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Resistance test of several sweet potato genotypes against sweetpotato weevil *Cylas formicarius* Fabricus (Coleoptera: Curculionidae) in the lowlands

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Resistance test of several sweet potato genotypes against sweetpotato weevil *Cylas formicarius* Fabricus (Coleoptera: Curculionidae) in the lowlands

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Abstract. The sweetpotato weevil (SPW), *Cylas formicarius* Fabricius, is the main pest in sweet potatoes and spread throughout the world. One of the efforts that can be used to reduce SPW attacks is to use sweet potato genotypes that contain high beta-carotene. The objective of this research was to know the resistance level of some sweet potato genotypes to sweetpotato weevil in the lowlands. This research used a randomized block design with one factor, namely sweet potato consisting of 5 genotypes that came from different accessions (Saribu Dolok Simalungun, Kesemak Simalungu, Batang Beruh Dairi, Binjai accession and National Superior Varieties Beta-1). This research was carried out in Cengkeh Turi, Binjai Utara, Sumatera Utara from April to August 2018. The results showed that the lowest intensity and percentage of attack was on sweet potato accession of Saribu Dolok Simalungun, which was 7.94% and 27.08% respectively while the highest intensity and percentage of attack was on sweet potato accession of Batang Beruh Dairi, which was 18.60% and 48.7% respectively. It is recommended that Saribu Dolok accession is more resistance rather than others and suitable to grow on low land.

1. Introduction
In tropical countries, sweet potatoes are an important food crop [1]. Judging from the nutritional value, the presence of beta-carotene as pro-vitamin A, anthocyanin and phenol as antioxidants, dietary fiber and a low glycemic index is the added value of sweet potatoes as a local food diversification material [2]. Orange sweet potato varieties can contribute to overcome vitamin A deficiency and function as wheat flour in processed products [3].

Constraints in the development of sweet potatoes are the low level usage of superior clones [4]. Most of the farmers still use local clones which are preferred for generations despite their low productivity. There are an availability of superior clones with high yield and good quality also resistant to pests and diseases. Farmer's preference for sweet potatoes is also very diverse [5].

National sweet potato production has decreased by as much as 2.382.658 tons to 2.169.386 tons from 2014 to 2016 [6]. Activities to increase sweet potato production are faced with pest attacks. Sweet potato Weevil is one of the main pests that can cause yield losses between 20-70% [7].

Sweetpotato weevil is a major pest in sweet potatoes and spread throughout the world. This pest causes damage in the field, storage and quarantine significantly [8]. In Indonesia, SPW causes yield losses between 10-80%, depending on location and climate [9]. In Indonesia, SPW is found in Papua, Java, Sulawesi, Sumatra and Nusa Tenggara. In Java, SPW attack is usually under 5%, but in the dry season the attack can reach to 50% [10].

Adult SPW feeds on the epidermis at the base of the stem and the outer surface of the tuber, forming a hole in the tuber. Broken tubers produce toxic compounds (*terpene*) thus it cannot be consumed [11]. Several control components of SPW that have been studied include farming techniques, host destruction, and the use of resistant varieties [12].

This research was aimed to find out the resistance level of some sweet potato genotypes to sweetpotato weevil (*Cylas formicarius*) in the lowlands.

2. Materials and Methods

This research was carried out from April to August 2018 in Cengkeh Turi, Binjai Utara, Sumatera Utara. This research used a randomized block design with one factor, which was sweet potato consisting of 5 genotypes that came from different accessions (Saribu Dolok Simalungun, Kesemak Simalungun, Batang Beruh Dairi, Binjai and National Superior Varieties Beta-1). The stages of this research are survey of research land in endemic pest areas, land preparation and bed making, planting material preparation from 3 different accession, planting, maintenance namely by watering, sprouting, control of pest, diseases and weeds, as well as fertilization and harvesting. Observation of intensity and percentage of pest attacks carried out after harvest. Inoculation was done naturally in location that planted with sweet potatoes by local farmers and was an endemic area of this pest.

Data were analyzed statistically by F test and continued by Duncan Multiple Range Test (DMRT) at α 5%.

3. Results and Discussion

The results showed that sweet potato from Batang Beruh Dairi had the highest attack intensity at 18.60%, while the lowest intensity was sweet potato accession from Saribu Dolok Simalungun (7.94%) and Beta-1 (12.51%) (Table 1.). This is because the planting area is an area that is planted with sweet potatoes by local farmers and is an endemic area of SPW. Mao *et al*. [13] found that the expression of sweet potato genotypic resistance to SPW was slightly affected by it production sites. The resistance level of several genotypes is an expression of it genetic character. The level of resistance in the other three genotypes showed differences in the expression of resistance when planted in different locations, which can be caused by differences in the type and content of soil nutrients and planting environment conditions, including temperature, humidity, light intensity, and altitude [14].

Table 1. The average intensity of SPW attack on some sweet potato genotypes in the lowlands

Genotypes	Intensity of Attack (%)
Saribu Dolok Simalungun accession	7.94
Kesemak Simalungun accession	13.19
Batang Beruh Dairi accession	18.60
Binjai accession	14.46
Beta-1	12.51

The location of tubers and sweet potato genotypes significantly influence the number of cuts on the tuber surface [15]. The genus *Ipomoea* plant is the main host of this insect and is a serious pest on sweet potato plants which causes losses of up to 97% [16]. Because of the nocturnal activity of adult SPW, these pests are difficult to control using chemicals [17]. The mechanism of sweet potato resistance to SPW is probably caused by more than one factor. Antixenosis (non-preference) and tolerance are the main factors determining the resistance of sweet potato plants to SPW [18].

The data in Table 2 showed that the percentage results of SPW attack on some genotypes in the lowlands with the highest percentage are sweet potato accession of Batang Beruh Dairi, which was 48.7%. The high attack of SPW on sweet potatoes is thought to be due to the continuous availability of food including potato plants so that the availability of the host remains. Another factor that influences the presence of SPW is temperature [19]. Natawigena [20] reported that each insect species has its own temperature range where insects can live. Insects have a certain temperature range for their life. Beyond this temperature range, insects can experience death.

Table 2. The average percentage of SPW attacks on some sweet potato genotypes in the lowlands

Genotypes	Percentage of Attack (%)
Saribu Dolok Simalungun accession	27.08
Kesemak Simalungun accession	41.40
Batang Beruh Dairi accession	48.70
Binjai accession	42.98
Beta-1	27.32

Environmental effects are seen in the physiological processes of insects, which at a certain temperature insect activity is high and will decrease at other temperatures. Generally the effective temperature range is 15ºC for minimum temperature, 25º C for optimum temperature and 45º C for maximum temperature. At optimal temperatures the ability of insects to reproduce will increase and death (mortality) before the age limit will decrease. Other influencing factors are humidity, wind and climate, which according to local farmers, the climate in the previous year was hot compared to the climate which is now often fluctuating or erratic [19].

In addition to environmental conditions, the content of nutrients contained in the tubers is thought to determine the level of SPW attack. Sweet potato accession of Saribu Dolok Simalungun has the highest betacarotene content compared to other sweet potato genotypes [21]. Sweet potatoes which have yellow-orange tuber meat with high betacarotene content are less favored by SPW [22]. The content of beta carotene in the tuber is characterized by the color of tuber meat. The higher the beta carotene content in the tuber, the more the color of the tuber leads to an older yellow/orange yellowish. Not all accessions with yellow to dark yellow color meat that have high resistance to SPW. This shows that the resistance level of sweet potatoes to SPW attack is not only influenced by carotene levels in the tubers, but other factors such as water levels and other chemical compounds found in the tuber can also affect the resistance level to these pests (antibiosis) [23, 24].

4. Conclusions

The lowest attack intensity and percentage of SPW attacks were at sweet potato accession of Saribu Dolok Simalungun, which was 7.94% and 27.08% respectively. Whereas the highest intensity and percentage of attack was at sweet potato accession of Batang Beruh Dairi, which amounted to 18.60% and 48.7% respectively. It is recommended that Saribu Dolok accession is more resistance rather than others and suitable to grow on low land.

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