and GSH

Reduced protein thiol groups were quantified by using 5,5-dithiobis-nitrobenzoic acid (DTNB). After 24h incubation with venom, K562 cells (1×10^5/mL) were treated with 5 % (w/m) TCA and centrifuged at 3000×*g* for 5 min. After suspension of the pellet in PBS, 0.2 mmol/L DTNB was added followed by absorbance determination at 412 nm. The concentration of reduced protein thiol groups was calculated using $\varepsilon = 13.600\ (mol/L)^{-1}.cm^{-1}$. For GSH estimation, K562 cells (1×10^5 cells/mL) treated with 0.2 μg/μL crude venom for 24 h were treated with 0.5 mL of 13 % trichloroacetic acid and centrifuged at 3000×*g* for 5 min. For the GSH assay, aliquots (100 μL) of the supernatant were mixed with 1.8 mL of a 0.1 M sodium phosphate buffer at a pH of 8.0 containing 5 mM EGTA plus 100 μL of 1 mg/mL o-phthalaldehyde (Sigma-Aldrich, USA). After 15 min of incubation, fluorescence emission was detected at 350/420 nm (excitation/emission) in a Hitachi F2500 fluorescence spectrophotometer (Tokyo, Japan).

2.10. Isolation of mitochondria and O_2 consumption measurements

Adult male Wistar rats weighing approximately 180 g (n = 3) were kept in a 12/12 h light/dark cycle, and fed *ad libitum*. Liver mitochondria were isolated from rats by differential centrifugation in isosmotic media, as previously described (Calgaro-Helena et al., 2006). All experiments involving animals were conducted in accordance with the guide for the care and use of laboratory animals (NIH Guidelines) and previously approved by the Animal Ethics Committee of University of Mogi das Cruzes (CEUA/UMC) under protocol number 002/2019. Mitochondrial oxygen consumption was monitored polarographically with an oxygraph equipped with a Clark-type O_2 electrode (Hansatech Instruments, Norfolk, UK). Mitochondria (1.0 mg/mL) were incubated in a medium composed by 125 mM sucrose, 65 mM KCl, 10 mM K_2HPO_4, 0.5 mM EGTA, and 10 mM HEPES-KOH, pH 7.4, and energized by the addition of 5 mM potassium succinate, in the presence of 2 μM rotenone.

2.11. Data analysis

Values are the mean of at least three independent experiments run in triplicate. Data for each assay are expressed as mean ± S.E.M. and were statistically analyzed by ANOVA. Multiple comparisons among groups mean differences were tested by Bonferroni's post hoc test for multiple comparisons. Differences were considered significant when $p < 0.05$. All graphical and statistical analyses were performed with Graph Pad Prism 8.0 (GraphPad, San Diego, CA).

3. Results

3.1. Characterization of the venom obtained from Odontomachus affinis

The crude venom extracted from the glands of *O. affinis* ants (Fig. 1A) was characterized by spectroscopic and chromatographic assays. The protein quantification showed that the obtained extract contains 19.8 mg protein/mL. Firstly, the electronic absorption UV–visible spectrum acquired from 200 to 800 nm of a venom solution at 5.7 μg/mL concentration revealed a strong absorption band in the region of 250–310 nm, with maximal absorbance of 0.0364 at 280 nm (Fig. 1B), suggestive of peptide bonds (and also the amino acids tyrosine and/or tryptophan) in peptides or proteins present in the venom. The excitation of the

venom at 280 nm resulted in an electronic fluorescence emission band in the region of 300–450 nm, with maximal emission at 350 nm, which was dependent on concentration (Fig. 1C). Then, crude venom was submitted to a high pressure liquid chromatographic (HPLC) separation and the absorbance at 280 nm was followed by a diode array detector (DAD), resulting in 12 peaks (Fig. 1D). After that, the extract was submitted to mass spectroscopy to the identification of the mass-to-charge ratio (m/z) of the peptides contained in the extract (Fig. 1E and Table 1). For the most molecular ions the charge is +1 and then the $[m/z]^{+1}$ reflects the molecular mass of the peptide.

3.2. Evaluation of the cytotoxicity of the O. affinis ant venom tumor and normal cells

The possible cytotoxic action of the crude venom obtained from *O. affinis*' glands was screened by the MTT reduction assay in two tumor cell lines, human chronic myeloid leukemia cells (K562) and hepatoma (HTC) cells. Also, the cytotoxicity was comparatively evaluated in normal peripheral blood mononuclear cells (PBMC). The crude venom decreased the cell viability in a concentration-dependent manner in all cell types (Fig. 2A), showing that the *O. affinis* venom has a potent but not selective cytotoxic activity. The half maximal effective concentration (EC_{50}) values for the three cell lines were presented in Table 2, with PBMC being the most sensitive cells with EC_{50} of 0.13 μg/mL, followed by K562 cells with an EC_{50} of 0.199 μg/mL, and then HTC cells with the EC_{50} of 0.40 μg/mL. In order to confirm these results and to exclude any possible analytical interference with the MTT assay, we confirmed the cytotoxicity of the venom by the trypan blue exclusion assay in K562 cells and the EC_{50} was very similar (0.196 μg/mL) to that obtained by MTT (Fig. 2B). When the venom was obtained by electrostimulation of the glands, without its removal and maceration, no cytotoxicity was observed at the same concentration range (data not shown).

3.3. Odontomachus affinis venom induces apoptosis with secondary necrosis in K562 cells

To investigate the molecular features of the cytotoxic action of *O. affinis* venom, we evaluated its ability to promote plasma membrane permeabilization in K562 leukemia cells through the release of lactate dehydrogenase (LDH) to the culture medium. The crude venom did not promote permeabilization until 0.2 μg/mL, which is the EC_{50} value calculated for this cell type (Fig. 2C). At higher concentration (0.4 μg/mL), a slight plasma membrane permeabilization is observed, compared to the permeabilization promoted by the detergent Triton X-100, considered as 100 % (positive control for permeabilization). Then, a double-staining annexin V/propidium iodide (PI) assay was used to gain further information. As observed in Fig. 2D, the incubation of K562 cells with increasing concentration of ant venom resulted in double staining, i.e., annexin V and PI positive cells at 0.1 and 0.2 μg/mL concentrations, which is suggestive of the triggering of apoptosis followed by secondary necrosis.

Table 1
Chromatographic separation of crude venom obtained from *Odontomachus affinis* glands.

Peak	Retention time (min)	$[m/z]^{+1}$
1	9.35	654
		980
		1538
2	10.43	870
		1304
3	11.43	1427
4	12.02	850
		1275
5	13.68	865
		1297
6	15.12	1390
		1853
		1389.4
7	15.50	662
		992
8	15.83	651
		976
9	16.15	647
		969
10	17.20	23075[a]
11	19.49	625
		1338

[a] Deconvolution mass spectra due to the presence of multiples peaks with $[m/z]^{+1}$ of 891; 956; 1050; 1099; 1155; 1215; 1283; 1358; 1443; 1539; 1649; 1776; and 1910.

3.4. Cell death induced by Odontomachus affinis venom is associated with thiol oxidation and mitochondrial disfunction

To evaluate a possible effect of the venom on mitochondrial energetics, isolated rat liver mitochondria (RLM) were used as a model. The oxygen consumption was recorded in succinate-energized RLM suspension and the representative trace (Fig. 3A). The respiratory control ratio (RCR) was 7.1, calculated as the ratio between state 3 and state 4 respiratory rates, which shows the high quality and coupling of the mitochondrial preparation. The addition of the venom to the cuvette containing RLM suspension increased the mitochondrial basal respiration rate (state 4) from 5.67 nmol/mL/min to 8.03 and 10.87 nmol/mL/min at 0.1 and 0.2 μg/mL, respectively (Fig. 3A). Further, the addition of 0.1 and 0.2 μg/mL to digitonin-permeabilized K562 cells resulted in immediate dissipation of $\Delta\Psi$ (Fig. 3B). Further, the venom was incubated with K562 cells for 24 h. The reduced thiol groups of mitochondrial proteins and reduced glutathione (GSH) were quantified. The crude venom was able to oxidize protein thiol groups (Fig. 3C) but not GSH (Fig. 3D). Together these data indicate that *O. affinis* venom might trigger mitochondrial permeability transition (MPT), which accounts for the cytotoxicity.

4. Discussion

Nature has been inspiring researchers for a long time in the search or development of novel compounds with pharmacological potential (Neergheen-Bhujun et al., 2017; Newman and Cragg, 2020). In this scenario, venoms have been studied as a source of substances with biological activity, since they have a complex composition, including macromolecules, small organic molecules, and toxins (Bordon et al., 2020; Minutti-Zanella et al., 2021; Sadek et al., 2024). Amongst the venomous animals, insects are the largest group of organisms on earth, and the Hymenoptera order presents more than one hundred thousand extant species described (Stork, 2018). A recent study estimated number of ants on earth around 20×10^{15} individuals (Schultheiss et al., 2022), playing a pivotal role in the ecosystems. Thus, ants are a dominant group of venomous animals, presenting a well-developed venom apparatus and more than 70 % are stinging species. Among them, *O. affinis* is highlighted due to the large pair of strong mandibles to kill or maim the prey. Its distribution is strongly concentrated in tropical and subtropical regions, particularly in Brazil (Baccaro et al., 2015). However, the studies involving the venom from *O. affinis* ants are scarce and considering this lack of information led us to conduct this study. Since the composition of ant venoms is varied, but it is rich in peptides (Agarwal et al., 2022; Aili et al., 2016; Palma, 2006) the analysis of the *O. affinis* crude venom revealed 12 fractions possibly composed by peptides, with a mass-to-charge ration varying from 646.4 to 23075, and further studies will be conducted to identify all these peptides. Then, we performed a prospective investigation about the cytotoxic activity of the crude venom and investigated the underlying mechanisms to provide clues about the molecular action of this venom. For the first time, we showed that the venom from *O. affinis* presents a significant cytotoxic activity, which was associated with induction of thiol oxidation and

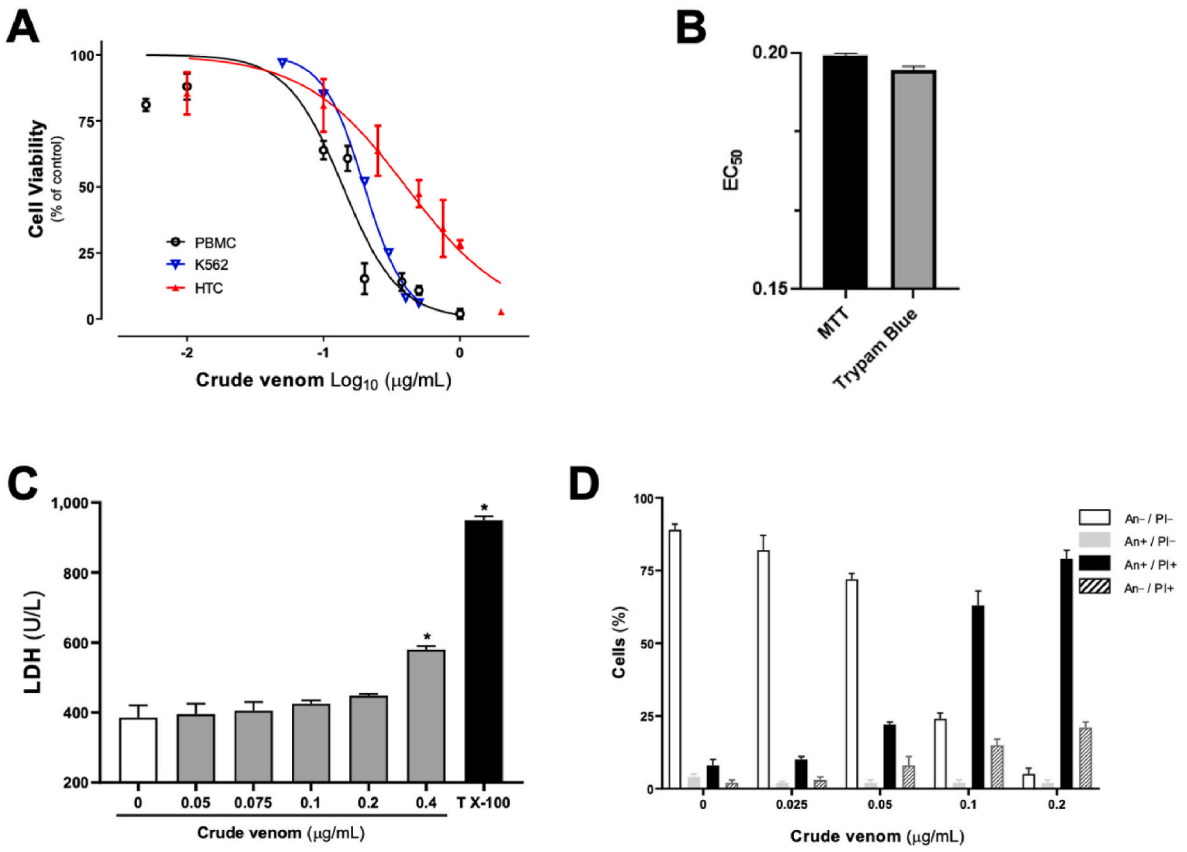


Fig. 2. Cytotoxicity of *O. affinis* venom *in vitro*. Cells (1×10^5 cells/mL) were incubated with increasing concentration of *O. affinis* venom extract for 24 h. (A) Concentration-response curves obtained by MTT assay in K562, HTC, and PBMCs cells. (B) Comparison of the half maximal effective concentration (EC_{50}) values obtained by two different methods (MTT and trypan blue) in K562 cells. (C) Release of LDH by K562 cells treated with the crude venom. Maximal release was achieved by incubation with 0.2 % Triton X-100. (D) Annexin V-FITC/PI double staining assay in K562 cells. Data are presented as mean ± S.E.M. from three independent experiments performed in triplicate. Statistical analysis was conducted using one-way ANOVA followed by Bonferroni's post hoc test for multiple comparisons. $p < 0.05$ was considered statistically significant. (For interpretation of the references to color in this figure legend, the reader is referred to the Web version of this article.)

Table 2
Half maximal effective concentration (EC_{50}) values calculated from concentration-response curves with different cells.

Cell line	EC_{50} (µg/mL)	Assay
K562	0.196	trypan blue
K562	0.199	MTT
HTC	0.400	MTT
PBMC	0.130	MTT

mitochondrial dysfunction.

The cytotoxicity exhibited by the crude extract was concentration-dependent, and it was not selective only for tumor cells since PBMC was also sensitive to the venom. This result is in accordance with those obtained in other studies that investigated the cytotoxicity of ant toxins (Arbiser et al., 2007; Noga et al., 2016; Wu et al., 1998). However, regarding *O. affinis* venom, further experiments are required to evaluate whether other normal cell types are also sensitive. To further investigate the mechanisms of cytotoxicity exhibited by the *O. affinis* venom, its ability to promote plasma membrane permeabilization was evaluated by the release of LDH by cells. Thus, the detection of higher LDH activity in the supernatant of treated cells in relation to control is indicative of plasma membrane permeabilization, which is a characteristic of necrotic cell death (de Faria et al., 2015). This was not observed by the action of the venom, at least at the EC_{50} concentration, i.e., the venom concentration that decrease cell viability by 50 %, which is about 0.2 µg/mL, indicating that the venom does not promote necrotic cell death. Then, a double-staining annexin V/propidium iodide (PI) assay was used to gain further information about the molecular features of cell death. Annexin V is a protein with a high affinity for phosphatidylserine, which is an apoptosis marker when externalized for dying cells, and PI is a fluorescent dye when bound to DNA, but it is cell impermeant, indicating membrane rupture in necrotic cells (Kabakov and Gabai, 2018). The incubation of cells with the venom for 24 h resulted in predominantly the positive staining for annexin V and for PI, which is suggestive of the occurrence of apoptotic program followed by secondary necrosis (Silva et al., 2015), which is relatively usual in chemical-induced apoptosis in *in vitro* assays, since there are no macrophages to phagocyte the apoptotic cells, evolving to secondary necrosis. In accordance, it was not observed significant plasma membrane permeabilization, assessed by the LDH release, at the EC_{50} concentration. At 0.4 µg/mL (2-fold EC_{50}), the crude venom of *O. affinis* promoted LDH release suggestive of non-regulated necrotic cell death.

Mitochondrial dysfunctions have been frequently related to the occurrence of cell death (Pessoto et al., 2007). The mitochondrial permeability transition is a process associated with the oxidation of thiol groups of proteins in the mitochondrial membranes (Pessoto et al., 2007; Santana et al., 2009), opening of the permeability transition pore, dissipation of mitochondrial $\Delta\psi$, calcium homeostasis disruption and release of apoptotic proteins, such as cytochrome *c* (Kroemer et al., 2007; Moraes et al., 2013, 2022). *Odontomachus affinis* venom increased the oxygen consumption in isolated mitochondria, which might be observed during uncoupling or permeabilization of the inner mitochondrial membrane. In K562 leukemia cells, the addition of the venom

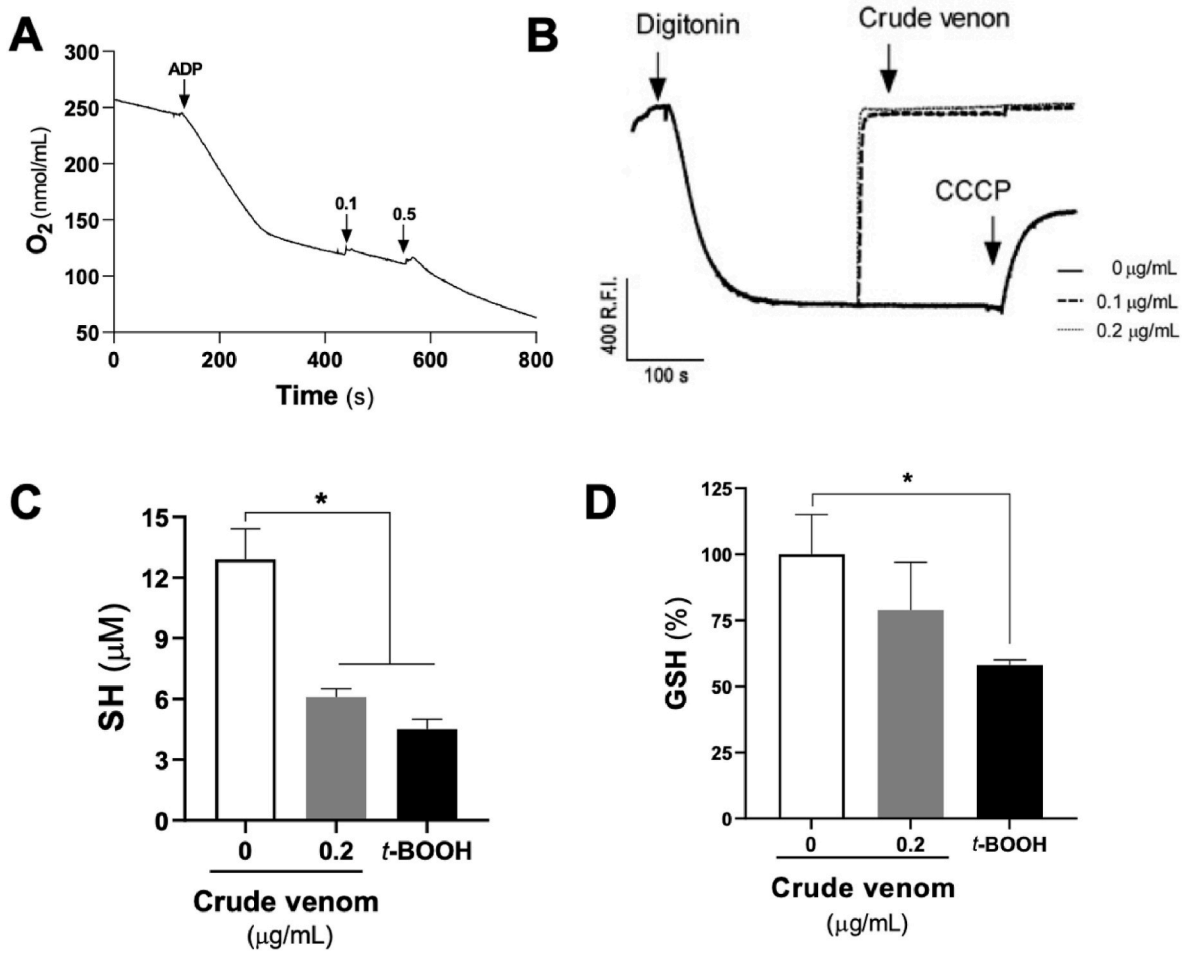


Fig. 3. *O. affinis* venom affects mitochondrial bioenergetics and promotes thiol oxidation. (A) Effects of the venom on state 4 mitochondrial respiration evaluated by succinate-supported oxygen consumption in isolated rat liver mitochondria. (B) Crude venom dissipated the mitochondrial membrane potential (ΔΨ) in K562 cells permeabilized with 0.004 % (w/v) digitonin. The ΔΨ formed by adding 5 mM succinate and 2.0 µM CCCP was used as positive control. Traces are representative of three independents experiments. R.F.I.: Relative fluorescence intensity. Oxidation of protein thiol groups (C) and GSH (D) in K562 cells incubated with 0.2 µg/µL of venom for 24 h. The oxidizing agent *t*-BOOH (2.0 mM) was used as positive control. Data are presented as mean ± S.E.M. of three independent experiments performed in triplicate. Data are presented as mean ± S.E.M. from three independent experiments performed in triplicate. Statistical analysis was conducted using one-way ANOVA followed by Bonferroni's post hoc test for multiple comparisons. *$p < 0.05$ was considered statistically significant.

resulted in the prompt dissipation of the mitochondrial membrane potential, which was associated with thiol oxidation but not GSH oxidation, indicating that *O. affinis* venom promotes mitochondrial permeabilization independent on oxidative stress, culminating with cell death. For the first time, these results contribute to unveiling the mechanisms of cytotoxicity of *O. affinis* venom.

Recently, Guimarães et al. (2023) identified multiple peptides in the extract of *O. chelifer* glands, including phospholipase A_2, which is capable of triggering the apoptotic cascade via mitochondrial cytochrome *c* release and caspase activation (Lee et al., 2006). In a similar context, Ascoët et al. (2023) demonstrated that a venom peptide from *Tetramorium bicarinatum*, named U9, exerts cytotoxicity in insect cells by inducing pore formation in mitochondrial membranes, leading to organelle disorganization and cell death. Although the venom composition of *O. affinis* has not yet been fully characterized at the peptide level, it is plausible that some of its peptides might share similar mechanisms of cytotoxicity with other ant venoms. Future studies are required to investigate whether any of the peptides identified in *O. affinis* venom share structural or functional similarities with U9 and could likewise contribute to mitochondrial damage and cytotoxicity.

5. Conclusion

Data presented highlighted the cytotoxic activity of the crude venom of the ant *Odontomachus affinis* and evidence of the mechanisms accounting for these effects (Fig. 4). Since, these ant species are endemic in Brazil, this study contributes to the comprehension of the mechanisms of toxicity elicited by their venom and also prospects a potential source for new bioactive molecules to be used as scaffolds for (bio)synthetic routes, highlighting the importance of biodiversity conservation and to deepen the studies to maintaining these sources of bioactive compounds and to prospect their biological activity. Therefore, protecting biodiversity is not only a matter of environmental preservation, but also of ensuring the continuity of scientific discoveries and technological innovations that can arise from bioprospecting.

CRediT authorship contribution statement

Jorge Luis Maria Ruiz: Investigation, Formal analysis, Writing – original draft, Data curation. **Vyctória dos Santos Ramos:** Investigation, Data curation. **Débora Cristina de Oliveira Gonçalves:** Investigation. **Thamires Regine Corga da Silva Angelo:** Investigation. **Priscila dos Santos Pazini:** Investigation. **Ricardo José Soares Torquato:** Investigation. **Wagner Alves de Souza Júdice:** Investigation,

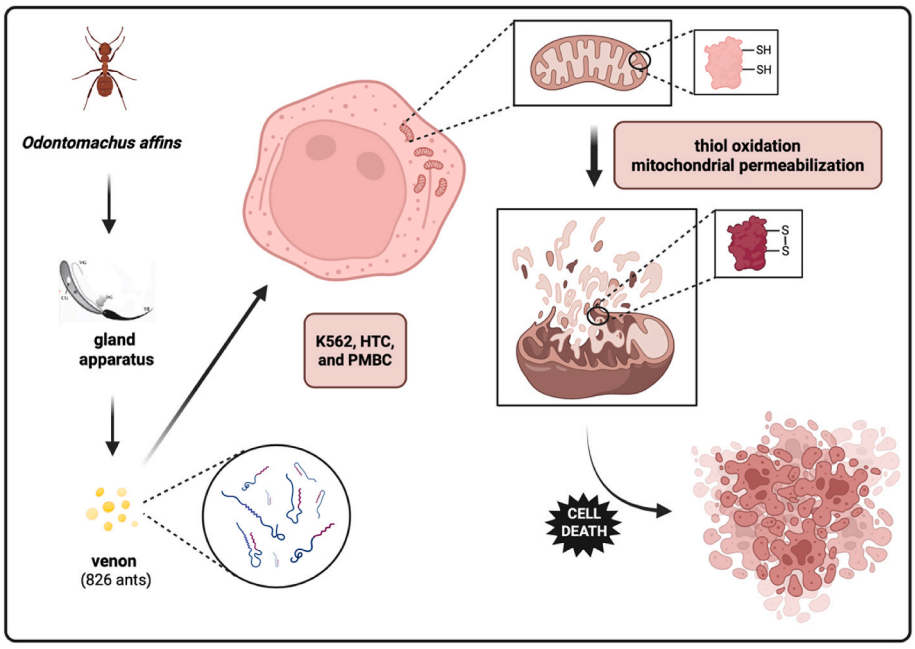


Fig. 4. Schematic illustration of the mechanisms of cytotoxicity of the venom obtained from the glands of *O. affinis* ants.

Formal analysis. **Antonio Miranda:** Formal analysis, Data curation. **Edgar Julian Paredes-Gamero:** Investigation, Writing – original draft. **Maria Santina de Castro Morini:** Project administration, Conceptualization, Writing – review & editing. **Tiago Rodrigues:** Project administration, Data curation, Writing – review & editing, Funding acquisition, Conceptualization, Supervision, Formal analysis.

Ethical statement

Hereby, I Tiago Rodrigues consciously assure that for the manuscript "Cytotoxic Activity of the Crude Venom from *Odontomachus affinis* Ants is Mediated by Thiol Oxidation and Mitochondrial Dysfunction" the following is fulfilled.

1) This material is the authors' own original work, which has not been previously published elsewhere.
2) The paper is not currently being considered for publication elsewhere.
3) The paper reflects the authors' own research and analysis in a truthful and complete manner.
4) The paper properly credits the meaningful contributions of co-authors and co-researchers.
5) The results are appropriately placed in the context of prior and existing research.
6) All sources used are properly disclosed (correct citation). Literally copying of text must be indicated as such by using quotation marks and giving proper reference.
7) All authors have been personally and actively involved in substantial work leading to the paper and will take public responsibility for its content.

All authors agree with the above statements and declare that this submission follows the policies of Toxicon as outlined in the Guide for Authors and in the Ethical Statement.

Funding

This work was supported by Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP) (Grant number: 2021/14650-3), Conselho Nacional de Pesquisa e Desenvolvimento Científico e Tecnológico (CNPq, Grant number: 306681/2023-4), and Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES, Grant number: Finance Code 001).

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

We acknowledge Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES), Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) and Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP) for financial support. We thank for J. F. Rezende, who kindly provided the photograph of *O. affinis*.

Data availability

Data will be made available on request.

References

Agarwal, S., Sharma, G., Verma, K., Latha, N., Mathur, V., 2022. Pharmacological potential of ants and their symbionts – a review. Entomol. Exp. Appl. 170 (12), 1032–1048. https://doi.org/10.1111/eea.13236.

Aili, S.R., Touchard, A., Koh, J.M., Dejean, A., Orivel, J., Padula, M.P., Escoubas, P., Nicholson, G.M., 2016. Comparisons of protein and peptide complexity in poneroid and formicoid ant venoms. J. Proteome Res. 15 (9), 3039–3054. https://doi.org/10.1021/acs.jproteome.6b00182.

Arbiser, J.L., Kau, T., Konar, M., Narra, K., Ramchandran, R., Summers, S.A., Vlahos, C. J., Ye, K., Perry, B.N., Matter, W., Fischl, A., Cook, J., Silver, P.A., Bain, J., Cohen, P., Whitmire, D., Furness, S., Govindarajan, B., Bowen, J.P., 2007. Solenopsin, the alkaloidal component of the fire ant (solenopsis invicta), is a naturally occurring inhibitor of phosphatidylinositol-3-kinase signaling and angiogenesis. Blood 109 (2), 560–565. https://doi.org/10.1182/blood-2006-06-029934.

Ascoët, S., Touchard, A., Téné, N., Lefranc, B., Leprince, J., Paquet, F., Jouvensal, L., Barassé, V., Treilhou, M., Billet, A., Bonnafé, E., 2023. The mechanism underlying toxicity of a venom peptide against insects reveals how ants are master at disrupting membranes. iScience 26 (3), 106157. https://doi.org/10.1016/j.isci.2023.106157.

Baccaro, F.B., Feitosa, R.M., Fernández, F., Fernandes, I.O., Izzo, T.J., de Souza, J.L.P., Solar, R.R.C., 2015. Guia Para Os Gêneros De Formigas Do Brasil. INPA. https://doi.org/10.5281/zenodo.32912.

Bolton, 2024. An Online Catalog of the Ants of the World. https://antcat.org.

Bordon, K.C.F., Cologna, C.T., Fornari-Baldo, E.C., Pinheiro-Junior, E.L., Cerni, F.A., Amorim, F.G., Anjolette, F.A.P., Cordeiro, F.A., Wiezel, G.A., Cardoso, I.A., Ferreira, I.G., de Oliveira, I.S., Boldrini-Franca, J., Pucca, M.B., Baldo, M.A., Arantes, E.C., 2020. From animal poisons and venoms to medicines: achievements, challenges and perspectives in drug discovery. Front. Pharmacol. 11, 1132. https://doi.org/10.3389/fphar.2020.01132.

Brandão, C.R.F., Silva, R.R., Delabie, J.C.H., 2009. Formigas (Hymenoptera). In: Panizzi, A.R., Parra, J.R.P. (Eds.), Bioecologia E Nutrição De Insetos: Base Para O Manejo Integrado De Pragas. Embrapa Informação Tecnológica, p. 1164.

Calgaro-Helena, A.F., Devienne, K.F., Rodrigues, T., Dorta, D.J., Raddi, M.S., Vilegas, W., Uyemura, S.A., Santos, A.C., Curti, C., 2006. Effects of isocoumarins isolated from Paepalanthus bromelioides on mitochondria: uncoupling, and induction/inhibition of mitochondrial permeability transition. Chem. Biol. Interact. 161 (2), 155–164. https://doi.org/10.1016/j.cbi.2006.04.006.

de Faria, P.A., Bettanin, F., Cunha, R.L., Paredes-Gamero, E.J., Homem-de-Mello, P., Nantes, I.L., Rodrigues, T., 2015. Cytotoxicity of phenothiazine derivatives associated with mitochondrial dysfunction: a structure-activity investigation. Toxicology 330, 44–54. https://doi.org/10.1016/j.tox.2015.02.004.

De la Mora, A., Livingston, G., Philpott, S.M., 2008. Arboreal ant abundance and leaf miner damage in coffee agroecosystems in Mexico. Biotropica 40 (6), 742–746. https://doi.org/10.1111/j.1744-7429.2008.00444.x.

Ferraz, L.S., Watashi, C.M., Colturato-Kido, C., Pelegrino, M.T., Paredes-Gamero, E.J., Weller, R.B., Seabra, A.B., Rodrigues, T., 2018. Antitumor potential of S-Nitrosothiol-Containing polymeric nanoparticles against melanoma. Mol. Pharm. 15 (3), 1160–1168. https://doi.org/10.1021/acs.molpharmaceut.7b01001.

Fox, E.G.P., Adams, R.M.M., 2022. On the biological diversity of ant alkaloids. Annu. Rev. Entomol. 67, 367–385. https://doi.org/10.1146/annurev-ento-072821-063525.

Guimarães, D.O., Ferro, M., Santos, T.S., Costa, T.R., Yoneyama, K.A.G., Rodrigues, V.M., Henrique-Silva, F., Rodrigues, R.S., 2023. Transcriptomic and biochemical analysis from the venom gland of the neotropical ant *Odontomachus chelifer*. Toxicon 223, 107006. https://doi.org/10.1016/j.toxicon.2022.107006.

Hanisch, P.E., Drager, K., Yang, W.H., Tubaro, P.L., Suarez, A.V., 2020. Intra- and interspecific variation in trophic ecology of 'predatory' ants in the subfamily Ponerinae. Ecol. Entomol. 45 (3), 444–455. https://doi.org/10.1111/een.12817.

Herzig, V., King, G.F., Undheim, E.A.B., 2019. Can we resolve the taxonomic bias in spider venom research? Toxicon X 1, 100005. https://doi.org/10.1016/j.toxcx.2018.100005.

Herzig, V., Cristofori-Armstrong, B., Israel, M.R., Nixon, S.A., Vetter, I., King, G.F., 2020. Animal toxins - nature's evolutionary-refined toolkit for basic research and drug discovery. Biochem. Pharmacol. 181, 114096. https://doi.org/10.1016/j.bcp.2020.114096.

Kabakov, A.E., Gabai, V.L., 2018. Cell death and survival assays. Methods Mol. Biol. 1709, 107–127. https://doi.org/10.1007/978-1-4939-7477-1_9.

Kazuma, K., Masuko, K., Konno, K., Inagaki, H., 2017. Combined venom gland transcriptomic and venom peptidomic analysis of the predatory ant *Odontomachus monticola*. Toxins 9 (10). https://doi.org/10.3390/toxins9100323.

Kroemer, G., Galluzzi, L., Brenner, C., 2007. Mitochondrial membrane permeabilization in cell death. Physiol. Rev. 87 (1), 99–163. https://doi.org/10.1152/physrev.00013.2006.

Lee, C., Park, D.W., Lee, J., Lee, T.I., Kim, Y.J., Lee, Y.S., Baek, S.H., 2006. Secretory phospholipase A2 induces apoptosis through TNF-alpha and cytochrome c-mediated caspase cascade in murine macrophage RAW 264.7 cells. Eur. J. Pharmacol. 536 (1–2), 47–53. https://doi.org/10.1016/j.ejphar.2006.02.043.

Lv, S., Wang, J., You, R., Liu, S., Ding, Y., Hadianamrei, R., Tomeh, M.A., Pan, F., Cai, Z., Zhao, X., 2022. Highly selective performance of rationally designed antimicrobial peptides based on ponericin-W1. Biomater. Sci. 10, 4848–4865. https://doi.org/10.1039/d2bm00744d.

Minutti-Zanella, C., Gil-Leyva, E.J., Vergara, I., 2021. Immunomodulatory properties of molecules from animal venoms. Toxicon 191, 54–68. https://doi.org/10.1016/j.toxicon.2020.12.018.

Mirzaei, S., Fekri, H.S., Hashemi, F., Hushmandi, K., Mohammadinejad, R., Ashrafizadeh, M., Zarrabi, A., Garg, M., 2021. Venom peptides in cancer therapy: an updated review on cellular and molecular aspects. Pharmacol. Res. 164, 105327. https://doi.org/10.1016/j.phrs.2020.105327.

Moraes, V.W., Caires, A.C., Paredes-Gamero, E.J., Rodrigues, T., 2013. Organopalladium compound 7b targets mitochondrial thiols and induces caspase-dependent apoptosis in human myeloid leukemia cells. Cell Death Dis. 4 (6), e658. https://doi.org/10.1038/cddis.2013.190.

Moraes, V.W.R., Santos, V.M., Suarez, E.R., Ferraz, L.S., Lopes, R.M., Mognol, G.P., Campeiro, J.D., Machado-Neto, J.A., Nascimento, F.D., Hayashi, M.A.F., Tersariol, I. L.S., Newmeyer, D.D., Rodrigues, T., 2022. Targeting Ca(2+) and mitochondrial homeostasis by antipsychotic thioridazine in leukemia cells. Life 12 (10). https://doi.org/10.3390/life12101477.

Mosmann, T., 1983. Rapid colorimetric assay for cellular growth and survival: application to proliferation and cytotoxicity assays. J. Immunol. Methods 65 (1–2), 55–63. https://doi.org/10.1016/0022-1759(83)90303-4.

Neergheen-Bhujun, V., Awan, A.T., Baran, Y., Bunnefeld, N., Chan, K., Dela Cruz, T.E., Egamberdieva, D., Elsasser, S., Johnson, M.V., Komai, S., Konevega, A.L., Malone, J. H., Mason, P., Nguon, R., Piper, R., Shrestha, U.B., Pesic, M., Kagansky, A., 2017. Biodiversity, drug discovery, and the future of global health: introducing the biodiversity to biomedicine consortium, a call to action. J. Glob. Health 7 (2), 020304. https://doi.org/10.7189/jogh.07.020304.

Newman, D.J., Cragg, G.M., 2020. Plant endophytes and epiphytes: burgeoning sources of known and "Unknown" cytotoxic and antibiotic agents? Planta Med. 86 (13–14), 891–905. https://doi.org/10.1055/a-1095-1111.

Noga, D.A., Brandao, L.E., Cagni, F.C., Silva, D., de Azevedo, D.L., Araujo, A., Dos Santos, W.F., Miranda, A., da Silva, R.H., Ribeiro, A.M., 2016. Anticonvulsant effects of fractions isolated from Dinoponera quadriceps (Kempt) ant venom (Formicidae: Ponerinae). Toxins 9 (1). https://doi.org/10.3390/toxins9010005.

Oliveira, D.d., Guerra-Duarte, C., Stransky, S., Scussel, R., Pereira de Castro, K.L., Costal-Oliveira, F., Aragão, M., Oliveira-Souza, G.d., Saavedra-Langer, R., Trevisan, G., Bonilla-Ferreyra, C., Chávez-Olórtegui, C., Machado-de-Ávila, R.A., 2023. Toxic and antigenic characterization of Peruvian Micrurus surinamensis coral snake venom. Toxicon 225, 107056. https://doi.org/10.1016/j.toxicon.2023.107056.

Palma, M.S., 2006. Chapter 56 - insect venom peptides. In: Kastin, A.J. (Ed.), Handbook of Biologically Active Peptides. Academic Press, pp. 389–396. https://doi.org/10.1016/B978-012369442-3/50059-3.

Pessoto, F.S., Faria, P.A., Cunha, R.L., Comasseto, J.V., Rodrigues, T., Nantes, I.L., 2007. Organotellurane-promoted mitochondrial permeability transition concomitant with membrane lipid protection against oxidation. Chem. Res. Toxicol. 20 (10), 1453–1461. https://doi.org/10.1021/tx700092r.

Raimundo, R., Freitas, A., Oliveira, P., 2009. Seasonal patterns in activity rhythm and foraging ecology in the neotropical forest-dwelling ant, Odontomachus chelifer (Formicidae: Ponerinae). Ann. Entomol. Soc. Am. 102, 1151–1157. https://doi.org/10.1603/008.102.0625.

Sadek, K.M., Shib, N.A., Taher, E.S., Rashed, F., Shukry, M., Atia, G.A., Taymour, N., El-Nablaway, M., Ibrahim, A.M., Ramadan, M.M., Abdelkader, A., Abdo, M., Imbrea, I., Pet, E., Ali, L.S., Abdeen, A., 2024. Harnessing the power of bee venom for therapeutic and regenerative medical applications: an updated review. Front. Pharmacol. 15, 1412245. https://doi.org/10.3389/fphar.2024.1412245.

Santana, D.P., Faria, P.A., Paredes-Gamero, E.J., Caires, A.C., Nantes, I.L., Rodrigues, T., 2009. Palladacycles catalyse the oxidation of critical thiols of the mitochondrial membrane proteins and lead to mitochondrial permeabilization and cytochrome c release associated with apoptosis. Biochem. J. 417 (1), 247–256. https://doi.org/10.1042/BJ20080972.

Schultheiss, P., Nooten, S.S., Wang, R., Wong, M.K.L., Brassard, F., Guenard, B., 2022. The abundance, biomass, and distribution of ants on Earth. Proc. Natl. Acad. Sci. U. S. A. 119 (40), e2201550119. https://doi.org/10.1073/pnas.2201550119.

Senji Laxme, R.R., Suranse, V., Sunagar, K., 2019. Arthropod venoms: biochemistry, ecology and evolution. Toxicon 158, 84–103. https://doi.org/10.1016/j.toxicon.2018.11.433.

Serrão, J.E., Martins, L.C.B., Santos, P.P., Gonçalves, W.G., 2015. Morfologia interna de poneromorfas. In: Delabie, J. (Ed.), As Formigas Poneromorfas Do Brasil. Editus.

Silva, M.F., Mota, C.M., Miranda Vdos, S., Cunha Ade, O., Silva, M.C., Naves, K.S., de Oliveira, F., Silva, D.A., Mineo, T.W., Santiago, F.M., 2015. Biological and enzymatic characterization of proteases from crude venom of the Ant Odontomachus bauri. Toxins 7 (12), 5114–5128. https://doi.org/10.3390/toxins7124869.

Skilleter, D., Cain, K., Dinsdale, D., Paine, A., 1985. Biochemical mechanisms and morphological selectivity in hepatotoxicity: studies in cultures of hepatic-parenchymal and non-parenchymal cells. Xenobiotica 15 (8–9), 687–693. https://doi.org/10.3109/00498258509047428.

Sorger, D.M.Z.H., 2011. On the ants (Hymenoptera: formicidae) of the Philippine Islands: V. The genus *Odontomachus* Latreille, 1804. Myrmecol News 14, 22.

Stork, N.E., 2018. How many species of insects and other terrestrial arthropods are there on Earth? Annu. Rev. Entomol. 63, 31–45. https://doi.org/10.1146/annurev-ento-020117-043348.

Suranse, V., Srikanthan, A., Sunagar, K., 2018. Animal venoms: origin, diversity and evolution. In: Els. John Wiley & Sons, Ltd. https://doi.org/10.1002/9780470015902.a0000939.pub2.

Tani, N., Kazuma, K., Ohtsuka, Y., Shigeri, Y., Masuko, K., Konno, K., Inagaki, H., 2019. Mass spectrometry analysis and biological characterization of the predatory ant *Odontomachus monticola* venom and venom sac components. Toxins 11 (1). https://doi.org/10.3390/toxins11010050.

Touchard, A., Dejean, A., Escoubas, P., Orivel, J., 2015. Intraspecific variations in the venom peptidome of the ant *Odontomachus haematodus* (Formicidae: Ponerinae) from French Guiana. J. Hymenopt. Res. 47. https://doi.org/10.3897/jhr.47.6804.

Touchard, A., Brust, A., Cardoso, F.C., Chin, Y.K., Herzig, V., Jin, A.H., Dejean, A., Alewood, P.F., King, G.F., Orivel, J., Escoubas, P., 2016. Isolation and characterization of a structurally unique beta-hairpin venom peptide from the predatory ant Anochetus emarginatus. Biochim. Biophys. Acta 1860 (11 Pt A), 2553–2562. https://doi.org/10.1016/j.bbagen.2016.07.027.

Touchard, A., Robinson, S.D., Lalagüe, H., Ascoët, S., Billet, A., Dejean, A., Téné, N.J., Petitclerc, F., Troispoux, V., Treilhou, M., Bonnafé, E., Vetter, I., Vizueta, J., Moreau, C.S., Orivel, J., Tysklind, N., 2024. Adaptive trade-offs between vertebrate defence and insect predation drive Amazonian ant venom evolution. Proc. R. Soc. A B 291, 20242184. https://doi.org/10.1098/rspb.2024.2184.

von Reumont, B.M., Anderluh, G., Antunes, A., Ayvazyan, N., Beis, D., Caliskan, F., Crnkovic, A., Damm, M., Dutertre, S., Ellgaard, L., Gajski, G., German, H., Halassy, B., Hempel, B.F., Hucho, T., Igci, N., Ikonomopoulou, M.P., Karbat, I., Klapa, M.I., Zancolli, G., 2022. Modern venomics-current insights, novel methods, and future perspectives in biological and applied animal venom research. GigaScience 11. https://doi.org/10.1093/gigascience/giac048.

Walker, A.A., 2020. The evolutionary dynamics of venom toxins made by insects and other animals. Biochem. Soc. Trans. 48 (4), 1353–1365. https://doi.org/10.1042/BST20190820.

Wu, Q.X., King, M.A., Donovan, G.R., Alewood, D., Alewood, P., Sawyer, W.H., Baldo, B. A., 1998. Cytotoxicity of pilosulin 1, a peptide from the venom of the jumper ant Myrmecia pilosula. Biochim. Biophys. Acta 1425 (1), 74–80. https://doi.org/10.1016/s0304-4165(98)00052-x.

DOCUMENTOS COMPROBATÓRIOS Nº 1/2025 - CICV/ILACVN

(Nº do Protocolo: NÃO PROTOCOLADO)

(Assinado digitalmente em 10/09/2025 11:29)
LIGIA DA FRE WINKERT
CHEFE DE DEPARTAMENTO - TITULAR
DAILACVN (10.01.06.03.04.01)
Matrícula: ###502#3

Visualize o documento original em https://sig.unila.edu.br/documentos/ informando seu número: ***1****, ano:* ***2025****, tipo:* ***DOCUMENTOS COMPROBATÓRIOS****, data de emissão:* ***10/09/2025*** *e o código de verificação:* ***023c7c2efe***

MEMÓRIA DA REUNIÃO ORDINÁRIA DO CENTRO INTERDISCIPLINAR DE CIÊNCIAS DA VIDA

Reunião:	**1ª Reunião Ordinária do Centro Interdisciplinar de Ciências da Vida (CICV) – semestre 2025.2**		
Data:	**29/08/2025**	**Horário:**	**10h**
Organização da reunião:	**Coordenação do CICV**	**Local:**	meet.google.com/skw-yvmt-fzx

a). expediente - ausências e justificativas de ausências

1. Ausências justificadas:
   Ehideé Isabel Gomez La Rotta
   Peter Löwenberg-Neto
   Cristian Antônio Rojas
   Jean Franciesco Vettorazzi
   Flavio Luiz Tavares
   Robson Zazula
   Kelvinson Viana
   Wagner Antônio Chiba De Castro
   Luis Fernando Boff Zarpelon
   Laura Cristina Pires Lima
   Maria Claudia Gross
   Fernando Kenji Nampo
   Luiz Roberto Ribeiro Faria Júnior

2. Composição Coordenação Colegiada e Colegiado do CICV
   I - Coordenador do CICV (membro nato), como presidente;
   II - Vice coordenador do CICV (membro nato), como vice-presidente;
   III - um representante escolhido dentre os coordenadores de curso de graduação oferecido pelo CICV e seu respectivo suplente...
   IV - Um representante escolhido dentre os coordenadores de projeto de pesquisa ou de ação de extensão lotados no CICV e seu respectivo suplente...
   Colegiado - todos os docentes vinculados ao CICV e em efetivo exercício (Discentes e TAEs)

- Professor Michel informou que foi enviado e-mail para todos os docentes do Centro Interdisciplinar de Ciências da Vida, solicitando indicação dos nomes (titulares e suplentes) até a data de 15 de setembro de 2025.

b). Ordem do dia

1. Mudança composição Coordenação CICV 2025/2027

Aprovar modificação na composição da Coordenação do CICV 2025/2027: Vice coordenação

- Prof. Cristian Antônio Rojas (atual); Prof. Jorge Luís Maria Ruiz (irá assumir a vice coordenação)

2. Aprovar Processo: 23422.006295/2024-48 - Afastamento para Pós-Doutorado no país

Relatório final de afastamento para Pós-Doutorado no país do docente: Jorge Luís Maria Ruiz, processo 23422.006295/2024-48. Período do afastamento: 22/06/2024 a 21/06/2025. Relatório final referente aos meses: fevereiro/25-julho/25 - relator Dr. Michel Rodrigo Zambrano Passarini.

3. **PITD - RESOLUÇÃO CONSUN N° 044, DE 18 DE DEZEMBRO DE 2014**

Preparação de aula, atendimento do aluno e avaliação de desempenho discente - (carga horária: de 1 (uma) até 1,5 (uma vez e meia) a carga horária de aula. Acrescentar até 1 hora semanal em casos de primeira oferta de disciplina pelo professor).

c). Presentes

1 - Alexandre Vogliotti
2 - Analia Rosario Lopes
3 – Angela Maria Arenas Velasquez
4 – Carmen Justina Gamarra
5 - Danubia Frasson Furtado
6 – Deborah Ariza
7 – Elaine Della Giustina Soares
8 - Fabiana Aidar Fermino
9 – Felipe de Lemos
10 - Giovana Secretti Vendruscolo
11 - Gleisson Alisson Pereira De Brito
12 - Hermes Jose Schmitz
13 - Jorge Luis Maria Ruiz
14 - Luiz Henrique Garcia Pereira
15 - Michel Rodrigo Zambrano Passarini
16 - Pablo Henrique Nunes
17 - Rafaella Costa Bonugli Santos
18 - Rodrigo Juliano Grignet

d). Pré-trabalho/Preparação (documentos, material de leitura etc.)

Descrição	Preparado por
Convite da Reunião	Coordenação do CICV

e). Agenda, Notas, Decisões e Questionamentos

Tópico	Responsável	Horário
1- Mudança composição Coordenação CICV 2025/2027 O Professor Jorge Luís Maria Ruiz absteve-se de votar, devido ser o candidato.	Michel Passarini	

- Aprovada por todos os demais presentes, sendo 17 votos favoráveis.		
2- Aprovar Processo: 23422.006295/2024-48 - Afastamento para Pós-Doutorado no país - Professor Jorge Luís Maria Ruiz absteve-se de votar, devido ser o interessado. - Aprovado por todos os demais presentes, sendo 17 votos favoráveis.	Michel Passarini	
3- **PITD - RESOLUÇÃO CONSUN N° 044, DE 18 DE DEZEMBRO DE 2014** - Foi informado sobre a resolução CONSUN N° 044 de 2014, com relação a correta carga horária a ser informada bem como a importância do preenchimento do quadro "Observações", de eventuais projetos (pesquisa/extensão) e portarias de nomeações (coordenações, colegiados, NDEs, GTs, entre outras), a todos os docentes presentes.	Michel Passarini	

f). Informes

---

g). Finalização

A reunião foi finalizada às 10 horas e 40 minutos.

ATA Nº 3/2025 - CICV (10.01.06.03.04.03)

(Nº do Protocolo: NÃO PROTOCOLADO)

(Assinado digitalmente em 03/09/2025 15:50)
ALEXANDRE VOGLIOTTI
PROFESSOR(A) DO MAGISTÉRIO SUPERIOR
CCBIO (10.01.06.03.04.03.01)
Matrícula: ###594#6

(Assinado digitalmente em 03/09/2025 09:45)
ANALIA ROSARIO LOPES
PROFESSOR(A) DO MAGISTÉRIO SUPERIOR
ILACVN (10.01.06.03.04)
Matrícula: ###602#9

(Assinado digitalmente em 02/09/2025 13:55)
ANGELA MARIA ARENAS VELASQUEZ
PROFESSOR(A) VISITANTE
ILACVN (10.01.06.03.04)
Matrícula: ###735#7

(Assinado digitalmente em 02/09/2025 14:02)
CARMEN JUSTINA GAMARRA
PROFESSOR(A) DO MAGISTÉRIO SUPERIOR
ILACVN (10.01.06.03.04)
Matrícula: ###421#5

(Assinado digitalmente em 02/09/2025 17:23)
DANUBIA FRASSON FURTADO
PROFESSOR(A) DO MAGISTÉRIO SUPERIOR
ILACVN (10.01.06.03.04)
Matrícula: ###863#5

(Assinado digitalmente em 03/09/2025 16:33)
DEBORAH ARIZA
PROFESSOR(A) VISITANTE
ILACVN (10.01.06.03.04)
Matrícula: ###825#7

(Assinado digitalmente em 04/09/2025 08:33)
ELAINE DELLA GIUSTINA SOARES
PROFESSOR(A) DO MAGISTÉRIO SUPERIOR
DEACEX (10.01.05.18.02)
Matrícula: ###601#2

(Assinado digitalmente em 03/09/2025 12:58)
FABIANA AIDAR FERMINO
PROFESSOR(A) DO MAGISTÉRIO SUPERIOR
ILACVN (10.01.06.03.04)
Matrícula: ###946#4

(Assinado digitalmente em 03/09/2025 16:27)
FELIPE DE LEMOS
PROFESSOR(A) VISITANTE
ILACVN (10.01.06.03.04)
Matrícula: ###581#9

(Assinado digitalmente em 02/09/2025 15:35)
GIOVANA SECRETTI VENDRUSCOLO
PROFESSOR(A) DO MAGISTÉRIO SUPERIOR
ILACVN (10.01.06.03.04)
Matrícula: ###997#0

(Assinado digitalmente em 02/09/2025 15:15)
GLEISSON ALISSON PEREIRA DE BRITO
PROFESSOR(A) DO MAGISTÉRIO SUPERIOR
ILACVN (10.01.06.03.04)
Matrícula: ###248#2

(Assinado digitalmente em 02/09/2025 16:44)
HERMES JOSE SCHMITZ
PROFESSOR(A) DO MAGISTÉRIO SUPERIOR
ILACVN (10.01.06.03.04)
Matrícula: ###614#9

(Assinado digitalmente em 02/09/2025 20:05)
JORGE LUIS MARIA RUIZ
PROFESSOR(A) DO MAGISTÉRIO SUPERIOR
ILACVN (10.01.06.03.04)
Matrícula: ###420#2

(Assinado digitalmente em 05/09/2025 18:41)
LUIZ HENRIQUE GARCIA PEREIRA
PROFESSOR(A) DO MAGISTÉRIO SUPERIOR
ILACVN (10.01.06.03.04)
Matrícula: ###995#9

(Assinado digitalmente em 02/09/2025 13:33)
MICHEL RODRIGO ZAMBRANO PASSARINI
COORDENADOR(A) DE CURSO - TITULAR

(Assinado digitalmente em 02/09/2025 13:39)
PABLO HENRIQUE NUNES
PROFESSOR(A) DO MAGISTÉRIO SUPERIOR

CICV (10.01.06.03.04.03)
Matrícula: ###909#5

ILACVN (10.01.06.03.04)
Matrícula: ###959#2

(Assinado digitalmente em 08/09/2025 16:12)
RAFAELLA COSTA BONUGLI SANTOS
PROFESSOR(A) DO MAGISTÉRIO SUPERIOR
ILACVN (10.01.06.03.04)
Matrícula: ###500#7

(Assinado digitalmente em 02/09/2025 14:58)
RODRIGO JULIANO GRIGNET
PROFESSOR(A) DO MAGISTÉRIO SUPERIOR
ILACVN (10.01.06.03.04)
Matrícula: ###402#6

*Visualize o documento original em https://sig.unila.edu.br/documentos/ informando seu número: **3**, ano: **2025**, tipo: **ATA**, data de emissão: **02/09/2025** e o código de verificação: **329b47e2fa***

CÓPIA DE ATA Nº 1/2025 - CICV/ILACVN

(Nº do Protocolo: NÃO PROTOCOLADO)

(Assinado digitalmente em 10/09/2025 11:29)
LIGIA DA FRE WINKERT
CHEFE DE DEPARTAMENTO - TITULAR
DAILACVN (10.01.06.03.04.01)
Matrícula: ###502#3

Visualize o documento original em https://sig.unila.edu.br/documentos/ informando seu número: ***1****, ano:* ***2025****, tipo:* ***CÓPIA DE ATA****, data de emissão:* ***10/09/2025*** *e o código de verificação:* ***bc6482b2ce***

MINISTÉRIO DA EDUCAÇÃO
UNIVERSIDADE FEDERAL DA INTEGRAÇÃO LATINO-AMERICANA
CENTRO INTERDISCIPLINAR DE CIÊNCIAS DA VIDA

DESPACHO Nº 2/2025/CICV/ILACVN

Nº do Protocolo: NÃO PROTOCOLADO

Foz Do Iguaçu-PR, 10 de setembro de 2025.

PARA CONSUNI ILACVN

Encaminha-se o presente processo com a aprovação do relatório final de afastamento para pós doutorado do professor JORGE LUIS MARIA RUIZ, no âmbito do CICV.

Para continuidade pelo CONSUNI ILACVN.

atenciosamente,

(Assinado digitalmente em 10/09/2025 11:47)
MICHEL RODRIGO ZAMBRANO PASSARINI
COORDENADOR(A) DE CURSO - TITULAR
CICV (10.01.06.03.04.03)
Matrícula: ###909#5

Processo Associado: 23422.006295/2024-48

Visualize o documento original em https://sig.unila.edu.br/public/documentos/index.jsp informando seu número: **2**, ano: **2025**, tipo: **DESPACHO**, data de emissão: **10/09/2025** e o código de verificação: **1682e44c03**