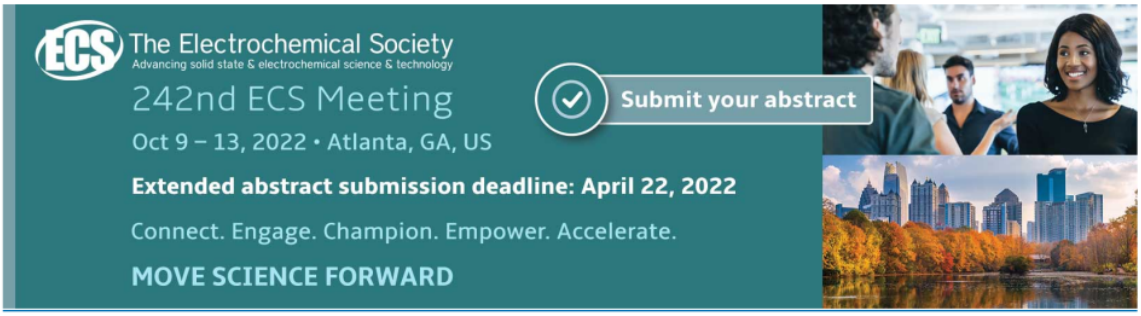
Botanical pesticides, a potential ethnobotany Karo Regency to support food safety of the horticultural product

by Turnitin.com ®

Submission date: 04-Oct-2022 04:16PM (UTC+0700)
Submission ID: 1916297719
File name: DOC-20220410-WA0004..pdf (900.55K)
Word count: 4176
Character count: 22502

Botanical pesticides, a potential ethnobotany Karo Regency to support food safety of the horticultural product



Botanical pesticides, a potential ethnobotany Karo Regency to support food safety of the horticultural product

L Sidauruk [1] E Panjaitan [1] P Sipayung [2] and S Hutauruk [2]

[1] Department of Agrotechnology, Universitas Methodist Indonesia, Jl. Harmonika Baru, Medan 20132, Indonesia

[2] Department of Agrotechnology, Universitas Katolik Santo Thomas, Jl. Setiabudi 479F, Medan 20132, Indonesia

E-mail: lamriasidauruk@yahoo.com

Abstract. The use of plants as materials to control pests was known by traditional communities before the introduction of synthetic pesticides. The use of botanical pesticides has received important attention along with the negative impacts of using synthetic pesticides on health and environment. In the world, Indonesia is the seventh-largest country with the number of species of plant. There are estimated more than 20,000 spesies and 25 percent of them are flowering plants. This study aims to determine the effectiveness of several native plants of Karo Regency, that have the potential as botanical pesticides to control pests in horticultural crops. Botanical pesticides are made by extraction methods, and indicator plants for observing pest attacks are potatoes. The results based on the inventory and exploration at Karo Regency, there are 12 species of plants that are most often used by farmers as botanical pesticides to control pests in horticultural crops from family Meliaceae, Solanaceae, Caricaceae, Asteraceae, Poaceae, Annonaceae, Rubiaceae, Euphorbiaceae and Amaryllidaceae. Botanical pesticide significantly reduced pest attack on plants, reduced population of *Myzus pesicae* and *Phthorimaea operculella* and increase potato yield. The most effective of botanical pesticides to control pests on potato plants were tobacco leaf extract, lemongrass extract, and soursop leaf extract, respectively.

1. Introduction

The main problem in increasing the production of horticultural crops in Karo Regency was the high intensity of pest infestation. The use of synthetic pesticides is widespread because they are considering the fastest, and most effective in overcoming pest disturbances, so yield loss can reduce. However, the use of synthetic chemical pesticides has a negative impact that is quite concerning. As toxic chemicals, pesticides results negative effect on agroecosystem such as soil and water contamination, the resistance of some pests to some conventional insecticides, killing of natural enemies of pest [1] and variety of negative effects for human health [2]. The intensity of application synthetic pesticides on vegetable crops at Karo Regency reported five until seven times during the growing season has impact on high pesticide residues on the plant [3].

The content of organochlorine pesticide residues in carrot plants in Karo Regency was above the tolerable limit when applied pesticides with high-frequency. The active ingredients Gamma BHC, Aldrin, and Endosulfan has exceeded the Maximum Residue Limit (MRL) in accordance with the provisions of the minister of health and the minister of agriculture. However in the assumption of low

usage of pesticide indication that the third type of active ingredients still under the tolerance threshold [4].

The use of plants as materials for pest control knowing by traditional communities before the introduction of synthetic pesticides. This idea is called ethnobotany, which is the study of the traditional use of plants by the smallest tribes. Now, many experts are concerned about ethnobotany because of its existence. The use of botanical pesticides has received important attention along with the negative impacts of using synthetic pesticides on health and environment. Indonesia is the second-largest country with rich biodiversity, including plant-based pesticides. In the world, Indonesia is the seventh-largest country with the number of species of plant. There are estimated more than 20,000 species and 25 percent of them are flowering plants [5]. That was reported that there were more than 1000 spp. plants containing insecticides, more than 380 spp. containing antifeedant, more than 35 spp. containing acaricides, more than 270 spp. containing repellents, and more than 30 spp. containing growth inhibitors. Based on this data, the potential of plant materials for pest control is quite large.[6]

The demand for plant-based pesticides or botanical pesticides increasing along with the development of organic agriculture and the prohibition of using some synthetic chemical pesticides. Indonesia is the second-largest country in the world after Brazil which has a wealth of biodiversity, including plant materials for botanical pesticides. Several botanical pesticide formulas have been proven to be effective in controlling pests. Its have been produced and exported to other countries. However, the development of botanical pesticides have several obstacles, including: (1) their performance is slow so that farmers prefer synthetic pesticides that work quickly; (2) it is easier to get synthetic pesticides in the market because the availability of botanical pesticides is still rare; (3) In its natural state, it is difficult to obtain raw materials for botanical pesticides in large quantities and (4) it is difficult to obtain registration and license because generally botanical pesticides are developed by small entrepreneurs [7].

Botanical pesticides have many advantages compared to synthetic pesticides. There is a unique mode of action, non-toxic for humans and pets, easily decompose in nature, does not pollute the environment, the residue is easy to lose, easy to obtain in nature. For illustration, Indonesia has numerous types of plants that can be used as botanical pesticides, the method of manufacture is relatively easy and economically give beneficial for small farmers in developing countries [8].

Various research results showed that the use of plants as pesticides gives positive results in pest control. *Cymbopogon citratus* leaf extract can kill *Sitophilus oryzae* ticks by 66% and *Morinda citrifolia* L leaf extract by 60% in the laboratory [9]. Observations on application extracts of *Annona squamosa* (Annonaceae/seed), *Piper retrofractum* (Piperaceae/fruit), and *Tephrosia vogelii* (Leguminosae/leaf) against larvae of *Crocidolomia pavonana* F. (Lepidoptera: Crambidae), showed that there are feeding inhibitory activity against *C. pavonana*. The *A. squamosa* extract has characteristic as contact poison than stomach poison, on the other hand, *P. retrofractum* extract has more stomach poison than contact poison. *P. retrofractum* extract and A. *squamosa* extract at a concentration of 0.2% were able to provide a fairly good inhibition of larval feeding activity, which was more than 80% [10]. Several potential plants for botanical pesticides such as Neem (*Azadirachta indica*), tobacco (*Nicotina tabacum*), and citronella (*Citrullus collocynthus*) were effective in reducing the population of ticks and thrips [11].

The study reported that soursop leaf and seed extract have an influence on the time to stop eating, the rate of pupa and imago formation and the mortality rate of armyworm larvae *Spodoptera litura* L. The effect of soursop leaf extract on the time to stop eating is higher 33.3% and increases to 46.7% in the 24th hour after an application was better than that of soursop and mahogany seed. The failure of pupation was 70%, and the imago was 76.6%. This indicates that the effect of soursop leave extract is better for short time application but in the long-term, the effect of mahogany seed is better than the others [12]. Soursop seeds contain bioactive acetogenin which has acted as insecticidal and antifeedant. Unripe fruit, seeds, leaves, and roots of soursop contain annonain chemical compounds that can act as insecticides, larvicides, insect repellents, and antifeedants by working as contact poisons and stomach poisons [13]. *Ageratum conyzoides* leaf extract contains an effective insecticide to kill *Sytophilus zeamays* with an LD50 of 0.09% in 24 hours [14]. The parts of the plant that can be used to control pests

are classified into 7 parts, namely leaves, stems, bark, fruit, fruit skin, tubers, and roots. The most widely used as a pesticide are leaves (12 species) and the lowest are tubers and roots (1 species) [15].

The studies indicate that the development of botanical pesticides in controlling food crop pests can improve the quality of these food products and the quality of their environment. This will increase the competitiveness of Indonesian food products in the export market. Horticultural products from Karo Regency are very potential for the export market but are unable to compete because the pesticide residue content exceeds the tolerable limit. Many importing countries are very concerned about the tolerance limits for pesticide residues in food products. Products containing pesticide residues exceeding the maximum residue level (MRL) will be refused entry to that country. The amounts of residues found in food must be safe for consumers and must be as low as possible. Currently, more MRL is set by the Codex Alimentarius Commission (CAC) are adopted by importing countries in line with the increasing consumer awareness of health [16].

Through the exploration and development of ethnobotany Karo Regency as botanical pesticides in pest control, it can be hoped that the MRL value will be lower according to food safety criteria and subsequently be able to produce export-worthy food products. Thus the objectives and urgency of this research are:

1. Discovering the potential of ethnobotany at Karo Regency as a source of active ingredients for botanical pesticides
2. To test the effectiveness of the active ingredients of botanical pesticides produced by extraction method in controlling horticultural plant pests.

2. Methodology

This research consists of two stages. The first stage is the exploration and inventory of the types of plants used by farmers in Karo Regency as botanical pesticides to control pests. Inventory was carried out using structured interview techniques, field observations, and documentation. A structured interview was carried out to dig up as much information as possible about the knowledge and experience of the community using native plants as pesticides.

The second stage is experimental research by testing the botanical effectiveness of these pesticides to control pests on potato plants. Botanical pesticide prepared by extraction method according to British Columbia Ministry of Forests [17][18]. The type of plant to be tested is selected which is easily obtained in the field in large numbers and abundant. Testing the effectiveness of botanical pesticides against potato pests was carried out with a non-factorial randomized block design consisting of seven treatments and three replications. The treatments are inorganic pesticide (P1-control); tobacco leaf extract (P2); lemongrass leaf extract (P3); tithonia leaf extract (P4); papaya leaf extract (P5); soursop leaf extract (P6) and ageratum leaf extract (P7). Application of pesticide doing at 3 and 5 weeks after planting (WAP) with an extract concentration of 20 percent. Parameters observed were the percentage of pest attack, pest population, and crop production. Observational data were tested by analysis of variance and the treatment that had a significant effect was followed by Tukey's HSD test.

3. Results and discussion

3.1. Plant inventory as a botanical pesticide

Based on the inventory from three districts at Karo regency obtained 12 species of plants that are most often used by farmers as botanical pesticides to control pests in horticultural crops presented in table 1 and plant documentation is presented in figure 1.

Table 1. Plant species used as botanical pesticides

Spesies	Family	Plant part used
Azadirachta indica A.Juss	Meliaceae	leaves, seeds
Nicotiana tabacum L.	Solanaceae	leaves
Carica papaya L.	Caricaceae	leaves, seeds
Tithonia diversifolia (Hemsl.) Gray	Asteraceae	leaves, flowers
Euphatorium odoratum L.	Asteraceae	leaves
Cymbopogon citratus DC.	Poaceae	leaves
Annona muricata L.	Annonaceae	leaves, seeds
Morinda citrifolia L.	Rubiaceae	leaves, fruits
Ageratum conyzoides L.	Asteraceae	leaves
Jatropha curcas L.	Euphorbiaceae	leaves, seeds
Allium porrum Linn.	Amaryllidaceae	leaves, tuber
Syzygium aromaticum L.	Myrtaceae	Leaves, fruits

Figure 1. The spesies of plants as botanical pesticides a)*Azadirachta indica* A.Juss; b)*Nicotiana tabacum* L; c)*Carica papaya* L; d)*Tithonia diversifolia* (Hemsl.) Gray; e)*Euphatorium odoratum* L.; f)Cymbopogon *citratus* DC; g)*Annona muricata* L; h)*Morinda citrifolia* L; i)*Ageratum conyzoides* L; j)*Jatropha curcas* L; k)*Allium porrum* Linn; l)*Syzygium aromaticum* L.

3.2. Percentage of pest attack

The percentage of pest attacks per plant at 4, 6, 8 and 10 weeks after planting (WAP) are presented in Table 2.

Table 2. Percentage of pest attacks at 4, 6, 8 and 10 Weeks After Planting (WAP)

Treatment	Percentage of pest attacks (%)			
	4 WAP	6 WAP	8 WAP	10 WAP
Inorganic pesticide (P1)	6.67a	11.53a	14.19a	14.78a
Tobacco leaf extract (P2)	7.53ab	12.50ab	14.25a	14.67a
Lemongrass extract (P3)	8.39bc	14.97bc	15.78a	15.78a
Tithonia leaf extract (P4)	9.86cd	18.00d	20.25bc	20.31b
Papaya leaf extract (P5)	13.78f	21.72d	22.50c	21.72b
Soursop extract (P6)	10.61de	17.61cd	19.64b	19.89b
Ageratum leaf extract (P7)	11.83e	17.44cd	19.94bc	20.11b
HSD Tukey$_{0.05}$	1.58	2.66	2.62	2.85

Table 2 shows that the lowest percentage of pest attacks was found in the application of inorganic pesticides but was not significantly different with an application of tobacco leaf extract and lemongrass extract as botanical pesticides. This is because the active compounds contained in these plants are repellent which resists the presence of pests because of the strong odor. The active ingredient can also be antifeedant which can prevent insects eat plants that have been sprayed or inhibit the reproduction of female insects, as poison nerves and can disrupt the hormonal system in the insect body [19]. Reducing the population of pests on plants causes the percentage of crop damage also decrease.

3.3. Pest population: Myzus persicae Sulzer, *Phthorimaea operculella* Zell, *Liriomyza huidobrensis* Blanchard

Observations of three main pests of potato at 4, 6, 8 and, 10 weeks after planting (WAP) are presented in table 3, table 4, and table 5.

Table 3 and Table 4 show that the pest populations of *M. persicae* and *P. operculella* due to the application of tobacco leaf extract and lemongrass extract were not significantly different from inorganic pesticides. The decline in pest populations due to the application of botanical pesticides was caused by the essential oil of citronella and geraniol contained in lemongrass which has desiccant and contacts poison properties. Insects affected by this poison will die due to a lack of fluids. Besides that, lemongrass leaves are repellent too [19][20]. The bioactive compound of tobacco is nicotine, d-limonene, pyridine, and indole, which can be used as biopesticides because the compounds have a function as pesticides to control crop pests [21].

Table 3. The population of *M. persicae* at 4, 6, 8, and 10 weeks after planting (WAP)

Treatment	Population of *M. persicae*			
	4 WAP	6 WAP	8 WAP	10 WAP
Inorganic pesticide (P1)	1.44a	3.44a	4.11a	3.58abc
Tobacco leaf extract (P2)	1.72ab	3.50a	4.31a	3.28ab
Lemongrass extract (P3)	1.72ab	3.69a	3.81a	2.92a
Tithonia leaf extract (P4)	2.46b	5.08b	4.64a	4.67bcd
Papaya leaf extract (P5)	3.17b	7.03c	8.14c	5.86d
Soursop leaf extract (P6)	1.92ab	6.08bc	6.00b	4.78bcd
Ageratum leaf extract (P7)	2.36ab	6.83c	7.00b	4.92cd
HSD Tukey$_{0.05}$	0.99	1.04	1.07	1.53

Table 4. The population of P. operculella at 4, 6, 8, and 10 weeks after planting (WAP)

Treatment	Population of *P. opercullela*			
	4 WAP	6 WAP	8 WAP	10 WAP
Inorganic pesticide (P1)	1.12a	2.44a	2.72a	1.48a
Tobacco leaf extract P2)	1.54ab	3.56ab	4.31ab	1.70 a
Lemongrass extract (P3)	2.50b	4.69ab	3.81ab	2.52 ab
Tithonia leaf extract (P4)	2.86b	5.08bc	4.64ab	2.67ab
Papaya extract (P5)	3.17b	7.03c	8.10d	3.86bc
Soursop extract (P6)	2.92b	6.08cd	6.00bcd	3.78bc
Ageratum leaf extract (P7)	3.36c	6.85c	7.16cd	4.92c
HSD Tukey$_{0.05}$	1.09	2.44	2.57	1.51

Table 5 showed that there was no significant difference between the application of inorganic pesticides and botanical pesticides. This is presumably because basically all types of botanical pesticides tested have relatively the same characteristics, as pest repellent compounds, antifeedant compounds, and contact poison compounds. *Tithonia diversifolia* and *A. conyzoides* from the family Asteraceae contains saponins, flavonoids, and polyphenols [19]. Every part of this plant contains active ingredients which act as a pesticide, ovicide, and antifeedant against pests [22] and reported that application Ageratum leaf extract at dose 6 percent is effective for controlling *Sitophilus spp*. on stored corn seeds [23]. Meanwhile, soursop leaf extract has long been known as a botanical pesticide because of its compound content of acetogenin namely asimycin and anonin IV or butalacin which can kill nematodes [19]. The research showed that the application of flour soursop leaf at concentration 10 g/100 g corn seed effective control of *Sitophilus spp*.and caused mortality at 92.5 percent [24].

Table 5. The population of *L huidobrensis* at 4, 6, 8, and 10 weeks after planting (WAP)

Treatment	Population *L. huidubrensis*			
	4 WAP	6 WAP	8 WAP	10 WAP
Inorganic pesticide (P1)	1.66	3.66	3.83	1.33
Tobacco leaf extract P2)	1.87	3.83	4.16	1.67
Lemongrass extract (P3)	2.00	4.30	4.33	1.67
Tithonia leaf extract (P4)	2.50	3.83	4.13	2.11
Papaya extract (P5)	2.33	4.50	4.67	1.87
Soursop extract (P6)	1.87	4.28	4.50	1.33
Ageratum leaf extract (P7)	2.30	4.11	4.67	2.11

3.4. Potato yield

The observations results on the weight of tubers per plant and the number of tuber per plant are presented in Figure 2. From the picture can be seen that the highest production is found in the treatment of inorganic pesticides, but from the statistical test results, it is not significantly different from the botanical pesticide treatment of tobacco leaf extract and lemongrass extract. Meanwhile, the lowest yield was found in the treatment of papaya leaf extract. Based on the observed parameters, there is a significant correlation between the parameters, namely a low percentage of plant damage has a positive correlation with a low pest population. Likewise, in low pest populations, high crop yields will be obtained.

The application of six types of plant extracts to potato plants showed that there were 3 types that gave the best results, namely tobacco leaf extract, lemongrass extract, and soursop leaf extract, respectively. The three types of plant extracts have the potential to be developed on a wide scale as

botanical pesticides on potato pests because of their ubiquitous presence, found in large quantities, easy to process, economical, and its use for highly effective and efficient pest control. The use of these extracts in controlling pests has good prospects because the effectivity not significantly different to inorganic pesticides, friendly to the environment, and supporting components for integrated pest control that always pays attention to ecological aspects.

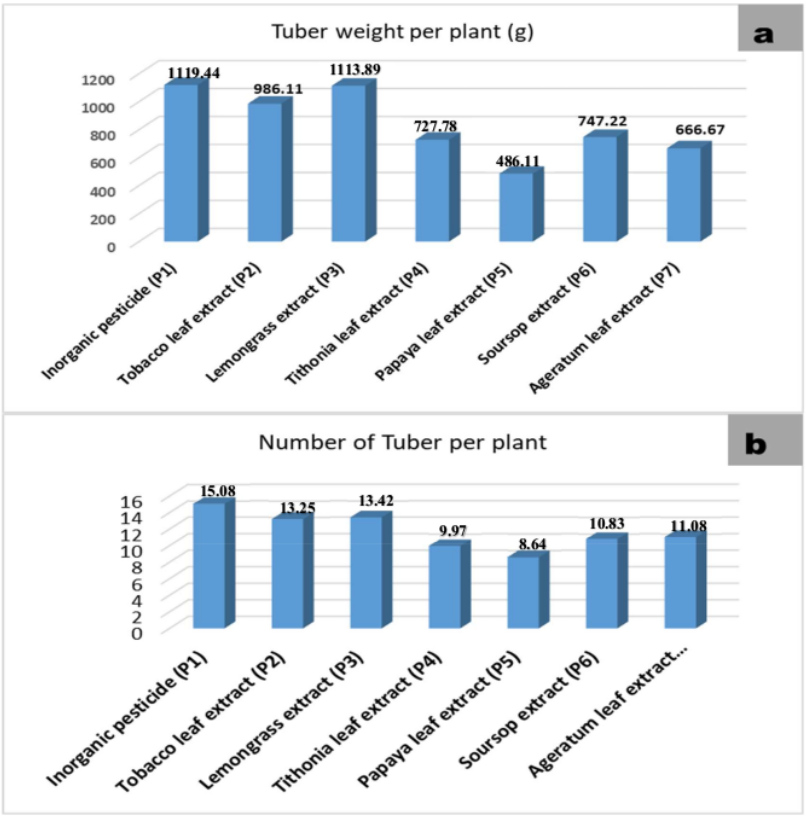


Figure 2. Tuber weight per plant (a) and number of tuber per plant (b)

4. Conclusion

Based on inventory and exploration at Karo Regency, there are 12 species of plants that are most often used by farmers as botanical pesticides to control pests in horticultural crops from family Meliaceae, Solanaceae, Caricaceae, Asteraceae, Poaceae, Annonaceae, Rubiaceae, Euphorbiaceae and Amaryllidaceae.

Botanical pesticides significantly reduced pest attacks on plants, reduced the population of *Myzus persicae* and *phthorimaea operculella,* and increase potato yield. The most effective botanical pesticides to control pests on potato plants were tobacco leaf extract, lemongrass extract, and soursop leaf extract, respectively.

References

[1] Aktar MW, Sengupta D and Chowdhury A 2009 Impact of pesticides use in agriculture: their benefits and hazards *Interdisc Toxicol* **2**(1) pp 1-12
[2] Yuantari MGC, Widjanarko B and Sunoko HR 2015 Pesticide exposure risk analysis against farmer's health *kemas* **10**(2) pp 239-245
[3] Sidauruk L, Bakti D, Kuswardani RA and Chairani H 2016 Potato intercropping design to suppress pest infestation in organic farming systems Disertation USU Medan p 213
[4] Sinulingga K 2006 Study og organochlorine residue in carrot *Daucus carota* L *J Sistem Tek Industri* **7**(1) pp 92-97
[5] Kusmana C and Hikmat A 2015 The Biodiversity of Flora in Indonesia *JPSL* 5(2) pp 187-198
[6] Grainge M, Ahmed S, Mitchell WC and Hylin JW 1986 Plant species reportedly possessing pest control properties. An EWC/UH database. Institut EWC, Univ. Of Hawaii, Honolulu. 249p
[7] Kardinan, A 2011 Penggunaan pestisida nabati sebagai kearifan lokal dalam pengendalian hama tanaman menuju sistem pertanian organik. *Peng Inovasi Pert* **4**(4) pp 262-278.
[8] Asmaliyah, Wati EE, Utami S, Mulyadi K, Yudhistira, Sari FW 2010 pengenalan tumbuhan penghasil pestisida nabati dan pemanfaatannya secara tradisional Kementerian Kehutanan Indonesia p 62
[9] Isnaini M, Pane ER and Wiridianti S 2015 Study of the effectiveness of several types of botanical insecticides against rice lice *Sitophilus oryzae* L. *Jurnal Biota* **1**(1) pp 1-9
[10] Dadang and Prijono Dj 2011 The development of natural insecticide formulation technology for horticultural pest management in order to produce horticultural healthy product. *JIPI* **16**(2) pp 100-111
[11] Kunbhar S, Rajput LB, Gilal AA, Channa GA and Sahito JGM 2018 Impact of botanical pesticides against sucking insect pests and their insect predators in brinjal crop. *J. Entomol. Zool. Stud.* **6**(2) pp 83-87
[12] Yanuwiadi B, Leksono HS, Guruh HH, Fathoni M and Bedjo 2013 Potensi ekstrak daun sirsak, biji sirsak dan biji mahoni untuk pengendalian ulat grayak (*Spodoptera litura* L.) *Natural* 2 (1) pp 84-89
[13] Kardinan A 2002 Pestisida nabati: Ramuan dan aplikasi **4**. 88p
[14] Kardono LBS, Artanti N, Dewiyanti ID and Basuki T 2003 Selected Indonesian medicinal plants. *Monographs and Descriptions* **1** pp 42-55.
[15] Utami S and Haneda NF 2010 Utilization of Ethnobotany from Bengkulu Tropical Forest as Biopesticide. *JMHT* **XVI**(3) pp 143–147
[16] The CGIAR Systemwide Program on Integrated Pest Management, 2010. Integrated pest management and crop health — bringing together sustainable agroecosystems and people's health. SP-IPM Secretariat, International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria. p.17
[17] British Columbia Ministry of Forests. 1996. Techniques and procedures for collecting, preserving, processing, and storing botanical specimens. Res. Br.,B.C. Min. For., Victoria, B.C. Work. Pap. **18** p 13
[18] Muaja AG, Koleangan HSJ, Runtuwene MRJ 2013 Uji toksisitas dengan metode BSLT dan analisis kandungan fitokimia ekstrak daun soyogik (*Saurauia bracteosa* DC) dengan metode Soxletasi *J.Mipa* **2**(2) pp 115-118
[19] Saenong MS 2013 Indonesian plants potensial as bioonsecticide for controlling maize weevil (*Sitophilus* spp.) *J. Litbang pert.***35**(3) pp 131-142
[20] Herminanto, Nuriati and Kristianti DM 2010 The potential of citronella leaves to control *Collosobruchus analyst* F. on soybeans in storage. *J Agrivigor* **3**(1) pp 19-27
[21] Dewi TSK, Supartini, Haryuni, Suprapti E, Priyadi S, Ardiyanto DD, Priyatmojo A and Gozan M 2018 Effect of *Nicotiana tabacum* extract concentration as biopesticide on protein content of robusta coffee beans and skin *ASSEHR* **247** pp 545-567
[22] Agusta A 2000 Minyak atsiri, Tumbuhan tropika Indonesia ITB Bandung p.101

[23] Astriani D 2010 Pemanfaatan gulma babadotan dan tembelekan dalam pengendalian *Sitophilus* spp. pada benih jagung *Agrisains* **1** (1) pp 56-57
[24] Sembiring RD, Salbiah and Rustam R 2016 Pemberian tepung daun sirsak (*Annona muricata* L.) dalam mengendalikan hama kumbang bubuk jagung (*Sitophilus zeamais* M.) pada biji jagung *Jurnal Faperta* **1**(2) pp 1-11

Botanical pesticides, a potential ethnobotany Karo Regency to support food safety of the horticultural product

ORIGINALITY REPORT

16%	16%	10%	6%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	A Z Siregar, Tulus, Yunilas, S C A Nisa. "The Use of Biopesticide to Control of Thrips palmi on potato Plant of Sorik Merapi Mountain, Madina, North Sumatera", IOP Conference Series: Earth and Environmental Science, 2022 Publication	4%
2	orgatrop.faperta.ugm.ac.id Internet Source	3%
3	natural-b.ub.ac.id Internet Source	2%
4	www.preprints.org Internet Source	2%
5	istina.ipmnet.ru Internet Source	1%
6	researchrepository.murdoch.edu.au Internet Source	1%
7	worldwidescience.org Internet Source	1%

8	hrcak.srce.hr Internet Source	1 %
9	Submitted to University of Mount Olive Student Paper	1 %
10	www.semanticscholar.org Internet Source	1 %

Exclude quotes	Off	Exclude matches	Off
Exclude bibliography	Off		

Botanical pesticides, a potential ethnobotany Karo Regency to support food safety of the horticultural product

GRADEMARK REPORT

FINAL GRADE

/0

GENERAL COMMENTS

Instructor

PAGE 1

PAGE 2

PAGE 3

PAGE 4

PAGE 5

PAGE 6

PAGE 7

PAGE 8

PAGE 9

PAGE 10