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Pilot study on the effect of a standardized earthworm humus extract on the populations of pest insects in a productive olive grove

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ABSTRACT

In the present study, the standardized, aqueous extract of earthworm humus, Bioremiq™ by Green Arsenal, which in Hungary, its country of origin, is licensed for use in organic crops as a growth enhancer and natural fertilizer. During April and July 2021, the effect of the product on the insect populations, present in an irrigated, conventional, productive olive grove, in Vartholomio, Prefecture of Ilia, was recorded. The product is reported to aid soil fertility restoration, plant growth stimulation, reduction of the negative effects of adverse weather conditions and increase of tolerance to various plant pathogens and pests. The analysis of its components shows a high content of macro- and trace elements, natural enzymes and hormones that contribute to healthy plant growth, while they seem to improve soil structure, improving the ability of plants to absorb nutrients, resulting in a quality and quantity produce increase. It is recommended for frequent use at all kinds of crops, mainly olive and various vegetables, and is applied both by foliar application and root irrigation. For the requirements of the study, we selected an 11-year-old olive grove, where the variety "Koroneiki" is cultivated, at of 7 x 7m distance. The experimental plot consisted of three rows of ten trees each: row E (application of Bioremiq™), row M (no intervention) and row C (according to the producer's program). In row E, five Bioremiq™ applications were performed, every 15 days, the first with root irrigation, the following foliarly, with 3L and 1L / acre respectively, according to the manufacturer's instructions. To record the insect populations, 10 days after each application, 4 branches (~ 20cm) were sampled from each tree, one from each side, a total of 40 branches from each row, 120 from the entire plot. Each branch was placed individually in a plastic bag and stored in the refrigerator until completion of the study. Significant presence of the harmful insects *Prays oleae*, *Palpita unionalis*, *Euphyllura olivina* and *Liothrips oleae* was recorded, while we also detected a scattered presence of *Rhynchites cribripennis*, *Dasyneura oleae*, *Drosophila suzuki*, *Chrysopa* sp. and *Mantis religiosa* and of the mites *Tetranychus urticae* and *Eriophyes oleae*. The results were studied on Excel for trend visualization and then put into SPSS for statistical comparison. There was an obvious trend of population decline, probably also due to climatic factors; nevertheless, a clear statistically significant difference was observed between the Bioremiq™ and conventionally treated rows compared to the control, for all insect species. A statistically significant difference (paired value t-test) between Bioremiq™ and the control was clear for *L. oleae* (p value = 0.033) and *P. unionalis* (p value = 0.317), at 95% significance level.

KEY WORDS: compost, growth enhancer, *Prays oleae*, *Palpita unionalis*, *Euphyllura olivina*, *Liothrips oleae*.

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Introduction

Olive production plays a vital role in Greece's agricultural heritage, economy, and culinary traditions, making it a cornerstone of the country's identity. Olives have been a significant part of Greek culture and economy for millennia. The olive tree is deeply intertwined with Greek mythology, and olive oil has been used in Greek cuisine, medicine, and religious ceremonies since ancient times.

Greece has a diverse climate and terrain, which is well-suited for olive cultivation. Olive trees are grown throughout the country, with major production regions including Crete, Peloponnese, and the Aegean islands. Overall, Greece is home to several olive varieties, each with its own unique characteristics and flavor profiles. Some popular Greek olive varieties include Kalamata, Koroneiki, Amfissa, and Manzanilla. The Koroneiki olive variety is particularly important in Greece, accounting for a significant portion of the country's olive oil production. Known for its high oil content and robust flavor, Koroneiki variety gives olives primarily used for oil production rather than table consumption. Olive cultivation in Greece typically follows traditional methods, with many small-scale producers using differential farming practices. Olives are harvested during autumn, and then processed to extract olive oil or for other uses. Olive cultivation is a crucial sector of the Greek economy, providing income and employment for many rural communities. Olive oil exports are an essential source of revenue for Greece, with Greek olive oil prized for its quality and flavor in international markets. However, despite its long history and favorable growing conditions, Greek olive industry faces challenges such as climate change, pests and diseases, and market competition and efforts are being made to modernize and innovate within the sector to ensure its sustainability and resilience (Therios, 2005).

Amongst the most significant challenges to olive cultivation in Greece are insect pests that affect both olive fruit production as well as quality of olive oil. Some key species that are encountered are *Bactrocera oleae* (Rossi), (Diptera: Tephritidae), *Prays oleae* Bern. (Lepidoptera: Yponomeutidae), *Palpita unionalis* (Hübner) (Lepidoptera: Pyralidae), *Closterotomus* (*Calocoris*) *trivialis* (Costa) (Heteroptera: Miridae), *Parlatoria oleae* (Colvee) (Hemiptera: Diaspididae), *Aspidiotus nerii* Bouché (Hemiptera: Diaspididae), *Euphyllura* spp. (Hemiptera: Psyllidae), and *Rhynchites cribripennis* Desbrochers (Coleoptera: Attelabidae). Controlling these pests in olive cultivation often involves integrated pest management (IPM) strategies, which may include cultural practices, biological control methods, and judicious use of pesticides. Monitoring pest populations, maintaining tree health, and implementing preventative measures can help minimize the impact of insect pests on olive production in Greece (Zartaloudis, 2006).

With environmental degradation and climate change at the forefront of our global concerns, the impact of agriculture on the environment is increasingly under scrutiny (EEA, 2021; Lynch et al.,2021; FAO, 2020). Within the framework of the EU Green Deal, there's a concerted effort to diminish the environmental and climate effects of the EU food system. One of the focal points is the escalating use of chemical insecticides, which can persist in the soil for decades post-application, posing serious health hazards (Tsiantas et al., 2021).

The formulated product Bioremiq™ (Green Arsenal, Hungary) is recommended for application in organic crops as a growth enhancer and natural fertilizer. It is a watery extract of earthworm humus for which the distributor asserts that, as a natural bacterial

culture, it facilitates soil life recovery and is recommended for poor soils; it supports plants' physiological processes, helps crops absorb nutrients more easily, decreasing the use of fertilizers and chemicals while promoting yield (mass and nutrient content); it is considered an aid to make plants more drought resistant, assists crops against pests and diseases. The analysis of its ingredients shows a high content of macro- and trace elements, natural enzymes and hormones. Regular use is recommended in all types of crops, mainly olive and various horticultural crops, while its application is done both by root irrigation and foliar sprays. In a study conducted in 2020 by György Dudok (Lipthay Béla Secondary School of Agriculture, Szécsény, Hungary), 100% of treated corn developed a second ear by late July vs 40% for the control and by harvest, grain weight was higher by 22.4% and crude protein content by 6.9%. Likewise, the grain weight of treated sunflower was higher by 40.1%, and oil content of seeds by 15.3%. Finally, in treated rapeseed, two months after treatment, pests were hardly present on the treated group (about 10% compared to the control) while the control group was densely populated by Curculionidae species and other phytophagous beetles. Dudok concluded that in general, Bioremiq™ treated plants looked sappier, luscious and lively, while differences were observed in the leaf color, stem thickness and height, crop density and

FIG. 1.**:** Location of the olive grove where the trial took place in Vartholomio, Prefecture of Ilia.

number of pests present (personal communication).

In the present study, Bioremiq™, was tested on olive trees of the Koroneiki variety, in an 11-year-old irrigated, productive olive grove, in Vartholomio, Ilia Prefecture, where during April-July 2021 the present insect populations were recorded.

Materials and Methods

The olive grove in which the trial took place is situated in Vartholomio, Prefecture of Ilia, and consists of 660 olive trees at planting distances of 7x7m (Figure 1).

The trial was conducted at three consecutive rows of ten olive trees each (Figure 2) as follows:

(E) row: application of Bioremiq™

(M) row: positive control (no application), at the west of (E) row and

(C) row: negative control (conventional insecticides as applied for the rest of the olive grove by the grower), at the west of (M) row.

A total of 5 Bioremiq™ applications were performed on the (E) trees, the first one as root irrigation with 2 liters of Bioremiq™ in 200 liters of water (20 liters per tree), on 25/04/2021, the remaining four as foliar spraying with 1% aqueous Bioremiq™ solution (on 09/05/2021, 22/05/2021, 12/06/2021 and 27/06/2021).

FIG. 2.**:** Set up of the trial in three rows: (E) Bioremiq™ (M) positive control (no application), (C) negative control (conventional insecticides)

On the negative control tress (row C), two conventional treatments were performed, the first on 15/05/2021 (deltamethrin + liquid copper) and the second on 30/06/2021 (λ-cyhalothrin + copper hydroxide and 20-20-20 foliar fertilizer).

Sampling was performed a few days (~10) after each application, depending on weather conditions as follows: 4 twigs (~20cm) were sampled from each tree, oriented to the four points of the horizon (North-East-South-West, 40 twigs from each row in total, 120 for each sampling. Each twig was separately placed in a plastic bag and kept in the fridge refrigerator until examination.

The climate data for the area were recorded via Meteoblue.com (Figure 3).

Results

A significant presence of the harmful insects *Prays oleae*, *Palpita unionalis*, *Euphyllura olivina* and *Liothrips oleae* was recorded, while the species *Closterotomus* (*Calocoris*) *trivialis*, *Rhynchites cribripennis*, *Dasyneura oleae* and *Drosophila suzuki* were scarcely observed, as well as the mites *Tetranychus urticae* and *Eriophyes oleae* and the beneficial insects *Chrysopa* sp. and *Mantis religiosa*.

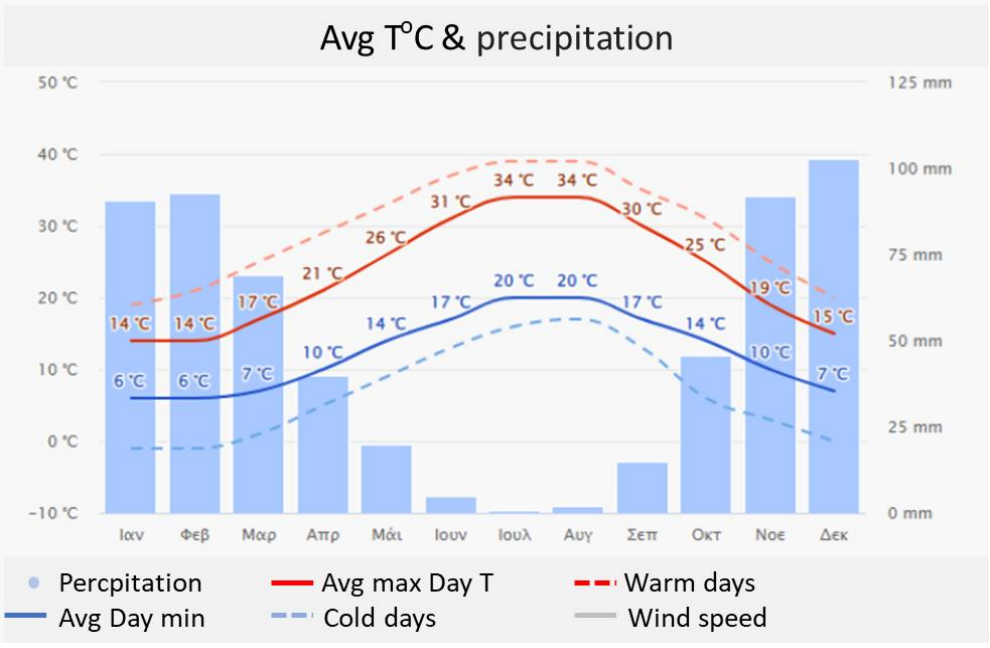
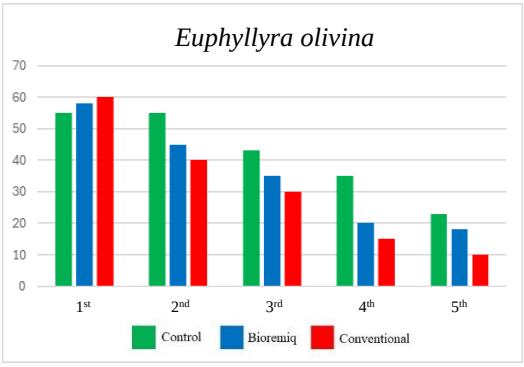
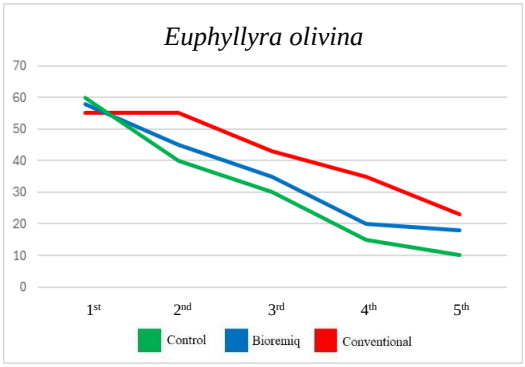
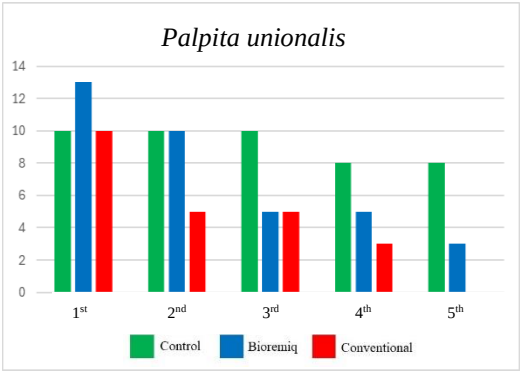
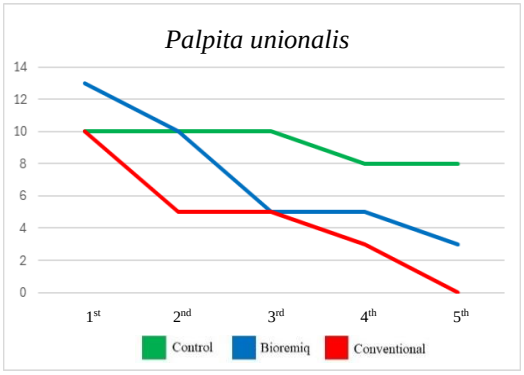


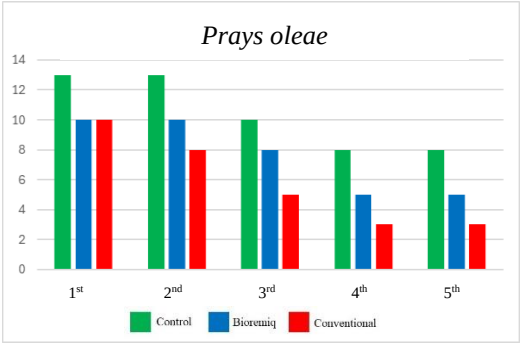
FIG. 3.: Climate data for the area of Vartholomio, Prefecture of Ilia, as recorded via Meteoblue.com

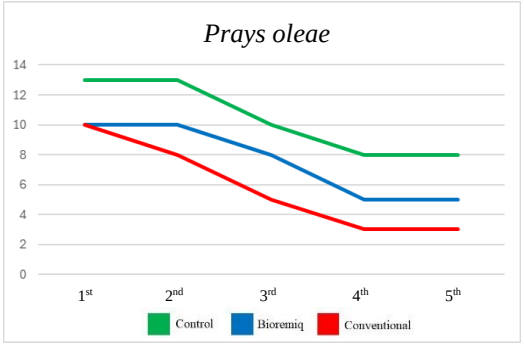


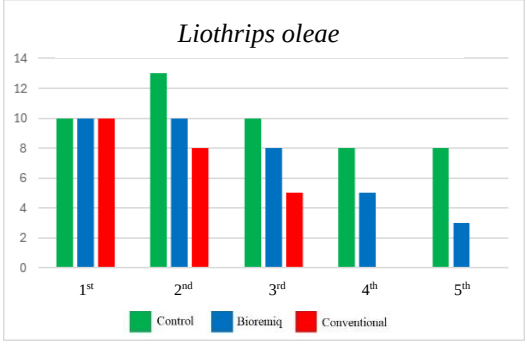


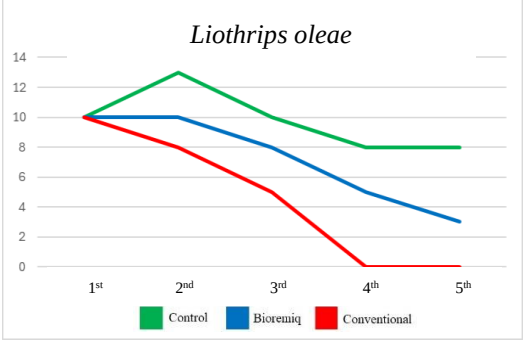












Conclusions

The recordings were visualized in trends and then statistically compared in SPSS. An obvious trend of decreasing populations was recorded which is probably also due to climatic factors, although a clear difference was observed in the Bioremiq™ and conventional treatments series compared to the control, for all species.

Statistically significant difference (paired value t-test) * between Bioremiq™ and control is clearly distinguished for the *Liothrips oleae* (p value=0.033) and marginally for the *Palpita unionalis* (p value=0.317), at a significance level of 95%.

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Πιλοτική μελέτη επί της επίδρασης τυποποιημένου εκχυλίσματος χούμου γαιοσκωλήκων στους πληθυσμούς επιβλαβών εντόμων σε παραγωγικό ελαιώνα

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ΠΕΡΙΛΗΨΗ

Στην παρούσα μελέτη δοκιμάστηκε το τυποποιημένο, υδατικό εκχύλισμα χούμου γαιοσκωλήκων, Bioremiq™ της Green Arsenal, το οποίο στην Ουγγαρία, χώρα προέλευσής του, έχει άδεια εφαρμογής σε βιολογικές καλλιέργειες ως ενισχυτικό ανάπτυξης και φυσικό λίπασμα. Την περίοδο Απριλίου-Ιουλίου 2021, καταγράφηκε η επίδραση του σκευάσματος στους πληθυσμούς εντόμων σε αρδευόμενο, παραγωγικό ελαιώνα συμβατικής καλλιέργειας, στο Βαρθολομιό, Ν. Ηλείας. Το σκεύασμα αναφέρεται ότι βοηθά στην αποκατάσταση της εδαφικής γονιμότητας, διεγείρει την ανάπτυξη των φυτών, μειώνει τις δυσμενείς επιπτώσεις από αντίξοες καιρικές συνθήκες και αυξάνει την ανοχή σε διάφορα παθογόνα και εχθρούς. Η ανάλυση των συστατικών του δείχνει υψηλή περιεκτικότητα σε μάκρο- και ιχνοστοιχεία, φυσικά ένζυμα και ορμόνες που συμβάλλουν στην υγιή ανάπτυξη των φυτών, ενώ φαίνεται να βοηθά στη βελτίωση της εδαφικής δομής, αυξάνοντας την ικανότητα απορρόφησης των θρεπτικών από τα φυτά, με τελικό αποτέλεσμα την αύξηση της ποιότητας και ποσότητας του παραγόμενου προϊόντος. Συνιστάται τακτική χρήση σε όλους τους τύπους καλλιεργειών, κυρίως στην ελιά και διάφορα κηπευτικά, και η εφαρμογή του γίνεται με ριζοπότισμα και διαφυλλικά. Για τις ανάγκες του πειράματος επιλέχθηκε ελαιώνας, ηλικίας 11 ετών, όπου καλλιεργείται η ποικιλία κορωνέικη, σε αποστάσεις φύτευσης 7 x 7m. Το πειραματικό τεμάχιο περιλάμβανε τρεις σειρές των δέκα δέντρων: σειρά Ε (εφαρμογή Bioremiq™), σειρά Μ (καμία επέμβαση) και σειρά C (συμβατική μεταχείριση σύμφωνα με το πρόγραμμα του παραγωγού). Στη σειρά Ε πραγματοποιήθηκαν πέντε εφαρμογές Bioremiq™, ανά 15 ημέρες, η 1η με ριζοπότισμα, οι ακόλουθες διαφυλλικά, με 3L και 1L / στρέμμα αντίστοιχα, σύμφωνα με τις οδηγίες του παρασκευαστή οίκου. Για την καταγραφή των εντομολογικών πληθυσμών, 10 ημέρες μετά από κάθε εφαρμογή, πραγματοποιήθηκε δειγματοληψία 4 κλάδων (~20cm) από κάθε δέντρο, ενός από κάθε πλευρά, σύνολο 40 κλάδων από κάθε σειρά, 120 συνολικά. Κάθε κλάδος τοποθετήθηκε μεμονωμένα σε πλαστική σακούλα και συντηρήθηκε στο ψυγείο μέχρι την ολοκλήρωση των καταγραφών. Καταγράφηκε σημαντική παρουσία των επιβλαβών εντόμων *Prays oleae*, *Palpita unionalis*, *Euphyllura olivina* και *Liothrips oleae*, ενώ παρατηρήθηκε διάσπαρτη παρουσία καλόκορης, ρυγχίτη, κηκιδόμυγας και δροσόφιλας και των ακάρεων *Tetranychus urticae* και *Eriophyes oleae*, επίσης εντοπίστηκαν περιστασιακά τα μη επιβλαβή *Chrysopa* sp. και *Mantis religiosa*. Οι καταγραφές εισήχθησαν στο Excel για την οπτικοποίηση των τάσεων και ακολούθησε στατιστική επεξεργασία στο SPSS. Αποτυπώθηκε εμφανής τάση μείωσης των πληθυσμών που πιθανόν οφείλεται και σε κλιματικά στοιχεία, αν και παρατηρήθηκε σαφής διαφορά μεταξύ Bioremiq™ και συμβατικών χειρισμών σε σχέση με τον μάρτυρα, για όλα τα είδη. Στατιστικά σημαντική διαφοροποίηση (paired value t-test)* μεταξύ Bioremiq™ και μάρτυρα διακρίνεται σαφώς για τον θρίπα (p value=0,033) και οριακά για τη μαργαρόνια (p value=0,317), σε επίπεδο σημαντικότητας 95%.

