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## Inventory of arthropoda in endophytic hybrid corn plants (Variety Mr14 x Variety Nei9008)

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## Inventory of arthropoda in endophytic hybrid corn plants (Variety Mr14 x Variety Nei9008)

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**Abstract.** Development of endophytic corn-seeds is a method of maintaining a high yield since the seed escapes from pest and disease infestation. Mr14 varieties and Nei9008 varieties have advantages such as resistant to downy mildew (*Peronosclerospora maydis* L), leaf rust disease (*P. sorgi*), leaf blight (*Helminthosporium maydis*), have high yield potential, drought tolerant, root and stem resistance and are recommended planting in the dry season in paddy fields or dry land. Arthropods are one of the pests that often attack corn plants. This study aims to determine the type of arthropods found in endophytic plants. The results showed that in endophytic hybrid corn area (Variety Mr14 x Variety Nei9008) found 28 types of arthropods. Arthropods that are most commonly found on land are black beetles (Coleoptera order) of 194 tails. From arthropods found in corn plantations, there are several Arthropods that act as pests, as predators, and as parasitoids. Diversity index is moderate.

### 1. Introduction

Corn, *Zea mays* L., is a seed-Bijan plant that is still a family with grasses. Corn plantation is origin from America which spreads to the continents of Asia and Africa. The development of maize breeding technology that has become more advanced has released many kinds of superior varieties of corn, especially hybrid corn. By planting hybrid corn, it is expected that production will be abundant so that it can increase farmers' incomes.

In order to meet the national food needs and realize sustainable corn self-sufficiency, the Central and Regional Governments set an agreement on production targets. Based on Cereals Plant Research Institute data (2014) South Sulawesi corn production will also fall 4.97% to 1.52 million tons. That happened because the harvested area was shrinking, there was a shift in the growing season due to climate and natural disasters (floods).

One of the major pests having a role in reducing the production of corn is insect pests. This is an obstacle in the effort to achieve a corn surplus in the national food security. Arthropod insects are often found to attack corn plants. So we need an effort to control pests using biological control agents. Biological control agent is the use of living organism such as entomopathogenic fungi to suppress pest population and to cease its life cycle. Of the several types of entomopathogenic fungi that have been identified, *Beauveria bassiana* is one of the effective and efficient agents in controlling insect pests [1]. Several studies have revealed that the *B. bassiana* produces a poison (toxic) which can cause



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aggressive paralysis in larvae and insect imago. Several types of poisons isolated from *B. bassiana* include beauvericin, beauverolide, isorolide, and dyes and oxalic acid [2-3].

Treatment by watering of fungal *B. bassiana* on the soil which is a growing medium for corn plants and seed soaking with *B. bassiana* solution shows that the fungus can enter the plant tissue, roots, stems and leaves. The development of endophytic corn plants is one way to produce corn plants so that they are protected from pests. Mr14 varieties and Nei9008 varieties, both varieties have such advantages resistant to downy mildew (*Peronosclerospora maydis* L), leaf rust disease (*P. sorgi*) and leaf blight (*Helminthosporium maydis*) and has a high yield potential, drought tolerant, resistant to roots and stems and recommended planting in the dry season in paddy fields or fields dry [4]. This study aims to determine the type of Arthropods found in endophytic plants. Arthropods found will be classified based on their role in the ecosystem, namely as plant disturbing organisms that interfere with plants, predators and parasitoids.

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## 2. Materials and Methods

### 2.1. Preparation of *Beauveria bassiana* isolate

Breeding isolates as sources of inoculums from insects that died due to *Beauveria bassiana* with the composition per liter of media were 10 g glucose, 20 g agar, and 4g instant yeast in Petri dishes and incubated at room temperature added with corn obtained by taking extracts from corn.

### 2.2. State of planting

The land used is in Tammu-tammu hamlet, Moncongloe Bulu Village, Moncongloe subdistrict, Maros Distric. The area of land used is 1ha and without tillage.

### 2.3. Soaking corn seed

Soaking is done the day before planting. The seeds were soaked for 24 hours using a *Beauveria bassiana* isolate with a concentration of  $10^7$ .

### 2.4. Planting

Planting is done by using seed varieties that have been soaked using the *Beauveria bassiana* isolate the day before. Each hole is planted with 1-2 seeds with a spacing of 70 x 25cm, with 3 rows of female and then 1 male row.

### 2.5. Hood and suction method

A suction method is used to determine the types of pests found in maize. The containment height used is 1.5 m with a width of 50 cm. The method of sampling is by placing a hood on a randomly determined plot of 25 plots, then each plot is sucked using vacuum suction. Insects trapped in vacuum are put into small bottles for later identification in the laboratory. After being identified, they will be photographed and the observations obtained will be recorded.

### 2.6. Observation parameter

Observation of the parameters was carried by counting the number of populations and types of arthropods trapped in vacuum suction.

### 2.7. Data analysis

To calculate the diversity of arthropods obtained on land, the Shannon-Weiner Index (H) is used with the formula: (Michael, 1955).

$$Diversity (H') = - \sum p_i \ln p_i$$

Note: H': diversity index; Pi: Comparison of the number of individual unit types with the whole type  
Pi: Ni/N; Ni: Number of individuals of type i; N: Total number of individuals.

The criteria for Shannon H's diversity value use the modified criteria [5] as follows:

**Table 1.** Criteria of diversity index

Value of diversity	Level of diversity
$H < 1$	Very low
$1 < H < 2$	Low
$2 < H < 3$	Medium
$3 < H < 4$	High
$H < 4$	Very high

### 3. Results and discussion

Based on observations of the number of arthropods on corn plant land using hood and suction methods can be seen in the table below:

**Table 2.** Number of arthropods present in weeks 1-6 and arthropod diversity index in endophytic corn varieties Mr14 and Nei9008.

Arthropoda	Observation (week)						Number	Pi	Ln Pi	Pi Ln Pi	Shannon Index
	1	2	3	4	5	6					
Koksi beetles ( <i>Coccinella septempunctata</i> )	25	26	25	23	14	25	138	0.174	-1.7486	-0.3043	0.3043
Grasshopper ( <i>Valanga sp.</i> )	4	3	0	1	0	0	8	0.0101	-4.5964	-0.0464	0.0464
Flies ( <i>Ordo Diptera</i> )	9	6	3	9	12	32	71	0.0895	-2.4131	-0.2161	0.2161
Spider ( <i>Lycosidae</i> )	1	2	1	1	1	3	9	0.0113	-4.4786	-0.0508	0.0508
Moth A ( <i>Ordo Lepidoptera</i> )	15	0	0	0	9	2	26	0.0328	-3.4177	-0.1121	0.1121
Cocopets ( <i>Forficulidae</i> )	0	0	0	0	0	2	2	0.0025	-5.9827	-0.0151	0.0151
Red Ant ( <i>Solenopsis</i> )	5	2	7	3	2	30	49	0.0618	-2.784	-0.172	0.172
Black ant ( <i>Dolichoderus thoracicus</i> )	10	4	1	3	11	2	31	0.0391	-3.2418	-0.1267	0.1267
Cockroach ( <i>Periplaneta</i> )	0	0	3	1	15	19	138	0.174	-1.7486	-0.3043	0.3043
Aphids ( <i>Aphid sp.</i> )	21	5	27	0	0	0	53	0.0668	-2.7055	-0.1808	0.1808
Dome Pupa Beetles	0	1	7	0	0	0	8	0.0101	-4.5964	-0.0464	0.0464
Dome Beetle Larvae	0	10	38	0	0	0	48	0.0605	-2.8046	-0.1698	0.1698
Green Grasshopper ( <i>Oxya chinensis</i> )	0	1	0	1	0	0	2	0.0025	-5.9827	-0.0151	0.0151
Walang Sangit ( <i>Leptocoris acuta</i> )	0	0	0	6	1	0	7	0.0088	-4.7299	-0.0418	0.0418
Mosquito ( <i>Aedes sp.</i> )	0	1	1	2	6	5	15	0.0189	-3.9678	-0.0751	0.0751
Black beetle ( <i>Ordo Lepidoptera</i> )	19	47	29	19	62	18	194	0.2446	-1.408	-0.3444	0.3444
Cricket ( <i>Gryllus sp.</i> )	3	3	2	2	1	2	13	0.0164	-4.1109	-0.0674	0.0674
Cornbread ( <i>Peregrinus Maidis Ashm.</i> )	9	0	0	22	9	22	62	0.0782	-2.5487	-0.1993	0.1993
Corn Stem Borer ( <i>Ostrinia furnacalis</i> )	1	0	0	2	0	0	3	0.0038	-5.5772	-0.0211	0.0211
Ladybug ( <i>Riptortus linearis Fabr</i> )	0	0	0	0	0	1	1	0.0013	-6.6758	-0.0084	0.0084
Bee ( <i>Ordo Hymenoptera</i> )	0	0	0	1	0	0	1	0.0013	-6.6758	-0.0084	0.0084
Beetle A ( <i>Ordo Coleoptera</i> )	0	0	0	1	2	0	3	0.0038	-5.5772	-0.0211	0.0211
Moth B ( <i>Ordo Lepidoptera</i> )	0	0	0	0	1	1	2	0.0025	-5.9827	-0.0151	0.0151
Moth C ( <i>Ordo Lepidoptera</i> )	0	0	0	0	1	0	1	0.0013	-6.6758	-0.0084	0.0084
Moth D ( <i>Ordo Lepidoptera</i> )	0	0	0	1	0	0	1	0.0013	-6.6758	-0.0084	0.0084
Beetle B ( <i>Ordo Coleoptera</i> )	0	0	0	1	0	1	2	0.0025	-5.9827	-0.0151	0.0151
Beetle C ( <i>Ordo Coleoptera</i> )	0	0	0	1	0	3	4	0.005	-5.2895	-0.0267	0.0267
Beetle D ( <i>Ordo Coleoptera</i> )	0	0	0	0	0	1	1	0.0013	-6.6758	-0.0084	0.0084
Total	122	111	144	100	147	169	793			-2.6289	2.6289

Table 1 shows the data on Mr14 and Nei9008 varieties of corn land found as many as 28 types of arthropods starting from the 1<sup>st</sup> to the 6<sup>th</sup> week of observation. Through the hood and suction method, 138 koksi beetles were found, 8 Grasshoppers, 71 flies, 9 spiders, 26 moths A, 2 cocopets, 49 red ants, 31 black ants, 138 cockroaches, 53 aphids, 8 dome pupae beetles, 48 dome beetle larvae, 2 green

grasshoppers, 7 walang sangit, 15 mosquito<sup>9</sup>, 194 black beetles 13 crickets, 62 cornbread, 3 corn stem borer, 1 ladybug, 1 bee, 3 beetles A, 2 Moth B, 1 Moth C, 1 Moth D, 2 beetle B, 4 beetle C, 1 Beetle D.

Based on the calculation results of the Diversity Index ( $H'$ ) shows that diversity index of Mr14 and Nei9008 varieties as a whole is 2.6289 and categorized as a medium diversity index. In the criteria for Shannon  $H'$  diversity value which is  $2 < H < 3$  is a moderate level of diversity. In the table above, it can be seen the number of arthropods attacking corn plants by using hood and suction methods. <sup>5</sup> is in accordance with the opinion of [6] who said that every arthropod on corn plants is known to attack in all phases of plant growth, both vegetative and generative. Some arthropods were obtained using a hood and suction method on *Beauveria bassiana* endophytic corn varieties Mr14 and Nei9008 varieties, namely:

Koksi beetles (*Coccinella septempunctata*). The amount obtained on the planted land for 6 weeks of observation was 138 tails. *Dome pupa beetles*; the amount obtained on the planted land for 6 weeks of observation was 8 tails. *Dome beetle larvae*; the amount obtained on the plantation land for 6 weeks of observation was 48 tails. The koksi beetle has morphological characteristics, which are small body shapes similar to ladybugs on the orange wings that have black spots. The koksi beetle also has six limbs, located on the front two, middle two, and back two. Koksi beetle has morphological characteristics, which are small body shapes similar to ladybugs on the orange wings that have black spots. The koksi beetle also has six limbs, located on the front two, middle two, and rear two. In the legs there are also small feathers that function as adhesives. The dome beetles are only about 4-8 mm in size. The koksi beetle eats several types of ticks including aphids on the corn plant. Both larvae and imago can act as predators, but the search power for koksi beetle larvae is higher than in adulthood.

Grasshopper (*Valanga sp.*). The amount contained in the planted land for 6 weeks of observation was 8 tails. Grasshoppers attack corn plants when they are young (eating young leaf buds), the leaves look damaged due to attacks from grasshoppers, grasshoppers can deplete the corn plant all at once up to their leaf bones. Grasshoppers can also eat corn stalks and cobs if the population is very high with limited food sources.

Flies (*Ordo Diptera*) The amount contained in the planted land for 6 weeks of observation was 71 tails.

Spiders (*Lycosidae*) The amount contained in the planted land for 6 weeks of observation was 9 tails. Spiders are ambush predators, that wait for prey to pass near them while hiding behind leaves, petals, rock slits, or earth holes. These spiders eat moths, caterpillars and other insects. After catching the insect, the spider injects poison that paralyzes the victim, then sucks the victim's body fluids.

Moth A (*Ordo Lepidoptera*) The amount contained in the planted land for 6 weeks of observation was 26 tails. Moth B (Order Lepidoptera) as much as 2 tails. Moth C (Order Lepidoptera) 1 tail and Moth D (Order Lepidoptera) 1 tail.

Cocopets (*Porficulidae*) The amount contained in the planted land for 6 weeks of observation was 2 tails. Most cocopets are carcasses or herbivores that hide in the dark during the day and are active at night (predators). Cocopets eat dead plant material or slow invertebrates.

Red ant (*Solenopsis*) the amount contained in the planted land for 6 weeks of observation was 49 tails.

Black ant (*Dolichoderus thoracicus*) The amount contained in the planted land for 6 weeks of observation was 31 tails. Black ants (*Dolichoderus thoracicus*) usually come out of nest in the morning and evening when temperature is not too hot. Black ant nests are above the surface of the ground, ants will go to the tops of plants to get sunlight while carrying out their activities. Ants attack caterpillars and several other types of pests.

Cockroach (*Periplaneta*) The amount contained in the planted land for 6 weeks of observation was 138 tails.

Aphids (*Aphid sp.*) The amount contained in the planted land for 6 weeks of observation was 53 tails. Aphids in large clusters on leaves and stems, suck leaf and stem fluids causing abnormal colored leaves which ultimately cause the plant to dry out. These aphids produce honeydew which is released

so that it forms a black soot that covers the leaves and causes the photosynthesis process of the plant to not be optimum.

Green Grasshopper (*Oxya chinensis*) The amount obtained in the planted land for 6 weeks of observation was 2 tails. Grasshopper's body consists of 3 main parts, namely the head, chest (thorax) and abdomen (abdomen). Grasshopper also has 6 six jointed legs, 2 pairs of wings, and 2 antennae. The long hind legs are used for jumping while the short front legs are used for walking. Green grasshoppers feed on small insects and several types of pests on corn plants.

Walang sangit (*Leptocorisa acuta*) the amount contained in the planted land for 6 weeks observation of 7 tails.

Mosquito (*Aedes sp.*) the amount obtained in the planted land for 6 weeks of observation was 15 tails.

Black beetle (*Ordo Lepidoptera*) the amount obtained in the planted land for 6 weeks of observation was 194 tails.

Cricket (*Gryllus sp.*) the amount obtained in the planted land for 6 weeks of observation was 16 tails.

Cornbread (*Peregrinus Maidis Ashm.*) the amount obtained in the planted land for 6 weeks of observation was 62 individuals.

Corn Stem Borer (*Ostrinia furnacalis*) The amount contained in the planted land for 6 weeks of observation was 3 individuals. *Ostrinia furnacalis* larvae have characteristics of damage to each part of the corn plant, namely a small hole in the leaf, a hole in the stem, a male flower or the base of the cob, and a stem that is easily broken [7].

Ladybug (*Riptortus linearis Fabr*) the amount contained in the planted land for 6 weeks of observation was 1 tail.

Bee (*Ordo Hymenoptera*) the amount contained in the planted land for 6 weeks of observation was 1 tail.

Beetle A (*Ordo Coleoptera*) the amount contained in the planted land for 6 weeks of observation were 3 trails, 2 beetles B, 4 beetles C and 1beetles D.

Arthropods obtained in the field can be classified based on their role in the ecosystem, namely as plant disturbing organisms, predators or parasitoid. Plant-disturbing organisms are all organisms that can damage, disrupt life, or cause death in plants. Arthropods that act as pests found in corn plantations include; Grasshopper (*Valanga sp.*), Moth A (Order Lepidoptera), Aphids (*Aphid sp.*), Walang sangit (*Leptocorisa acuta*), Black beetle (Order Lepidoptera), Cornbread (*Peregrinus maidis* Ashm.), Corn Stem Borer (*Ostrinia furnacalis*), and Ladybug (*Riptortus linearis* Fabr). Predatory insects are insects that obtain their food by preying on other insects. Arthropods that act as predators found in maize plantations include; Spiders (Lycosidae), Coci beetles (*Coccinella septempunctata*), Green Grasshopper (*Oxya chinensis*), Black Ants (*Dolichoderus thoracicus*) and Cocopet (Porficulidae). Parasitoid insects are insects that part of their life cycle are parasitic to other insects to be able to grow and develop to a certain stage. Arthropods that act as parasitoids found in maize plantations are the Hymenoptera Order and the Diptera Order.

#### 4. Conclusion

In the endophytic corn cultivated Mr14 and Nei9008 varieties, 28 species of arthropods were found. Arthropods that are most commonly found on land are black beetles (Coleoptera order) of 194 tails. From arthropods found in maize plantations, there are several Arthropods that act as plant disturbing organisms, predators, and parasitoids. From the calculation results of the Diversity Index (H') shows that the Index of diversity in Mr14 and Nei9008 varieties are 2.6289. The Shannon H' diversity value, which is  $2 < H < 3$ , is a moderate level of diversity.

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