# AI Annotated Contract Review

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RESEARCH AGREEMENT 382  
THIS RESEARCH AGREEMENT 382 (the ³Agreement´) is made as of August 15,   
2023, by and between Project Apis m, a California nonprofit corporation (the ³PAm´), and   
Auburn University (the ³Contractor´).  
Recitals  
A.  
PAm is a party to a certain Research Management Agreement (the ³Funding   
Agreement´) with CropScience LP (³Bayer´), pursuant to which PAm receives funding from   
Bayer to support bee-related research. PAm desires to utilize a portion of such funding to   
engage Contractor to conduct certain research on the terms and conditions in this Agreement.  
B.  
Contractor desires to conduct the research as provided herein.  
Agreement  
NOW, THEREFORE, in consideration of the foregoing, and in reliance upon the mutual   
promises contained in this Agreement, the parties hereby agree as follows:  
1.  
Research. Contractor agrees to take the actions and conduct the research as set   
forth on Exhibit A hereto, including providing to PAm all deliverables described therein and the   
Reports (defined below) (the ³Project´). Dr. Geoffrey Williams shall be Contractor¶s project   
director for the Project (the ³Project Director´). Contractor shall maintain communication with   
the designated liaison for PAm regarding the status of the Project. Contractor shall provide PAm   
a copy of any final publication resulting from the Project.  
2.  
Reports. During the Term (defined below) Contractor shall provide to PAm: (i)   
regular project updates via email and telephone; (ii) detailed semi-annual reports due on October   
1 and April 1; and (iii) and a final report following completion of the Project (each a ³Report´   
and collectively, the ³Reports´). Each Report will include all elements outlined in PAm¶s online   
submission portal. Bayer and PAm shall be identified as the funding and research sponsor in all   
Reports. All Reports will be of high quality by professional and academic standards (the   
³Performance Standards´). PAm has the right to request, and Contractor shall provide, an update   
to and/or resubmission of any Report which does not meet the Performance Standards. In   
addition to the Reports, Contractor shall provide PAm with periodic updates regarding the   
Project, suitable for PAm to share with the general public, regarding new developments and   
overall status of the Project. PAm may provide copies of all Reports and other information   
regarding the Project to Bayer.  
3.  
Funding. PAm agrees to provide a total of $58,430.00 (the ³Funds´) to   
Contractor for performance of the Project, subject to and contingent upon PAm¶s receipt of such   
PO Box 26793  
Salt Lake City, UT 84126  
www.projectapism.org  
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Funds from Bayer pursuant to the terms of the Funding Agreement. The Funds are a fixed   
amount and are not subject to increase regardless of the amount expended by Contractor in   
performing the Project. The Funds will be distributed to Contractor, following receipt by PAm   
of an appropriate invoice from Contractor, in 2] installments, the first, $43,823.00 after signing   
this agreement], with the final installment, $14,607.00 being delivered to Contractor only   
following receipt by PAm of all deliverables set forth on Exhibit A and the final Report, each in   
form and substance satisfactory to PAm. If Contractor fails to timely produce any deliverables   
set forth in the Research Proposal or any Report or to resubmit any Report that does not meet the   
Performance Standards, then PAm may withhold any unpaid installments of Funds. No Funds   
may be used for overhead or indirect costs related to the performance of the Project. No Funds   
may be used in any manner for the purpose of influencing legislation and/or influencing   
governmental policy or action.   
4.   
Term and Termination. The term of the Agreement shall commence on the date   
hereof and end on July 1, 2025 (the ³Term´). This Agreement may be terminated prior to the   
expiration of the Term: (i) by PAm, if Contractor fails to produce Reports according to the   
Performance Standards or (ii) by PAm, if Contractor breaches or defaults in any of its   
representations, warranties, covenants or agreements set forth in this Agreement if such breach   
or default remains uncured following a ten (10) day cure period which shall commence upon   
PAm¶s written notice to Contractor of such breach or default; or (iii) by either party on thirty   
(30) days advance written notice to the other party. PAm shall have no obligation to pay any   
remaining installment payments of Funds that arise after the date of the termination of this   
Agreement. Upon termination of this Agreement, Contractor shall provide PAm with all   
complete and partially complete deliverables and Reports that exist as of the date of such   
termination.   
5.   
Independent Contractor Status. PAm and Contractor agree that Contractor and   
PAm are acting as independent parties and that Contractor is an independent contractor. Neither   
party shall be considered or represent itself as a joint venturer, partner, agent or employee of the   
other.   
6.   
Record Keeping. Contractor shall maintain accurate and complete books, records   
and accounts of all financial transactions pertaining to the Project and the Funds. Contractor shall   
permit PAm or its authorized representative to have access, during normal business hours, to all   
records necessary to support the amounts distributed for research hereunder. Contractor will use   
reasonable efforts to ensure that PAm receives all necessary documentation and responses to   
questions raised during an audit in a timely manner. PAm will provide notice to Contractor, of at   
least two (2) weeks prior to the commencement of any audit to allow the necessary time for   
Contractor to retrieve supporting documentation. Unless otherwise agreed to by the Parties in   
writing, Contractor shall retain its records for a period of at least five (5) years following the   
termination of this Agreement.   
7.   
Publicity. Contractor shall discuss and publish its findings with respect to the   
Project in scientific seminars, conferences, webinars, presentations and scientific journals,   
including venues and journals appropriate to communicate findings to commercial beekeepers.   
Contractor is required to prominently acknowledge the participation of PAm and Bayer¶s   
HealthyHives in the Project at all public announcements regarding the Project and is required to   
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prominently display the Project Apis m. and HealthyHives names, logos and trademarks on all   
written materials which are publicly released regarding the Project (including on websites);   
provided however that the right of Contractor to display the Project Apis m. and Healthy Hives   
names, logos and trademarks on written materials is limited solely to public written materials   
regarding the Project and for no other purpose. PAm may use Contractor¶s name and the name   
of Contractor¶s Project Director along with PAm¶s reason for funding the Project.   
8.  
Representations. Each party represents to the other that: he or it has full power,  
capacity and authority to enter into this Agreement; the execution, delivery, and performance of   
this Agreement has been duly authorized by all necessary action and constitutes a valid and   
binding obligation enforceable against him or it in accordance with its terms; no action, suit, or   
proceeding is pending or, to his or its knowledge, threatened against him or it before or by any   
court, administrative agency, or other governmental authority that brings into question the   
validity of the transactions contemplated by this Agreement. Contractor represents and warrants   
that Contractor will throughout the duration of this Agreement remain in strict compliance with   
all applicable laws and regulations.   
9.  
Third Party Claims. From and after the date hereof, Contractor shall defend and  
hold PAm harmless from and against any and all claims, liabilities, damages, losses or expenses   
(including reasonable attorney¶s fees) brought against PAm by third parties that arise from or are   
related to the acts or omissions of Contractor in connection with this Agreement.   
10.  
Miscellaneous. This Agreement constitutes the complete agreement between the  
parties with respect to the subject matter hereof and supersedes all previous agreements, whether   
written or oral. This Agreement may not be assigned by Contractor without the prior written   
consent of PAm. This Agreement may be amended by the written, mutual consent of the parties.   
The failure of a party to insist upon strict adherence to any provision of this Agreement on any   
occasion shall not be considered a waiver of such provision or deprive that party of the right   
thereafter to insist upon strict adherence to that provision or any other provision of this   
Agreement. This Agreement may be executed in counterparts, which, taken together, shall   
constitute the whole of the Agreement as between the parties. Electronic signatures shall have   
the same force and effect as manual signatures in respect of execution of this Agreement.   
 [SIGNATURE PAGE FOLLOWS]  
SIGNATURE PAGE TO RESEARCH AGREEMENT   
IN WITNESS WHEREOF, the parties hereto have executed this Agreement as of the date   
first set forth above.   
PAm:   
PROJECT APIS M   
By:   
\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_   
Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_   
Name: Danielle Downey   
Title: Executive Director   
CONTRACTOR:   
By: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_   
Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_   
Anthony Ventimiglia, Assistant VP   
for Research Administration for   
Steven Taylor, Senior VP for   
Research & Economic   
Development  
Digitally signed by Anthony Ventimiglia,   
Assistant VP for Research Administration   
for Steven Taylor, Senior VP for Research   
& Economic Development   
Date: 2023.08.01 08:48:48 -05'00'  
8/1/23  
EXHIBIT A   
   
   
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Management and dispersal of Tropilaelaps honey bee mites experiencing a   
continental climate.   
   
Problem and Significance   
   
This work addresses PAm¶s mission to improve honey bee health by examining management   
and biology of a honey bee pest which could severely impact U.S. beekeepers. The research will   
address knowledge gaps concerning the management and dispersal of the mite Tropilaelaps   
mercedesae in Apis mellifera honey bee colonies. This information will contribute to the   
development of appropriate plans if Tropilaelaps is introduced to the U.S., and will identify   
effective Tropilaelaps management strategies should it become established. To accomplish this,   
we will perform two field experiments in South Korea, and communicate our findings to   
appropriate government agencies and the beekeeping community.   
1. Principal Investigator(s)  
Rogan Tokach, Dan Aurell, Geoff Williams\*   
Entomology & Plant Pathology, Auburn University, Auburn AL, USA   
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\*Contact: 334-329-8202 | williams@auburn.edu   
   
Collaborator   
   
Chuleui Jung   
Andong National University, Andong, South Korea | cjung@andong.ac.kr   
https://orcid.org/0000-0001-8134-9279   
   
2. Date and Duration of Proposed Study   
   
Submission date: 1 June 2023   
Duration of study: 1 January 2024 ± 1 July 2025   
   
3. Problem and Significance   
   
The Tropilaelaps mercedesae mite has the potential to harm the U.S. beekeeping industry   
like the Varroa destructor mite has done since it was introduced to the U.S. in the 1980s. Reports   
from Asia, where the mite is currently present, suggest that Tropilaelaps parasitism causes   
greater colony losses than Varroa (Buawangpong et al. 2015; Ritter & Schneider-Ritter 1988).   
Feeding by Tropilaelaps on developing Apis mellifera honey bee larvae and pupae results in   
disease transmission, reduced honey bee weight upon adult emergence, and shortened adult   
honey bee life span (Khongphinitbunjong et al. 2015; 2016).   
To protect U.S. honey bees, it is critical to prepare for a potential future introduction of   
Tropilaelaps to the U.S. We currently lack knowledge on the mite¶s routes of dispersal between   
colonies, and we lack documented tools that can eradicate the mite without destroying colonies;   
these are two priorities identified by USDA-APHIS as critical to developing an appropriate   
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response plan. Knowledge of these areas of biology and management will be essential in an   
eradication program, but will also be useful for continued management if the mite becomes   
established in the U.S. Therefore, the proposed work fulfills PAm¶s overall mission of improving   
honey bee health by investigating practical, non-destructive control solutions for Tropilaelaps   
mites and by examining routes of Tropilaelaps dispersal.   
Similar to that of Varroa, the life cycle of Tropilaelaps has two phases ± reproductive and   
dispersal (Traynor et al. 2020; Woyke 1994). During the reproductive phase, they reproduce   
within capped brood cells and feed on developing larvae and pupae; during the dispersal phase,   
they reside on adult bees. The Tropilaelaps mite spends only one-half to one-third as much time   
in the dispersal phase as Varroa (Häubermann et al. 2016; Woyke 1994). This not only increases   
the reproductive rate of Tropilaelaps compared to Varroa, but also limits effective chemical   
control since most of the mites are protected by the wax capping of a brood cell (Buawangpong   
et al. 2015; Woyke 1987). Unlike Varroa, there is no evidence that Tropilaelaps feeds on adult   
honey bees during its dispersal phase (Rinderer et al. 1994).   
To completely eliminate Tropilaelaps without destroying colonies, we propose to deprive the   
mites of brood (eliminating their protected location and food source), and to apply chemical   
treatment when all mites are in the dispersal phase on adult bees. By caging the queen for 24   
days, we will induce the absence of brood (brood break), which has not been examined for   
Tropilaelaps control since the early 1990s in western Asia (Woyke 1985; Woyke 1994).   
Treatment with formic acid alone (a U.S.-registered treatment for honey bees) provided ~90%   
efficacy against Tropilaelaps (Pettis et al. 2017) but was not sufficient to eliminate them   
completely. By combining a brood break with chemical treatment with formic acid or oxalic   
acid, we hope to achieve 100% efficacy against Tropilaelaps.   
Also critical to developing a response to Tropilaelaps is an understanding of the ability of the   
mite to disperse between colonies and apiaries ± to assess the risk and speed of spread from a   
location of first introduction. It is speculated that Tropilaelaps mites primarily disperse among   
colonies via exchange of brood frames during colony equalization, splitting, and consolidation   
(K. Khongphinitbunjong, personal communication); however, drifting adult honey bees or   
robbing forager honey bees may also play a role (Rath et al. 1991; Laigo & Morse 1968). During   
the dispersal phase, Varroa mites in colonies with low infestation rates prefer to feed on nurse   
bees; however, that preference disappears with mites in highly infested colonies as they attach to   
older workers that leave the colony, enabling dispersal to other colonies (Cervo et al. 2014). To   
date, no studies have evaluated natural routes of Tropilaelaps mite dispersal. This is important to   
evaluating the feasibility of containment, especially because feral colonies would likely be   
present near infested colonies.   
   
4. Objectives   
   
1) To determine whether the combination of a brood break and chemical treatment eliminates or   
reduces Tropilaelaps mite infestation in Apis mellifera honey bee colonies.   
2) To describe natural dispersal routes of Tropilaelaps mites from Apis mellifera honey bee   
colonies.   
   
   
   
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5. Experimental Design and Methods   
   
Objective 1: To determine whether the combination of a brood break and chemical treatment   
eliminates or reduces Tropilaelaps mite infestation in Apis mellifera honey bee colonies.   
In South Korea during late summer 2024, four treatments groups each with 10 queenright   
Apis mellifera honey bee colonies will be rented from a local beekeeper. Initially, we will   
measure the population of brood and adult honey bees (Delaplane et al. 2013), and uncap 200   
brood cells to determine the Tropilaelaps infestation rate (Dietemann et al. 2013; Pettis et al.   
2017). We will also assess the infestation rate of adult honey bees using the alcohol wash method   
(Anderson & Roberts 2013). Colonies will be assigned to treatments, ensuring that colony   
strength and Tropilaelaps infestation are similar among groups. Treatment groups will include:   
1) negative control, no management action, 2) brood break only, 3) brood break + oxalic acid   
dribble, and 4) brood break + FormicPro®. These treatment groups were chosen because a brood   
break only management plan was shown to be effective in previous studies (Woyke 1985; 1994).   
Oxalic acid should also be effective when no brood are present, and formic acid was recently   
shown to be effective against Tropilaelaps mites in the presence of brood (Pettis et al. 2017). On   
experiment day 0, colonies receiving the brood break will have their queen caged in a QCC   
queen cage (Thorne Beekeeping) attached to the top of a centrally placed brood frame (Büchler   
et al. 2020). Colonies will again be assessed on day 24 for brood and adult honey bee population   
size, as well as adult honey bee Tropilaelaps infestation rate (Anderson & Roberts 2013;   
Delaplane et al. 2013). At this time, queens will be released because all mites will be in their   
dispersal phase on adult honey bees due to the brood break. In FormicPro® colonies, one strip   
will be applied on day 24, followed by a second strip on day 34. During the brood break, oxalic   
acid treatment colonies will receive treatment using the dribble/solution method according to the   
U.S. label rate. We suspect these treatments will be adequate because no mites will be protected   
in brood cells. Once the queen has been laying and brood are present, 200 cells per colony will   
again be uncapped on day 60 to measure infestation rate in brood cells, as well as adult honey   
bee infestation rate, and brood and adult bee population (Dietemann et al. 2013; Pettis et al.   
2017; Anderson & Roberts 2013 Delaplane et al. 2013).   
Pitfalls: A potential challenge to the proposed work is finding colonies with sufficient   
Tropilaelaps infestation rates. However, the South Korean collaborator has excellent connections   
with local beekeepers so we anticipate that appropriate colonies will be identified; they will work   
with beekeepers several months in advance of the trial to ensure success. Furthermore, the trial   
will be performed in late summer when mite populations are historically high. Lastly, is potential   
that our queens do not resume laying after 24 days of caging. This should be alleviated by our   
use of the large queen cage (33x12x80 mm), which is designed for extended caging events   
(Büchler et al. 2020). Nonetheless, we will have mated queens available in case of issues with   
queen re-establishment.   
   
Objective 2: To describe natural dispersal routes of Tropilaelaps mites from Apis mellifera honey   
bee colonies.   
   
At least 15 Apis mellifera honey bee colonies will be inspected by uncapping 200 brood   
cells to evaluate Tropilaelaps infestation rates (Dietemann et al. 2013; Pettis et al. 2017), and   
then assigned to three treatment groups: 1) normal-functioning colonies with a brood infestation   
rate of 1-5%, 2) normal-functioning colonies with a brood infestation rate of >10%, and 3)   
normal-functioning colonies with a brood infestation rate of >10% to be experimentally   
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weakened to encourage robbing. Treatment groups were chosen based on Varroa mites¶   
preference for nurse bees in colonies with a low mite infestation rate, which disappears with   
increasing infestation (Cervo et al. 2014). If Tropilaelaps dispersal is like that of Varroa, colonies   
with higher infestation rates will be more likely to have Tropilaelaps on exiting adults, and the   
weakened colonies would be most likely to have dispersal mites on exiting adults (including   
robber honey bees). Each colony will be fitted with a funnel trap designed to collect exiting adult   
honey bees (Medrzycki 2013). Traps will be engaged for 10-15 minutes once a week for two   
months so that adult worker and drone honey bees can be collected. We will assess the   
infestation rate of these trapped bees using the alcohol wash method (Anderson & Roberts 2013).   
Pitfalls: The major potential pitfall is improper functioning of the funnel trap. To avoid this,   
we are currently testing prototypes in Auburn after discussing with the researcher who originally   
designed the trap. As with Objective 1, low colony Tropilaelaps infestation rates could limit this   
work, but again we think this will be overcome with the connections of the South Korean   
collaborator to identify suitable colonies; additionally, colonies from his existing research apiary   
can be used.   
   
6. Intended Outcome   
   
The intended outcome of this work is twofold: first, to support the development of   
appropriate Tropilaelaps response guidelines by USDA-APHIS, and second, to inform U.S.   
beekeepers of effective Tropilaelaps management strategies. Knowledge concerning non-  
destructive honey bee colony actions, as well as natural dispersal of the mite, are critical to the   
development of an appropriate response plan.   
This work will be done in conjunction with similar research scheduled to be conducted in   
Thailand. Together, the proposed experiments in South Korea and the planned experiments in   
Thailand will prepare for an introduction of Tropilaelaps in cooler or warmer weather,   
respectively. By testing formic acid and oxalic acid in both these conditions, we will test   
management actions that suit the diverse climatic regions of the U.S. Furthermore, most work on   
Tropilaelaps biology and management has been performed in Thailand, but traits affecting   
management and dispersal could vary among regional populations of Tropilaelaps. By   
replicating the work in South Korea, we importantly would determine whether the Tropilaelaps   
dispersal behavior is consistent between these two potential source populations of Tropilaelaps   
mites.   
   
Dissemination of findings: Results from these experiments will be reported to USDA-APHIS to   
address their current knowledge gaps, and will be communicated through talks at national   
entomology and beekeeper meetings (e.g. Entomological Society of America, American   
Beekeeping Federation, American Honey Producers Association) and in scientific journals.   
   
7. Economic Feasibility for New Products   
   
We do not anticipate that any new products will be developed from this research. However,   
we anticipate identifying new uses for miticides (Formic Pro® and oxalic acid) and procedures   
(brood breaks) that are currently registered and employed in the U.S. If effective, both miticides   
could immediately be used by beekeepers against Tropilaelaps, should it be detected in the U.S.,   
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because products can be applied to a new target pest if they are applied according to label rates   
(FIFRA 2012).   
   
8. Project Timeline   
   
The proposed project timeline is for funding over 18 months to allow for all experiments to   
be conducted, data to be analyzed, and results be written and submitted to a scientific journal for   
publication (Table 1). Research will be conducted in 2024 with funds provided through June   
2025 to account for the open access publishing fee and communication of results to beekeepers.   
   
Table 1. Anticipated timeline of the proposed work. X denotes activity.   
Research Step   
2024   
2025   
Jan-Mar   
Apr-Jun   
July-Sept   
Oct-Dec   
Jan-Mar   
Apr-Jun   
Experimental design   
finalization   
X   
X   
   
   
   
   
Colonies first inspected   
for Tropilaelaps   
   
X   
   
   
   
   
Data collection   
   
   
X   
X   
   
   
Data analysis   
   
   
   
X   
   
   
Dissemination of   
results   
   
   
   
X   
X   
X   
   
9. Information Regarding Prior or Simultaneous Submissions   
   
A proposal has been submitted to USDA-APHIS to conduct a similar study in Thailand   
during Spring 2024. The purpose of performing similar work in different geographic regions of   
Asia is to ensure that Tropilaelaps and Apis mellifera populations from Thailand are not over-  
represented when building an understanding of this important parasite. It is possible that slight   
differences in genotype-environment interactions could misinform response guidelines and the   
U.S. beekeeping community (Büchler et al. 2014). The purpose of performing work in different   
climatic regions and at different periods of the year is to improve our understanding of how two   
active ingredients commonly used in the U.S. against Varroa ± formic acid and oxalic acid ± will   
perform against Tropilaelaps under conditions likely to be experienced by U.S. beekeepers. It is   
well-documented that the effectiveness of formic acid against Varroa is affected by ambient   
temperature (Steube et al. 2021); this is likely also the case for Tropilaelaps.   
   
10. Matching Funds Proposal   
   
This proposal does not include a request for matching funds.   
   
   
   
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11. References   
   
Anderson, D. L., Roberts, J. M. 2013. Standard methods for Tropilaelaps research. Journal of   
Apiculture Research 52(4): 1-16.   
Buawangpong, N., de Guzman, L. I., Khongphinitbunjong, K., Frake, A. M., Burgett, M.,   
Chantawannakul, P. 2015. Prevalence and reproduction of Tropilaelaps mercedesae and   
Varroa destructor in concurrently infested Apis mellifera colonies. Apidologie 46:779-786.   
Büchler, R., Costa, C., Hatjina, F., Andonov, S., Meixner, M.. D., Le Conte, Y., Uzunov, A.,   
Berg, S., Bienkowska, M., Bouga, M., Drazic, M., Dyrba, W., Kryger, P., Panasiuk, B.,   
Pechhacker, H., Petrov, P., Ke  
origin and its interaction with environmental effects on the survival of Apis mellifera L.   
colonies in Europe. Journal of Apicultural Research 52(2): 205-214.   
Pavlov, B.,   
Charistos, L., Formato, G., Galarza, E., Gerula, D., Gregorc, A., Malagini, V., Meixner, M.,   
, Z., Rivera-  
Vallon, J.,   
Vojt, D., Wilde, J., Nanetti, A. 2020. Summer brood interruption as integrated management   
strategy for effective Varroa control in Europe. Journal of Apiculture Research 59(5): 764-  
773.   
Cervo, R., Bruschini, C., Cappa, F., Meconcelli, S., Pieraccini, G., Pradella, D., Turillazzi, S.   
2014. High Varroa mite abundance influences chemical profiles of worker bees and mite-  
host preferences. Journal of Experimental Biology 217: 2998-3001.   
Delaplane, K. S., van der Steen, J., Guzman-Novoa, E. Standard methods for estimating strength   
parameters of Apis mellifera colonies. Journal of Apicultural Research 52(1): 1-12.   
Dietemann, V., Nazzi, F., Martin, S. J., Anderson, D. L., Locke, B., Delaplane, K. S., Wauquiez,   
Q., Tannahill, C., Frey, E., Ziegelmann, B., Rosenkranz, P., Ellis, J. D. 2013. Standard   
methods for varroa research. Journal of Apicultural Research 52(1): 1-54.   
Federal Insecticide, Fungicide, and Rodenticide Act, 7 U.S.C. 168 (2012).   
https://www.agriculture.senate.gov/imo/media/doc/FIFRA.pdf   
Häußermann, C. K., Ziegelmann, B., Rosenkranz, P. Spermatozoa capacitation in female Varroa   
destructor and its influence on the timing and success of female reproduction. Experimental   
and Applied Acarology 69: 371-387.   
Khongphinitbunjong, K., Neumann, P., Chantawannakul, P., Williams, G. R. 2016. The   
ectoparasitic mite Tropilaelaps mercedesae reduces western honey bee, Apis mellifera,   
longevity and emergence weight, and promotes Deformed wing virus infections. Journal of   
Invertebrate Pathology 137: 38-42.   
Khongphinitbunjong, K., de Guzman, L. I., Tarver, M. R., Rinderer, T. E., Chantawannakul, P.   
2015. Interactions of Tropilaelaps mercedesae, honey bee viruses and immune response in   
Apis mellifera. Journal of Apicultural Research 54(1): 40-47.   
Laigo, F. M., Morse, R. A. 1968. The mite Tropilaelaps clareae in Apis dorsata colonies in the   
Philippines. Bee World 49(3): 116-118.   
Medrzycki, P. 2013. Funnel trap ± a tool for selective collection of exiting forager bees for tests.   
Journal of Apicultural research 52(3): 122-123.   
Pettis, J. S., Rose, R., Chaimanee, V. 2017. Chemical and cultural control of Tropilaelaps   
mercedesae mites in honeybee (Apis mellifera) colonies in Northern Thailand. Plos One   
12(11).   
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Rath, W., Delfinado-Baker, M., Drescher, W. 1991. Observations on the mating behavior, sex   
ratio, phoresy and dispersal of Tropilaelaps clareae (Acari: Laelapidae). International   
Journal of Acarology 17(3): 201-208.   
Rinderer, T. E., Oldroyd, B. P., Lekprayoon, C., Wongsiri, S., Boonthai, C., Thapa, R. 1994.   
Extended survival of the parasitic honey bee mite Tropilaelaps clarea on adult workers of   
Apis mellifera and Apis dorsata. Journal of Apicultural Research 33(3): 171-174.   
Ritter, W., Scneider-Ritter, U. 1988. Differences in biology and means of controlling Varroa   
jacobsoni and Tropilaelaps clareae, two novel parasitic mites of Apis mellifera. pp. 387±395.   
In G. R. Needham, M. Delfinado- Baker and C. E. Bowman (eds.), Africanized honey bees   
and bee mites. Halstead Press, New York, NY.   
Steube, X., Beinert, P., Kirchner, W. H. 2021. Efficacy and temperature dependence of 60% and   
85% formic acid treatment against Varroa destructor. Apidologie 52: 720-729.   
Traynor, K. S., Mondet, F., de Miranda, J. R., Techer, M., Kowallik, V., Oddie, M. A. Y.,   
Chantawannakul, P., McAfee, A. 2020. Varroa destructor: a complex parasite, crippling   
honey bees worldwide. Trends in Parasitology 36(7): 592-606.   
Woyke, J. 1985. Further investigations into control of the parasite bee mite Tropilaelaps clareae   
without medication. Journal of Apicultural Research 24(4): 250-254.   
Woyke, J. 1987. Comparative population dynamics of Tropilaelaps clareae and Varroa   
jacobsoni mites on honeybees. Journal of Apicultural Research 26(3): 196-202.   
Woyke, J. 1994. Tropilaelaps clareae females can survive for four weeks when given open bee   
brood of Apis mellifera. Journal of Apicultural Research 33(1): 21-25.   
   
12. Budget Request   
   
Budget Summary   
Description   
Year 1 ($)   
Year 2 ($)   
Total ($)   
Salary   
25,453   
3,041   
28,494   
Benefits   
3,359   
934   
4,293   
Equipment   
0   
0   
   
Supplies   
650   
0   
650   
Travel (Domestic)   
1,262   
1,131   
2,393   
Travel (International)   
5,300   
0   
5,300   
Contractual   
15,300   
0   
15,300   
Other   
0   
2,000   
2,000   
Total Direct   
51,324   
7,106   
58,430   
Indirect   
0   
0   
0   
Total   
51,324   
7,106   
58,430   
   
Budget Justification   
Personnel   
Total funds requested are $28,494. This includes funds for Williams (PI) for 0.5 month totaling   
$5,994 to coordinate the project (experimental procedures, data collection and analyses, and   
communication of results). Funds also requested for a post-doc for 5 months, totaling $22,500;   
this person will be responsible for day-to-day operations, especially data collection and analysis,   
as well as preparation of a manuscript and delivery of presentations.   
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Fringe benefits   
Total funds requested are $4,293. This includes funds for Williams¶ fringe (30.7%) totaling   
$1,840 and post-doc fringe (10.9%) totaling $2,453.   
   
Equipment   
No funds are requested.   
   
Supplies   
Total funds requested are $650. This includes beekeeping treatment applications totaling $125,   
lab supplies (e.g. gloves, forceps, sealable bags, magnifiers and lights) for $100, beekeeping   
supplies (e.g. beesuit, smokers, hive tools) for $200, and bee entrance collectors $225 ($15 x 15   
hives).   
   
Travel   
Domestic: Total funds requested are $2,393. This includes funds for return shuttle between   
Auburn and ATL ($131 x 3 return trips) totaling $393. One trip is for travel to Korea, the other   
two trips is for travel to the two national beekeeper organization meetings to present results.   
Funds are further requested for flights and accommodation for the two beekeeper meetings (each   
of AHPA and ABF - $500 for travel and $500 for accommodation).   
International: Total funds requested for travel and accommodation associated with field work in   
Andong, Korea totaling $5,300. This includes $2,200 for the flight, $100 for return transport   
between Seoul and Andong, and $3,000 for accommodation ($1,000 x 3 months).   
   
Contractual   
Funds are requested so that contractual services can be provided by Andong University, South   
Korea for a total of $15,300. This is to support the project with local personnel and colony rental   
fees to perform the work.   
Salary: Total request is for $7,800. This is to fund 2 local students to support the project   
(each person: $1,300 x 3 months).   
Fringe: No fringe is required for the salary requests   
Other: Total request is $7,500 to rent honey bee colonies for use in the trial ($150 x 50   
colonies).   
   
Other   
Funds are requested to cover open access publication costs totaling $2,000.   
   
   
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## 🧠 AI Summary of Flagged Clauses

1. Clause 1:  
   "- 1 - RESEARCH AGREEMENT 382 THIS RESEARCH AGREEMENT 382 (the ³Agreement´) is made as of August 15, 2023, by and between Project Apis m, a California nonprofit corporation (the ³PAm´), and Auburn University (the ³Contractor´). Recitals A. PAm is a party to a certain Research Management Agreement (the ³Funding Agreement´) with CropScience LP (³Bayer´), pursuant to which PAm receives funding from Bayer to support bee-related research. PAm desires to utilize a portion of such funding to engage Contractor to conduct certain research on the terms and conditions in this Agreement. B. Contractor desires to conduct the research as provided herein. Agreement NOW, THEREFORE, in consideration of the foregoing, and in reliance upon the mutual promises contained in this Agreement, the parties hereby agree as follows: 1. Research. Contractor agrees to take the actions and conduct the research as set forth on Exhibit A hereto, including providing to PAm all deliverables described therein and the Reports (defined below) (the ³Project´). Dr. Geoffrey Williams shall be Contractor¶s project director for the Project (the ³Project Director´). Contractor shall maintain communication with the designated liaison for PAm regarding the status of the Project. Contractor shall provide PAm a copy of any final publication resulting from the Project. 2. Reports. During the Term (defined below) Contractor shall provide to PAm: (i) regular project updates via email and telephone; (ii) detailed semi-annual reports due on October 1 and April 1; and (iii) and a final report following completion of the Project (each a ³Report´ and collectively, the ³Reports´). Each Report will include all elements outlined in PAm¶s online submission portal. Bayer and PAm shall be identified as the funding and research sponsor in all Reports. All Reports will be of high quality by professional and academic standards (the ³Performance Standards´). PAm has the right to request, and Contractor shall provide, an update to and/or resubmission of any Report which does not meet the Performance Standards. In addition to the Reports, Contractor shall provide PAm with periodic updates regarding the Project, suitable for PAm to share with the general public, regarding new developments and overall status of the Project. PAm may provide copies of all Reports and other information regarding the Project to Bayer. 3. Funding. PAm agrees to provide a total of $58,430.00 (the ³Funds´) to Contractor for performance of the Project, subject to and contingent upon PAm¶s receipt of such PO Box 26793 Salt Lake City, UT 84126 www.projectapism.org - 2 - Funds from Bayer pursuant to the terms of the Funding Agreement. The Funds are a fixed amount and are not subject to increase regardless of the amount expended by Contractor in performing the Project. The Funds will be distributed to Contractor, following receipt by PAm of an appropriate invoice from Contractor, in 2] installments, the first, $43,823.00 after signing this agreement], with the final installment, $14,607.00 being delivered to Contractor only following receipt by PAm of all deliverables set forth on Exhibit A and the final Report, each in form and substance satisfactory to PAm. If Contractor fails to timely produce any deliverables set forth in the Research Proposal or any Report or to resubmit any Report that does not meet the Performance Standards, then PAm may withhold any unpaid installments of Funds. No Funds may be used for overhead or indirect costs related to the performance of the Project. No Funds may be used in any manner for the purpose of influencing legislation and/or influencing governmental policy or action. 4. Term and Termination. The term of the Agreement shall commence on the date hereof and end on July 1, 2025 (the ³Term´). This Agreement may be terminated prior to the expiration of the Term: (i) by PAm, if Contractor fails to produce Reports according to the Performance Standards or (ii) by PAm, if Contractor breaches or defaults in any of its representations, warranties, covenants or agreements set forth in this Agreement if such breach or default remains uncured following a ten (10) day cure period which shall commence upon PAm¶s written notice to Contractor of such breach or default; or (iii) by either party on thirty (30) days advance written notice to the other party. PAm shall have no obligation to pay any remaining installment payments of Funds that arise after the date of the termination of this Agreement. Upon termination of this Agreement, Contractor shall provide PAm with all complete and partially complete deliverables and Reports that exist as of the date of such termination. 5. Independent Contractor Status. PAm and Contractor agree that Contractor and PAm are acting as independent parties and that Contractor is an independent contractor. Neither party shall be considered or represent itself as a joint venturer, partner, agent or employee of the other. 6. Record Keeping. Contractor shall maintain accurate and complete books, records and accounts of all financial transactions pertaining to the Project and the Funds. Contractor shall permit PAm or its authorized representative to have access, during normal business hours, to all records necessary to support the amounts distributed for research hereunder. Contractor will use reasonable efforts to ensure that PAm receives all necessary documentation and responses to questions raised during an audit in a timely manner. PAm will provide notice to Contractor, of at least two (2) weeks prior to the commencement of any audit to allow the necessary time for Contractor to retrieve supporting documentation. Unless otherwise agreed to by the Parties in writing, Contractor shall retain its records for a period of at least five (5) years following the termination of this Agreement. 7. Publicity. Contractor shall discuss and publish its findings with respect to the Project in scientific seminars, conferences, webinars, presentations and scientific journals, including venues and journals appropriate to communicate findings to commercial beekeepers. Contractor is required to prominently acknowledge the participation of PAm and Bayer¶s HealthyHives in the Project at all public announcements regarding the Project and is required to - 3 - prominently display the Project Apis m. and HealthyHives names, logos and trademarks on all written materials which are publicly released regarding the Project (including on websites); provided however that the right of Contractor to display the Project Apis m. and Healthy Hives names, logos and trademarks on written materials is limited solely to public written materials regarding the Project and for no other purpose. PAm may use Contractor¶s name and the name of Contractor¶s Project Director along with PAm¶s reason for funding the Project. 8. Representations. Each party represents to the other that: he or it has full power, capacity and authority to enter into this Agreement; the execution, delivery, and performance of this Agreement has been duly authorized by all necessary action and constitutes a valid and binding obligation enforceable against him or it in accordance with its terms; no action, suit, or proceeding is pending or, to his or its knowledge, threatened against him or it before or by any court, administrative agency, or other governmental authority that brings into question the validity of the transactions contemplated by this Agreement. Contractor represents and warrants that Contractor will throughout the duration of this Agreement remain in strict compliance with all applicable laws and regulations. 9. Third Party Claims. From and after the date hereof, Contractor shall defend and hold PAm harmless from and against any and all claims, liabilities, damages, losses or expenses (including reasonable attorney¶s fees) brought against PAm by third parties that arise from or are related to the acts or omissions of Contractor in connection with this Agreement. 10. Miscellaneous. This Agreement constitutes the complete agreement between the parties with respect to the subject matter hereof and supersedes all previous agreements, whether written or oral. This Agreement may not be assigned by Contractor without the prior written consent of PAm. This Agreement may be amended by the written, mutual consent of the parties. The failure of a party to insist upon strict adherence to any provision of this Agreement on any occasion shall not be considered a waiver of such provision or deprive that party of the right thereafter to insist upon strict adherence to that provision or any other provision of this Agreement. This Agreement may be executed in counterparts, which, taken together, shall constitute the whole of the Agreement as between the parties. Electronic signatures shall have the same force and effect as manual signatures in respect of execution of this Agreement. [SIGNATURE PAGE FOLLOWS] SIGNATURE PAGE TO RESEARCH AGREEMENT IN WITNESS WHEREOF, the parties hereto have executed this Agreement as of the date first set forth above. PAm: PROJECT APIS M By: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Name: Danielle Downey Title: Executive Director CONTRACTOR: By: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Anthony Ventimiglia, Assistant VP for Research Administration for Steven Taylor, Senior VP for Research & Economic Development Digitally signed by Anthony Ventimiglia, Assistant VP for Research Administration for Steven Taylor, Senior VP for Research & Economic Development Date: 2023.08.01 08:48:48 -05'00' 8/1/23 EXHIBIT A 1 of 10 Management and dispersal of Tropilaelaps honey bee mites experiencing a continental climate. Problem and Significance This work addresses PAm¶s mission to improve honey bee health by examining management and biology of a honey bee pest which could severely impact U.S. beekeepers. The research will address knowledge gaps concerning the management and dispersal of the mite Tropilaelaps mercedesae in Apis mellifera honey bee colonies. This information will contribute to the development of appropriate plans if Tropilaelaps is introduced to the U.S., and will identify effective Tropilaelaps management strategies should it become established. To accomplish this, we will perform two field experiments in South Korea, and communicate our findings to appropriate government agencies and the beekeeping community. 1. Principal Investigator(s) Rogan Tokach, Dan Aurell, Geoff Williams\* Entomology & Plant Pathology, Auburn University, Auburn AL, USA https://orcid.org/0000-0002-0093-1126 \*Contact: 334-329-8202 | williams@auburn.edu Collaborator Chuleui Jung Andong National University, Andong, South Korea | cjung@andong.ac.kr https://orcid.org/0000-0001-8134-9279 2. Date and Duration of Proposed Study Submission date: 1 June 2023 Duration of study: 1 January 2024 ± 1 July 2025 3. Problem and Significance The Tropilaelaps mercedesae mite has the potential to harm the U.S. beekeeping industry like the Varroa destructor mite has done since it was introduced to the U.S. in the 1980s. Reports from Asia, where the mite is currently present, suggest that Tropilaelaps parasitism causes greater colony losses than Varroa (Buawangpong et al. 2015; Ritter & Schneider-Ritter 1988). Feeding by Tropilaelaps on developing Apis mellifera honey bee larvae and pupae results in disease transmission, reduced honey bee weight upon adult emergence, and shortened adult honey bee life span (Khongphinitbunjong et al. 2015; 2016). To protect U.S. honey bees, it is critical to prepare for a potential future introduction of Tropilaelaps to the U.S. We currently lack knowledge on the mite¶s routes of dispersal between colonies, and we lack documented tools that can eradicate the mite without destroying colonies; these are two priorities identified by USDA-APHIS as critical to developing an appropriate 1 6/6/2023 382\_WilliamsProposal 2 of 10 response plan. Knowledge of these areas of biology and management will be essential in an eradication program, but will also be useful for continued management if the mite becomes established in the U.S. Therefore, the proposed work fulfills PAm¶s overall mission of improving honey bee health by investigating practical, non-destructive control solutions for Tropilaelaps mites and by examining routes of Tropilaelaps dispersal. Similar to that of Varroa, the life cycle of Tropilaelaps has two phases ± reproductive and dispersal (Traynor et al. 2020; Woyke 1994). During the reproductive phase, they reproduce within capped brood cells and feed on developing larvae and pupae; during the dispersal phase, they reside on adult bees. The Tropilaelaps mite spends only one-half to one-third as much time in the dispersal phase as Varroa (Häubermann et al. 2016; Woyke 1994). This not only increases the reproductive rate of Tropilaelaps compared to Varroa, but also limits effective chemical control since most of the mites are protected by the wax capping of a brood cell (Buawangpong et al. 2015; Woyke 1987). Unlike Varroa, there is no evidence that Tropilaelaps feeds on adult honey bees during its dispersal phase (Rinderer et al. 1994). To completely eliminate Tropilaelaps without destroying colonies, we propose to deprive the mites of brood (eliminating their protected location and food source), and to apply chemical treatment when all mites are in the dispersal phase on adult bees. By caging the queen for 24 days, we will induce the absence of brood (brood break), which has not been examined for Tropilaelaps control since the early 1990s in western Asia (Woyke 1985; Woyke 1994). Treatment with formic acid alone (a U.S.-registered treatment for honey bees) provided ~90% efficacy against Tropilaelaps (Pettis et al. 2017) but was not sufficient to eliminate them completely. By combining a brood break with chemical treatment with formic acid or oxalic acid, we hope to achieve 100% efficacy against Tropilaelaps. Also critical to developing a response to Tropilaelaps is an understanding of the ability of the mite to disperse between colonies and apiaries ± to assess the risk and speed of spread from a location of first introduction. It is speculated that Tropilaelaps mites primarily disperse among colonies via exchange of brood frames during colony equalization, splitting, and consolidation (K. Khongphinitbunjong, personal communication); however, drifting adult honey bees or robbing forager honey bees may also play a role (Rath et al. 1991; Laigo & Morse 1968). During the dispersal phase, Varroa mites in colonies with low infestation rates prefer to feed on nurse bees; however, that preference disappears with mites in highly infested colonies as they attach to older workers that leave the colony, enabling dispersal to other colonies (Cervo et al. 2014). To date, no studies have evaluated natural routes of Tropilaelaps mite dispersal. This is important to evaluating the feasibility of containment, especially because feral colonies would likely be present near infested colonies. 4. Objectives 1) To determine whether the combination of a brood break and chemical treatment eliminates or reduces Tropilaelaps mite infestation in Apis mellifera honey bee colonies. 2) To describe natural dispersal routes of Tropilaelaps mites from Apis mellifera honey bee colonies. 2 6/6/2023 382\_WilliamsProposal 3 of 10 5. Experimental Design and Methods Objective 1: To determine whether the combination of a brood break and chemical treatment eliminates or reduces Tropilaelaps mite infestation in Apis mellifera honey bee colonies. In South Korea during late summer 2024, four treatments groups each with 10 queenright Apis mellifera honey bee colonies will be rented from a local beekeeper. Initially, we will measure the population of brood and adult honey bees (Delaplane et al. 2013), and uncap 200 brood cells to determine the Tropilaelaps infestation rate (Dietemann et al. 2013; Pettis et al. 2017). We will also assess the infestation rate of adult honey bees using the alcohol wash method (Anderson & Roberts 2013). Colonies will be assigned to treatments, ensuring that colony strength and Tropilaelaps infestation are similar among groups. Treatment groups will include: 1) negative control, no management action, 2) brood break only, 3) brood break + oxalic acid dribble, and 4) brood break + FormicPro®. These treatment groups were chosen because a brood break only management plan was shown to be effective in previous studies (Woyke 1985; 1994). Oxalic acid should also be effective when no brood are present, and formic acid was recently shown to be effective against Tropilaelaps mites in the presence of brood (Pettis et al. 2017). On experiment day 0, colonies receiving the brood break will have their queen caged in a QCC queen cage (Thorne Beekeeping) attached to the top of a centrally placed brood frame (Büchler et al. 2020). Colonies will again be assessed on day 24 for brood and adult honey bee population size, as well as adult honey bee Tropilaelaps infestation rate (Anderson & Roberts 2013; Delaplane et al. 2013). At this time, queens will be released because all mites will be in their dispersal phase on adult honey bees due to the brood break. In FormicPro® colonies, one strip will be applied on day 24, followed by a second strip on day 34. During the brood break, oxalic acid treatment colonies will receive treatment using the dribble/solution method according to the U.S. label rate. We suspect these treatments will be adequate because no mites will be protected in brood cells. Once the queen has been laying and brood are present, 200 cells per colony will again be uncapped on day 60 to measure infestation rate in brood cells, as well as adult honey bee infestation rate, and brood and adult bee population (Dietemann et al. 2013; Pettis et al. 2017; Anderson & Roberts 2013 Delaplane et al. 2013). Pitfalls: A potential challenge to the proposed work is finding colonies with sufficient Tropilaelaps infestation rates. However, the South Korean collaborator has excellent connections with local beekeepers so we anticipate that appropriate colonies will be identified; they will work with beekeepers several months in advance of the trial to ensure success. Furthermore, the trial will be performed in late summer when mite populations are historically high. Lastly, is potential that our queens do not resume laying after 24 days of caging. This should be alleviated by our use of the large queen cage (33x12x80 mm), which is designed for extended caging events (Büchler et al. 2020). Nonetheless, we will have mated queens available in case of issues with queen re-establishment. Objective 2: To describe natural dispersal routes of Tropilaelaps mites from Apis mellifera honey bee colonies. At least 15 Apis mellifera honey bee colonies will be inspected by uncapping 200 brood cells to evaluate Tropilaelaps infestation rates (Dietemann et al. 2013; Pettis et al. 2017), and then assigned to three treatment groups: 1) normal-functioning colonies with a brood infestation rate of 1-5%, 2) normal-functioning colonies with a brood infestation rate of >10%, and 3) normal-functioning colonies with a brood infestation rate of >10% to be experimentally 3 6/6/2023 382\_WilliamsProposal 4 of 10 weakened to encourage robbing. Treatment groups were chosen based on Varroa mites¶ preference for nurse bees in colonies with a low mite infestation rate, which disappears with increasing infestation (Cervo et al. 2014). If Tropilaelaps dispersal is like that of Varroa, colonies with higher infestation rates will be more likely to have Tropilaelaps on exiting adults, and the weakened colonies would be most likely to have dispersal mites on exiting adults (including robber honey bees). Each colony will be fitted with a funnel trap designed to collect exiting adult honey bees (Medrzycki 2013). Traps will be engaged for 10-15 minutes once a week for two months so that adult worker and drone honey bees can be collected. We will assess the infestation rate of these trapped bees using the alcohol wash method (Anderson & Roberts 2013). Pitfalls: The major potential pitfall is improper functioning of the funnel trap. To avoid this, we are currently testing prototypes in Auburn after discussing with the researcher who originally designed the trap. As with Objective 1, low colony Tropilaelaps infestation rates could limit this work, but again we think this will be overcome with the connections of the South Korean collaborator to identify suitable colonies; additionally, colonies from his existing research apiary can be used. 6. Intended Outcome The intended outcome of this work is twofold: first, to support the development of appropriate Tropilaelaps response guidelines by USDA-APHIS, and second, to inform U.S. beekeepers of effective Tropilaelaps management strategies. Knowledge concerning non- destructive honey bee colony actions, as well as natural dispersal of the mite, are critical to the development of an appropriate response plan. This work will be done in conjunction with similar research scheduled to be conducted in Thailand. Together, the proposed experiments in South Korea and the planned experiments in Thailand will prepare for an introduction of Tropilaelaps in cooler or warmer weather, respectively. By testing formic acid and oxalic acid in both these conditions, we will test management actions that suit the diverse climatic regions of the U.S. Furthermore, most work on Tropilaelaps biology and management has been performed in Thailand, but traits affecting management and dispersal could vary among regional populations of Tropilaelaps. By replicating the work in South Korea, we importantly would determine whether the Tropilaelaps dispersal behavior is consistent between these two potential source populations of Tropilaelaps mites. Dissemination of findings: Results from these experiments will be reported to USDA-APHIS to address their current knowledge gaps, and will be communicated through talks at national entomology and beekeeper meetings (e.g. Entomological Society of America, American Beekeeping Federation, American Honey Producers Association) and in scientific journals. 7. Economic Feasibility for New Products We do not anticipate that any new products will be developed from this research. However, we anticipate identifying new uses for miticides (Formic Pro® and oxalic acid) and procedures (brood breaks) that are currently registered and employed in the U.S. If effective, both miticides could immediately be used by beekeepers against Tropilaelaps, should it be detected in the U.S., 4 6/6/2023 382\_WilliamsProposal 5 of 10 because products can be applied to a new target pest if they are applied according to label rates (FIFRA 2012). 8. Project Timeline The proposed project timeline is for funding over 18 months to allow for all experiments to be conducted, data to be analyzed, and results be written and submitted to a scientific journal for publication (Table 1). Research will be conducted in 2024 with funds provided through June 2025 to account for the open access publishing fee and communication of results to beekeepers. Table 1. Anticipated timeline of the proposed work. X denotes activity. Research Step 2024 2025 Jan-Mar Apr-Jun July-Sept Oct-Dec Jan-Mar Apr-Jun Experimental design finalization X X Colonies first inspected for Tropilaelaps X Data collection X X Data analysis X Dissemination of results X X X 9. Information Regarding Prior or Simultaneous Submissions A proposal has been submitted to USDA-APHIS to conduct a similar study in Thailand during Spring 2024. The purpose of performing similar work in different geographic regions of Asia is to ensure that Tropilaelaps and Apis mellifera populations from Thailand are not over- represented when building an understanding of this important parasite. It is possible that slight differences in genotype-environment interactions could misinform response guidelines and the U.S. beekeeping community (Büchler et al. 2014). The purpose of performing work in different climatic regions and at different periods of the year is to improve our understanding of how two active ingredients commonly used in the U.S. against Varroa ± formic acid and oxalic acid ± will perform against Tropilaelaps under conditions likely to be experienced by U.S. beekeepers. It is well-documented that the effectiveness of formic acid against Varroa is affected by ambient temperature (Steube et al. 2021); this is likely also the case for Tropilaelaps. 10. Matching Funds Proposal This proposal does not include a request for matching funds. 5 6/6/2023 382\_WilliamsProposal 6 of 10 11. References Anderson, D. L., Roberts, J. M. 2013. Standard methods for Tropilaelaps research. Journal of Apiculture Research 52(4): 1-16. Buawangpong, N., de Guzman, L. I., Khongphinitbunjong, K., Frake, A. M., Burgett, M., Chantawannakul, P. 2015. Prevalence and reproduction of Tropilaelaps mercedesae and Varroa destructor in concurrently infested Apis mellifera colonies. Apidologie 46:779-786. Büchler, R., Costa, C., Hatjina, F., Andonov, S., Meixner, M.. D., Le Conte, Y., Uzunov, A., Berg, S., Bienkowska, M., Bouga, M., Drazic, M., Dyrba, W., Kryger, P., Panasiuk, B., Pechhacker, H., Petrov, P., Ke origin and its interaction with environmental effects on the survival of Apis mellifera L. colonies in Europe. Journal of Apicultural Research 52(2): 205-214. Pavlov, B., Charistos, L., Formato, G., Galarza, E., Gerula, D., Gregorc, A., Malagini, V., Meixner, M., , Z., Rivera- Vallon, J., Vojt, D., Wilde, J., Nanetti, A. 2020. Summer brood interruption as integrated management strategy for effective Varroa control in Europe. Journal of Apiculture Research 59(5): 764- 773. Cervo, R., Bruschini, C., Cappa, F., Meconcelli, S., Pieraccini, G., Pradella, D., Turillazzi, S. 2014. High Varroa mite abundance influences chemical profiles of worker bees and mite- host preferences. Journal of Experimental Biology 217: 2998-3001. Delaplane, K. S., van der Steen, J., Guzman-Novoa, E. Standard methods for estimating strength parameters of Apis mellifera colonies. Journal of Apicultural Research 52(1): 1-12. Dietemann, V., Nazzi, F., Martin, S. J., Anderson, D. L., Locke, B., Delaplane, K. S., Wauquiez, Q., Tannahill, C., Frey, E., Ziegelmann, B., Rosenkranz, P., Ellis, J. D. 2013. Standard methods for varroa research. Journal of Apicultural Research 52(1): 1-54. Federal Insecticide, Fungicide, and Rodenticide Act, 7 U.S.C. 168 (2012). https://www.agriculture.senate.gov/imo/media/doc/FIFRA.pdf Häußermann, C. K., Ziegelmann, B., Rosenkranz, P. Spermatozoa capacitation in female Varroa destructor and its influence on the timing and success of female reproduction. Experimental and Applied Acarology 69: 371-387. Khongphinitbunjong, K., Neumann, P., Chantawannakul, P., Williams, G. R. 2016. The ectoparasitic mite Tropilaelaps mercedesae reduces western honey bee, Apis mellifera, longevity and emergence weight, and promotes Deformed wing virus infections. Journal of Invertebrate Pathology 137: 38-42. Khongphinitbunjong, K., de Guzman, L. I., Tarver, M. R., Rinderer, T. E., Chantawannakul, P. 2015. Interactions of Tropilaelaps mercedesae, honey bee viruses and immune response in Apis mellifera. Journal of Apicultural Research 54(1): 40-47. Laigo, F. M., Morse, R. A. 1968. The mite Tropilaelaps clareae in Apis dorsata colonies in the Philippines. Bee World 49(3): 116-118. Medrzycki, P. 2013. Funnel trap ± a tool for selective collection of exiting forager bees for tests. Journal of Apicultural research 52(3): 122-123. Pettis, J. S., Rose, R., Chaimanee, V. 2017. Chemical and cultural control of Tropilaelaps mercedesae mites in honeybee (Apis mellifera) colonies in Northern Thailand. Plos One 12(11). 6 6/6/2023 382\_WilliamsProposal 7 of 10 Rath, W., Delfinado-Baker, M., Drescher, W. 1991. Observations on the mating behavior, sex ratio, phoresy and dispersal of Tropilaelaps clareae (Acari: Laelapidae). International Journal of Acarology 17(3): 201-208. Rinderer, T. E., Oldroyd, B. P., Lekprayoon, C., Wongsiri, S., Boonthai, C., Thapa, R. 1994. Extended survival of the parasitic honey bee mite Tropilaelaps clarea on adult workers of Apis mellifera and Apis dorsata. Journal of Apicultural Research 33(3): 171-174. Ritter, W., Scneider-Ritter, U. 1988. Differences in biology and means of controlling Varroa jacobsoni and Tropilaelaps clareae, two novel parasitic mites of Apis mellifera. pp. 387±395. In G. R. Needham, M. Delfinado- Baker and C. E. Bowman (eds.), Africanized honey bees and bee mites. Halstead Press, New York, NY. Steube, X., Beinert, P., Kirchner, W. H. 2021. Efficacy and temperature dependence of 60% and 85% formic acid treatment against Varroa destructor. Apidologie 52: 720-729. Traynor, K. S., Mondet, F., de Miranda, J. R., Techer, M., Kowallik, V., Oddie, M. A. Y., Chantawannakul, P., McAfee, A. 2020. Varroa destructor: a complex parasite, crippling honey bees worldwide. Trends in Parasitology 36(7): 592-606. Woyke, J. 1985. Further investigations into control of the parasite bee mite Tropilaelaps clareae without medication. Journal of Apicultural Research 24(4): 250-254. Woyke, J. 1987. Comparative population dynamics of Tropilaelaps clareae and Varroa jacobsoni mites on honeybees. Journal of Apicultural Research 26(3): 196-202. Woyke, J. 1994. Tropilaelaps clareae females can survive for four weeks when given open bee brood of Apis mellifera. Journal of Apicultural Research 33(1): 21-25. 12. Budget Request Budget Summary Description Year 1 ($) Year 2 ($) Total ($) Salary 25,453 3,041 28,494 Benefits 3,359 934 4,293 Equipment 0 0 Supplies 650 0 650 Travel (Domestic) 1,262 1,131 2,393 Travel (International) 5,300 0 5,300 Contractual 15,300 0 15,300 Other 0 2,000 2,000 Total Direct 51,324 7,106 58,430 Indirect 0 0 0 Total 51,324 7,106 58,430 Budget Justification Personnel Total funds requested are $28,494. This includes funds for Williams (PI) for 0.5 month totaling $5,994 to coordinate the project (experimental procedures, data collection and analyses, and communication of results). Funds also requested for a post-doc for 5 months, totaling $22,500; this person will be responsible for day-to-day operations, especially data collection and analysis, as well as preparation of a manuscript and delivery of presentations. 7 6/6/2023 382\_WilliamsProposal 8 of 10 Fringe benefits Total funds requested are $4,293. This includes funds for Williams¶ fringe (30.7%) totaling $1,840 and post-doc fringe (10.9%) totaling $2,453. Equipment No funds are requested. Supplies Total funds requested are $650. This includes beekeeping treatment applications totaling $125, lab supplies (e.g. gloves, forceps, sealable bags, magnifiers and lights) for $100, beekeeping supplies (e.g. beesuit, smokers, hive tools) for $200, and bee entrance collectors $225 ($15 x 15 hives). Travel Domestic: Total funds requested are $2,393. This includes funds for return shuttle between Auburn and ATL ($131 x 3 return trips) totaling $393. One trip is for travel to Korea, the other two trips is for travel to the two national beekeeper organization meetings to present results. Funds are further requested for flights and accommodation for the two beekeeper meetings (each of AHPA and ABF - $500 for travel and $500 for accommodation). International: Total funds requested for travel and accommodation associated with field work in Andong, Korea totaling $5,300. This includes $2,200 for the flight, $100 for return transport between Seoul and Andong, and $3,000 for accommodation ($1,000 x 3 months). Contractual Funds are requested so that contractual services can be provided by Andong University, South Korea for a total of $15,300. This is to support the project with local personnel and colony rental fees to perform the work. Salary: Total request is for $7,800. This is to fund 2 local students to support the project (each person: $1,300 x 3 months). Fringe: No fringe is required for the salary requests Other: Total request is $7,500 to rent honey bee colonies for use in the trial ($150 x 50 colonies). Other Funds are requested to cover open access publication costs totaling $2,000. 8 6/6/2023 382\_WilliamsProposal"  
   → Suggestion: Consider rephrasing this clause for clarity or reduced risk.