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Controlling Pests Sorghum using Integrated Pest Management as an Alternative Food in Northern Sumatera, Indonesia

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ABSTRACT

The purpose of this study was to determine the composition and comparison of species richness, diversity, and insect dominance in the phases of sorghum. This research was conducted from August to October 2021 in Lalang Village, Tebing Tinggi, at the location of a Sorghum monoculture (*Sorghum bicolor*). This study uses the purposive random sampling method, where insects are collected using 4 traps (yellow sticky trap, sweep net, pitfall trap, and light trap) installed according to standard regulations. The results showed that the insects identified in Sorghum consisted of 8 orders, 14 families (*Chrysomelidae, Muscidae, Alydidae, Pentatomidae, Cicadellidae, Aphididae, Apidae, Sphecidae, Formicidae, Noctuidae, Acrididae, Grylidae, Aeshnidae, Libellulidae*) with a total of 6499 individuals. There are 27 genera detected with 5 insect functional statuses, as pollinators (13 species), predators (5 species), herbivores (5 species), parasitoids (1 species), and decomposers (3 species). Knowing the functional status of insects in sorghum cultivation, it is predicted to control pests in an integrated manner in the future. The plant extracts, variances of pheromones, and the minimal use of chemicals in the integrated pest control system can increase the productivity of sorghum.

INTRODUCTION

Indonesia's population is increasing so that food needs are increasing, so it is necessary to find alternative sources of food other than rice. The potential of local food in Indonesia should be able to become an alternative to the main staple food of the community (Masithoh and Heni, 2016).

Sorghum is a cereal crop that has the potential to be cultivated and developed in marginal and dry areas in Indonesia. The advantage of sorghum lies in its wide agroecological adaptability, tolerance to drought (Wagaw, 2019), requires less costs for cultivation and is more resistant to pests and diseases (Anas, 2016).

One type of sorghum that can be used as feed and a source of renewable energy is sweet sorghum. Sugar content in sweet sorghum stalks is quite high likely 76%-78%, similar with sugar cane (68%-80%) (Balitsereal, 2012; Mishra, 2012). Various countries have long used sweet sorghum as a producer of ethanol, animal feed and has been widely used in several countries (Ekefre *et al.,* 2017; Phukoetphim *et al.,* 2017).

Data distributor of cereal cultivation in 2013 shows that Indonesia's sorghum production in the last 5 years only increased slightly from 6,114 tons to 7,695 tons. Increasing the production of sorghum in the country needs special attention because Indonesia is very potential for the development of sorghum (Subagio and Agil 2013; 2014).

Although the production of sorghum is high, in fact sorghum is still less popular so that only a small number of people know about the existence of sorghum. Therefore, sorghum needs to be introduced to the public in the form of processed food (Nurngaini and Riyanti, 2016). The use of sorghum flour as a mixture in the manufacture of food in Indonesia has not been widely used. Geographically, Tebing Tinggi has a large area of land that can support sorghum cultivation (Soeranto, 2016).

One of the obstacles in sorghum cultivation is pest attacks that reduce sorghum production significantly. Pests that attack sorghum plants generally come from a group of insects that vary from young plants to pre-harvest plants. According to Nonci et al. (2023) reported *Ostrinia furnacalis*, *Sesamia inferens, Spodoptera frugiferda*, and *Aphis* sp were detected during vegetative stages. Meanwhile, Ginting et al (2023) research of insect pests attack on cultivated sorghum varieties included *Spodoptera frugiperda, Peregrinus maidis, Rhopalosiphum maidis, Valanga nigricornis, Ostrinia furnacalis, Helicoperva armigera,* and *Sitophilus* sp.

The purpose of this study was to determine the composition and comparison of species richness, diversity, and insect dominance in the phases of sorghum. In addition, the application of Integrated Pest Management (IPM) using yellow sticky trap, sweep net, pitfall trap, and light trap can control pests on sorghum plantations. *The implementation of integrated pest management using multiple trapping methods significantly affects insect diversity and the abundance of pest species in sorghum plantations.*

METHODS

This research was carried out on rice farmers' land (800 meters^2) at an altitude of 21 meters above sea level (masl) in Lalang Village, Rambutan District, Tebing Tinggi during July-October 2021. This research consisted of survey stages, field research, identification of pests in the laboratory, and analysis of insect data obtained. The method used was purposive sampling on monoculture sorghum plots. The materials used in this study were sorghum Numbu, insect imago, detergent, transparent plastic, yellow asturo paper, adhesive glue 70%, jars, gauze, sweep net, light trap with emergency lights trap, yellow sticky trap (YST), pitfall trap, plastic cup, basin, masking tape, tweezers, scissors, sample bottle, syringe, loop, camera, stereo binocular microscope, stationery, identification book of Kalshoven (1981), Firmansyah dkk (2012).

Variables of Observation and Data Analysis

a. Calculation of species richness (R1) following formula:

$$\mathbf{R1} = \frac{\mathbf{S-1}}{\mathbf{ln}}$$

R = Specific richness index
S = Total number of types

b. Species Eveness
The formula is as follows: $\mathbf{E} = \frac{\mathbf{Ni}}{\mathbf{S}}$

Ni= Number of Species with the same abundance

c. Diversity Index Shannon-Wiener (H')

$$\mathbf{H'} = \sum_{i=1}^{s} \mathbf{(pi)(In\ pi)\ pi = \ pi/N}$$

The Shannon Wiener index formula is as follows:
s = Number of individuals in one sample unit
pi = Proportion of the number of individuals i to the total number of individuals
ln = logarithm to base e
N = total number of all individuals in the sample
H > 3 = Height; 1< H < 3 = Medium; H < 1= Low

RESULTS AND DISCUSSION

A. Composition of Insects in the Sorghum

Insects captured and identified in sorghum plantations consisted of 8 orders, 14 families (Chrysomelidae, Muscidae, Alydidae, Pentatomidae, Cicadellidae, Aphididae, Apidae, Sphecidae, Formicidae, Noctuidae, Acrididae, Grylidae, Aeshnidae, Libellulidae) with a total of 6499 individuals (Table 1), more than the sorghum studied in the village of Kolam, Percut Sei Tuan of 1173 individuals, 33 families with 10 orders (Parlindungan et al. 2020). Th insects classified into 3 groups, including: insect pests, parasitoid insects, and predatory insects.

Table 1. Insect Composition in Sorghum. Notes: + = little (1-25), ++ = moderate (26-50), +++ = a lot (>50), 0=none, YST=Yellow Sticky Trap , SN=Sweep Net, PT=Pitfall Trap, LT=Light Trap, DAP=Day After Plantations

Sample	Families	Spesies Name	YST	SN	PT	LT
20 DAP	*Chrysomelidae*	*Chaetocnema sp*	+++	++	+	++
	Muscidae	*Atherigona sp*	+	+	0	++
	Alydidae	*Riptortus linearis*	+	+	+	+
	Pentatomidae	*Nezara viridula*	+	+	+	+
	Cicadellidae	*Cicadulina bipunctata*	++	++	+	+
	Aphididae	*Sipha flava*	+	+	0	0
	Apidae	*Xylocopa sp*	+++	+	+	++
	Sphecidae	*Chalybion bengalense*	+	+	+	+
	Formicidae	*Solenopsis invicta*	+	+	+	+
	Noctuidae	*Agrotis ipsilon*	++	+	+	++
		Spodoptera exigua	+++	+	+	+++
	Acrididae	*A.crenulata*	+++	+	+	++
		Locusta migratoria	+++	+++	++	0
	Grylidae	*Grylus sp*	++	++	++	+
	Aeshnidae	*Gynanatha sp*	+	+	0	+
	Libelluilidae	*Chaetocnema sp*	+	+	0	+
30 DAP	*Chrysomelidae*	*Chaetocnema sp*	++	++	+	++
	Muscidae	*Atherigona sp*	+	+	0	++
	Alydidae	*Riptortus linearis*	+	+	+	+
	Pentatomidae	*Nezara viridula*	+	+	+	+
	Cicadellidae	*Cicadulina bipunctata*	++	+	+	+
	Aphididae	*Sipha flava*	+	+	0	0
	Apidae	*Xylocopa sp*	++	+	+	++
	Sphecidae	*Chalybion bengalense*	+	+	+	+
	Formicidae	*Solenopsis invicta*	+	+	+	+
	Noctuidae	*Agrotis ipsilon*	++	+	+	++
		Spodoptera exigua	++	++	+	+++
	Acrididae	*A. crenulate*	++	++	+	++
	Grylidae	*Locusta migratoria*	++	+	+	0
	Aeshnidae	*Grylus sp*	++	+	+	+
	Libellulidae	*Gynanatha sp*	++	+	+	+
		Orthetrum sabina	++		+	+
40 DAP	*Chrysomelidae*	*Chaetocnema sp*	+++	++	+	++
	Muscidae	*Atherigona sp*	+	+	0	++
	Alydidae	*Riptortus linearis*	+	+	+	+

	Pentatomidae	*Nezara viridula*	+	+	+	+
	Cicadellidae	*C.bipunctata*	++	++	+	+
	Aphididae	*Sipha flava*	+	+	0	0
	Apidae	*Xylocopa sp*	++	+	+	++
	Chrysomelidae	*Chaetocnema sp*	+	+	++	++
	Muscidae	*Atherigona sp*	+	+	+	++
	Alydidae	*Riptortus linearis*	+	+	+ +	+
	Apidae	*Xylocopa sp*	0	++	+	0
40 DAP	*Formicidae*	*Solenopsis invicta*	+	+	+	+
	Noctuidae	*Agrotis ipsilon*	++	+ +	+	+
	Acrididae	*Spodoptera exigua*	++	+++	+	+
			++	+ +	+	+
			++		+	+
50 DAP	*Grylidae*	*Chaetocnema sp*	++	++	+	+
	Aeshnidae	*Atherigona sp*	+	+	0	+
	Libellulidae	*Riptortus linearis*	+	+	0	+
		Nezara viridula	+++	++	+	++
	Chrysomelidae					
	Muscidae	*C.bipunctata*	+	+	0	++
	Alydidae	*Sipha flava*	+	+	+	+
	Pentatomidae	*Xylocopa sp*	+	+	+	+
	Cicadellidae	*Solenopsis invicta*	++	++	+	+
	Aphididae	*Agrotis ipsilon*	+	+	0	0
	Apidae	*S. exigua*	++	+	+	++
	Formicidae	*A. crenulate*	+	+	+	+
	Noctuidae	*L.migratoria*	++	+	+	++
		Grylus sp	++	++	+	+++
	Acrididae	*Gynanatha sp*	++	++	+	++
		Orthetrum Sabina	+++	+++	++	0
	Grylidae	*Chaetocnema sp*	++	++	++	+
	Aeshnidae	*Atherigona sp*	+	+	0	+
	Libellulidae	*Riptortus linearis*	+	+	0	+
60 DAP	*Chrysomelidae*	*Chaetocnema sp*	0	++	+	+
	Muscidae	*Atherigona sp*	0	+	+	0
	Alydidae	*Riptortus linearis*	0	++	+	+
	Pentatomidae	*Nezara viridula*	0	+	+	+
	Cicadellidae	*C. bipunctata*	++	+		
					+	
	Apidae	*Xylocopa sp*	0	++	++	+

	Sphecidae	*C. bengalense*	0	++	++	+
	Formicidae	*Solenopsis invicta*	0	+++	+++	+
	Noctuidae	*Agrotis ipsilon*	+	++	++	+
		Spodoptera exigua	+	+	+	+
	Acrididae	*A. crenulate*	+	+	+	+
		Locusta migratoria	+	++	++	++
	Grylidae	*Grylus sp*	+	+	+	++
	Aeshnidae	*Gynanatha sp*	+	+	+	0
70 DAP	*Chrysomelidae*	*Chaetocnema sp*	+	++	++	++
	Muscidae	*Atherigona sp*	+	+	+	0
	Alydidae	*Riptortus linearis*	+	+	+	+
	Pentatomidae	*Nezara viridula*	+	+	+	+
	Cicadellidae	*Bipunctata*	++	+	+	+
	Aphididae	*Sipha flava*	++	++	+	+
	Apidae	*Xylocopa sp*	+	+	+	+
	Formicidae	*Solenopsis invicta*	+	++	+	+
	Noctuidae	*Agrotis ipsilon*	+	++	++	+
		Spodoptera exigua	+	++	++	+
	Acrididae	*A. crenulate*	++	++	++	++
		Locusta migratoria	+	++	++	++
	Grylidae	*Grylus sp*	++	+	+	0
Total			2199	1369	1242	1689

The number of insects caught from the four traps carried out was the most diverse by the yellow sticky trap (YST), due to winged insects actively flying in the sorghum. Supported by Mas'ud research (2012) states the effectiveness of the use of yst can catch various types of insects because insects' attraction to the yellow color, able to trap insects around the plant surface.

The lowest insect trap yields using the pitfall trap, caught the insects which active on the soil surface with relatively few, insects fly more and prefer bright colors and light.

From the research data, the highest total number of insect populations came from the Acrididae family because they live in colonies and the availability of food factors (Wagaw 2012, Sidabutar 2016) to rapidly reproduce. Then, the lowest detected from the Aphididae family, is suspected insects prefer flower colors, nectar, and more attractive aromas than sorghum plants.

While the functional status and percentage of the Important Value Index of insects consists of 5 types, namely pollinators (13 species), predators (5 species), herbivores (5 species), parasitoids (1 species), and decomposers (3 species) are shown in Table 2 below.

Table 2. Status genera and percentages of Indices Value Importance (IVI)

Status Genera	% IVI
Polinators	
Aphias	2,99
Apis	18,95
Austroscolia	6,25
Chalybion	8,16
Culex	9,15
Euthalia	1,65
Hypolimnas	11,94
Junonia	7,43
Megascolia	1,56
Papilio	3,52
Phimenes	3,10
Vespa	11,40
Xylocopa	18.20
Predators	
Gynacantha	1,45
Mononomorium	11,07
Orthetrum	12,18
Polistes	5,95
Sphex	2,98
Herbivores	
Bactrocera	8,42
Coridius	1,49
Ophiomyia	11,12
Phaneroptera	2,74
Valanga	8,32
Parasitoid	
Hermetia	1,12
Decomposers	
Atherigona	11,45
Musca	18,02
Sarcophaga	9,28

Organisms with a high Indices Value Importance (IVI) have a role in a community that will form dominance between species. It is used to describe the amount of control a species exerts over its community. The insects with the highest IVI percentage in the pollinator category were *Apis* sp (18.95%), followed by *Musca* sp as decomposer (18.02%) and *Hypolimnas* sp is pollinator (11.94%). According to Aditama and Kurniawan (2013) which states the high of IVI is influenced by the ability of organisms to reproduce and adapt to environmental conditions. The use of resistant varieties, use of plant

Table 3. The number and types of insects identified in the sorghum planting area of Karang Anyar Beringin Village, Deli Serdang Regency, North Sumatra Province.

Classification		Observation								Total
		Vegetative		Reproductive				Seed ripening		
Ordo	Family	I	II	III	IV	V	VI	VII	VIII	
Coleoptera	*Coccinellidae*	3	5	10	7	12	16	11	8	72
	Carabidae	5	7	9	11	15	13	9	7	76
	Dermestidae	0	0	1	2	5	7	3	0	18
Diptera	*Tachinidae*	71	62	84	116	168	217	132	115	965
	Bibionidae	13	15	20	24	19	22	19	11	143
	Chironomidae	26	23	37	44	41	48	40	28	287
Hemiptera	*Gerridae*	0	0	1	3	1	1	0	0	6
	Alydidae	0	0	1	2	1	2	2	4	12
	Reduviidae	1	3	6	9	5	4	0	0	28
	pyrrhocoridae	0	1	7	5	11	5	3	1	33
Hymenoptera	*Vespidae*	3	7	12	9	7	11	13	16	78

	Spechidae	5	3	14	21	23	19	20	23	128
	Ichneumonidae	7	11	24	32	29	31	32	29	195
	Pompilidae	2	2	7	10	8	5	3	2	39
	Ceraphronidae	1	3	4	5	8	7	9	8	45
	Formicidae	4	6	12	16	22	18	14	11	103
Lepidoptera	*Noctuidae*	0	2	3	6	11	14	6	0	42
Odonata	*Libellulidae*	0	3	2	4	4	6	3	3	25
Orthoptera	*Acrididae*	4	13	16	25	21	13	9	4	105
	Gryllidae	3	11	6	4	4	3	1	0	32
Araneae	*Araneidae*	0	0	0	0	1	3	0	0	4
Blattodea	*Blaberidae*	9	7	5	3	6	5	4	2	41
	Total	157	184	281	358	422	470	333	272	2477

Based on the research results, it can be seen that the largest number of insects trapped in all traps was shown by observations IV, V, and VI, with a total of 358, 422, and 470 insects, respectively. This is because in this observation, the sorghum plant has entered the reproductive (generative) growth phase, and in this phase, the sorghum plant has flowered and the panicles have bloomed so that it can become a food source for insects. As a result, many insects appear as pests in sorghum plantations. This is following Siregar (2017), which states that insect diversity is influenced by several factors such as productivity and stable environmental conditions. Conditions like this can affect the diversity of insects.

The results showed that the Diptera order was the order with the largest number of insect populations. The large population of Diptera is related to environmental conditions and suitable food. Calculation of KM, KR, FM, FR Calculation data of Absolute Density (KM), Relative Density (KR), Absolute Frequency (FM), and Relative Frequency (FR) can be seen in Table 4 as follows.

Table 4. Calculation of Absolute Density, Relative Density, Absolute Frequency, and Relative Frequency of Sorghum Plantings in Karang Anyar Beringin Village, Deli Serdang Regency, North Sumatra Province. Classification of the Family Coccinellidae

Clasification					
Ordo	Family	KM	KR (%)	FM	FR (%)
Coleoptera	*Coccinellidae*	72	2.91	8	5.19
	Carabidae	76	3.07	8	5.19
	Dermestidae	18	0.73	5	3.25
Diptera	*Tachinidae*	965	38.96	8	5.19
	Bibionidae	143	5.77	8	5.19
	Chironomidae	287	11.59	8	5.19
Hemiptera	*Gerridae*	6	0.24	4	2.60
	Alydidae	12	0.48	6	3.90
	Reduviidae	28	1.13	6	3.90
	pyrrhocoridae	33	1.33	7	4.55
Hymenoptera	*Vespidae*	78	3.15	8	5.19
	Spechidae	128	5.17	8	5.19
	Ichneumonidae	195	7.87	8	5.19
	Pompilidae	39	1.57	8	5.19
	Ceraphronidae	45	1.82	8	5.19
	Formicidae	103	4.16	8	5.19
Lepidoptera	*Noctuidae*	42	1.70	6	3.90
Odonata	*Libellulidae*	25	1.01	7	4.55
Orthoptera	*Acrididae*	105	4.24	8	5.19
	Gryllidae	32	1.29	7	4.55
Araneae	*Araneidae*	4	0.16	2	1.30
Blattodea	*Blaberidae*	41	1.66	8	5.19
Total		2477	100	154	100

Based on the calculation data in Table 4, it can be seen that the highest Absolute Density (KM) value is the Diptera order, the Tachinidae family, which is 965 with a Relative Density (KR) value of 38.96%. Conditions like this can affect the diversity of insects. Table 3: The number and types of insects identified in the sorghum planting area of Karang Anyar Beringin Village, Deli Serdang Regency, North

Sumatra Province. Meanwhile, the lowest Absolute Density (KM) is the Araneae Order, the Araneidae family, which is 4 with a Relative Density (KR) value of 0.16%.

The highest Absolute Density (KM) and Relative Density (KR) values were from the Tachinidae family, because there were the most insects caught and the lowest value was from the Araneidae family, because only a few insects were caught. The existence of this insect is influenced by one of them, namely the food it gets. This is per what was stated by Siregar (2016), that the presence of insects in nature is influenced by habitat suitability, heterogeneous vegetation, weather conditions at the time of observation or sampling and biotic, physical and chemical factors.

The highest Absolute Frequency (FM) values were *Coleoptera (Coccinellidae), Diptera (Tachinidae), Coleoptera (Bibionidae), (Carabidae), Diptera Diptera (Chironomidae), Hymenoptera (Vespidae), Hymenoptera (Ichneumonidae), Hymenoptera (Pompilidae), Hymenoptera (Ceraphronidae), Hymenoptera (Formicidae), Orthoptera (Acrididae), Blattodea (Blaberidae)*, namely 8 each with an FR value of 5.19%. This is because these types of insects are the insects that are most often present at the research site and the spread of these insects is wide in the sorghum planting area studied.

The implementation of Integrated Pest Management (IPM) strategies using multiple trapping methods has been shown to significantly influence insect biodiversity and effectively reduce the abundance of pest species in sorghum (Sorghum bicolor) plantations. These trapping methods, including light traps, sticky traps, and pheromone traps, are tailored to the behavioral ecology of target pest species, thereby increasing the selectivity and efficiency of pest capture. Beyond merely reducing pest populations, this approach also promotes ecological balance by minimizing the impact on non-target beneficial insects such as pollinators, predators, and parasitoids, which play crucial roles in biological control and ecosystem stability. By reducing the reliance on chemical insecticides, IPM through trapping contributes to environmentally sustainable agriculture, helps prevent pest resistance development, and lowers long-term pest management costs. Furthermore, integrating routine monitoring of insect populations into the IPM framework ensures timely and site-specific interventions, making pest control both more adaptive and precise. The effectiveness of this method depends on local agroecological conditions, making farmer participation and extension support critical for success in the field.

Table 5. Important value index and functional status of insects

Clasification		Function state	%INP
Ordo	Family		
	Coccinellidae	*Predator*	8.10
Coleoptera	*Carabidae*	*Predator*	8.26
	Dermestidae	*Scavenger*	3.97
	Tachinidae	*Parasitoid*	44.15
Diptera	*Bibionidae*	*Predator*	10.97
	Chironomidae	*Scavenger*	16.78
	Gerridae	*Predator*	2.84
	Alydidae	*Hama*	4.38
Hemiptera	*Red uviidae*	*Predator*	5.03
	Pyrrhocoridae	*Hama*	5.88
	Vespidae	*Predator*	8.34
	Spechidae	*Predator*	10.36
	Ichneumonidae	*Parasitoid*	13.07
Hymenoptera	*Pompilidae*	*Parasitoid*	6.77
	Ceraphronidae	*Parasitoid*	7.01
	Formicidae	*Predator*	9.35
Lepidoptera	*Noctuidae*	*Hama*	5.59
Odonata	*Libellulidae*	*Predator*	5.55
Orthoptera	*Acrididae*	*Herbivora*	9.43
	Gryllidae	*Scavenger*	5.84
Araneae	*Araneidae*	*Predator*	1.46
Blattodea	*Blaberidae*	*Hama*	6.85
Total			200

Based on the data presented in Table 5, the insect family *Blaberidae*, which has the potential to act as a pest, recorded the highest Importance Value Index (IVI) among pest species, with a value of 6.85%. The IVI is a composite ecological index that combines relative density, relative frequency, and relative dominance, offering an integrated assessment of the ecological role and influence of a species within a given habitat. A higher IVI indicates that a species is ecologically prominent, often due to favorable environmental conditions that support its survival, reproduction, and activity patterns. As Borror (1992) emphasized, species with the highest IVI values tend to dominate their habitat because they are highly adapted to local ecological conditions and capable of exploiting available resources more efficiently than other species. In the case of *Blaberidae*, this high IVI suggests not only a strong presence within the sorghum plantation ecosystem but also a potential risk for crop damage, particularly if population densities increase.

Insects with high IVI values are typically characterized by rapid reproductive cycles, high mobility, and competitive resource acquisition strategies, which allow them to establish dominance in disturbed or agriculturally modified habitats. The ecological dominance of *Blaberidae* could be attributed to its generalist feeding behavior, high fecundity, and resilience to environmental changes, all of which are traits commonly observed in pest species that thrive in monoculture systems such as sorghum plantations. On the other hand, among predatory insects, the family *Bibionidae* demonstrated the highest IVI, recorded at 10.97%. This finding highlights the ecological significance of *Bibionidae* as a dominant predatory taxon within the sorghum agroecosystem. A high IVI among predatory insects indicates not only a stable and well-adapted population but also the potential for regulating pest species through natural predation. The dominance of *Bibionidae* can be attributed to several adaptive traits, including a high reproductive rate, tolerance to varying environmental conditions, and an ability to exploit a wide range of prey. These traits enable them to maintain a stable population and exert ecological control over pest populations.

Furthermore, the high IVI of *Bibionidae* suggests that this family plays a crucial role in the trophic structure of the sorghum ecosystem. Their presence may contribute significantly to the biological control of pests, thus reducing the need for chemical insecticides and supporting the principles of ecological pest management. This is consistent with the findings of Aditama and Kurniawan (2013), who reported that species with high IVI values generally possess superior adaptability, reproductive capacity, and resource-use efficiency, enabling them to become key ecological players in their respective communities.
Overall, the contrasting roles of *Blaberidae* as a potential pest and *Bibionidae* as a beneficial predator, both with high IVI values, underscore the importance of understanding community structure and species interactions in agroecosystems. Such knowledge is essential for developing sustainable pest management strategies that balance productivity with ecological stability.

The predatory insect with the highest IVI was the Bibionidae family, with an IVI value of 10.97%. A high IVI value means that a species is dominant and has better adaptability than other species. This value is influenced by several factors, namely, the ability to survive and adapt to a high habitat and the ability of the Bibionidae to utilize existing resources. This is following Aditama and Kurniawan (2013), who stated that the high IVI is influenced by the ability of organisms to reproduce and adapt to environmental conditions.

CONCLUSION

Insects on the sorghum plant identified consist of 8 orders, 14 families (*Chrysomelidae, Muscidae, Alydidae, Pentatomidae, Cicadellidae, Aphididae, Apidae, Sphecidae, Formicidae, Noctuidae, Acrididae, Grylidae, Aeshnidae, Libellulidae*) with a total of 6499 individuals. There are 27 genera with insect statuses as (13 species), predator (5 species), herbivore (5 species), parasitoid (1 species), and decomposer (3 species).

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