Use Of Various Germplasm Palm Oil Plantation Of Population Insect Pollinators (Elaeidobius Kamerunicus Faust.) In PPKS Collection, Riau

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Abstract: This study aims to determine the effect of various germplasm palm oil plantation of population insect pollinators (Elaeidobius kamerunicus Faust.) In PPKS collection at Kebun Kalianta, Riau. The study was conducted from May to July 2016 with a purposive sampling method. The results showed total population of E. kamerunicus is 9,123 head/0.5ha (3,160 head 0.5ha: 5,963 head/ 0.5ha) in the male flowers and amounted to 433 head/0.5ha (182 head/0.5ha: 251 heads/0.5ha) in female flowers. E. kamerunicus highest male population of 1,244 head/0.5ha and female high of 2,241 head/0.5ha germplasm contained in V3 (Accession Wild Angola) in the male flowers and the male population of E. kamerunicus high of 41 head/0.5ha and the highest female amounting to 65 head/0.5ha located on E. guineensis germplasm in the female flowers on the contrary the lowest population of 0 head/0.5ha located on E. oleifera germplasm of both the male flowers and female flowers. Only the air temperature significantly affect E. kamerunicus male population (r = 0763, p <0.05), while rainfall, humidity, light intensity, wind speed and no significant effect on the existence of E. Kamerunicus male and female.

Index Terms: Germplasm, Palm Oil Plantation, Insect Pollinator, Elaeidobius kamerunicus, PPKS, Riau.

1 INTRODUCTION

OIL palm (Elaeis guineensis) is a plantation crop widest reach 11.30037 million ha of the total area of plantations in Indonesia. In 2014 the productivity of oil palm plantations in Indonesia resulted in 29,278,189 tonnes and increased in the year 2015 amounted to 31,284,306 tonnes of crude palm oil (3). Palm oil productivity is influenced by various factors, among others, is the use of the type of germplasm, seed germination, maintenance and supervision of seeds, fertilization, the determination of the cropping pattern, planting, crop maintenance, pest and disease control, and harvesting (2) One important factor is the use of palm germplasm types in addition to potentially generate high production will also affect populations of E. kamerunicus (9). Palm germplasm is generally in the form of a cross Dura group (DxD) and group Tenera/Pisifera (txt/P). This genetic material by breeders palm oil used as the base population in the selection process to produce hybrid DXP. Furthermore, E. oleifera which is the wild relatives of commercial oil palm E. guineensis, also belong to the group of oil palm germplasm (17). Palm oil has monoecius flower type, physically separate male and female flowers on the same tree individual. Although there are male and female flowers on the same individual trees, but the male and female flowers usually bloom at different times (1). Another factor that led to population decline E. kamerunicus is high rainfall (7).

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Oil palm pollinator may be wind, water, human, vertebrate animals and insects (11). The pollination process flowers palm is cross-pollination because the trees are not found in the male and female flowers that bloom at the same time. One effective intermediary in assisting the process of pollination of flowers are insect pollinators (14). E. kamerunicus (Col: Curculionidae) is one of the insects that play an important role in the pollination process palm oil. The release of beetles E. kamerunicus in Indonesia in 1982 to significantly improve the productivity of palm oil from 40% to 60% (4) E. kamerunicus amount effective to pollinate the female flowers are 20,000 beetles per hectare. E. kamerunicus population of less than 700 head per female flower cluster anthesis will cause the fruit set to be low. Fruit set was good at oil palm plantation is above 75% (13). In general, male and female flowers are capable of producing 10-40 grams or similary with a million grains of pollen or pollen contained in spikelet stalk with yellowish white color with a diameter 1 cm (15). Based on the above writer interested in conducting research to study the effect of various palm germplasm collection Riau PPKS to the presence of insect pollinators (E. kamerunicus).

RESEARCH METHODS

This research was conducted with a purposive sampling method (sampling intended) that a direct observation of E. kamerunicus on oil palm male flowers anthesis every Monday at 10:00 to 11:00 pm and receptive female palm flowers every Thursday 08.00 - 09.00 (adopted from 8) for 8 (eight) weeks in a row on a variety of germplasm collections PPKS Riau. Germplasm comprising (DXT, Clones DXP, Accession Wild Angola, FTC clones, clones BC-1, BC-2 Deli, Elaeis oleifera, and BC-2 Africa) planting year 2013 with a rate of 75% florescence.

Implementation Research

Determination Gardens to be surveyed

Each of germplasm surveyed has a land area of 0.5 ha each (72 trees). The total land use area of 4 ha. Total Interest Males and Females Total Flowers Bloom. Number of male flowers and female flowers receptive anthesis calculated for each type of germplasm that will be used in research.

The population of pollinators observations Palm Oil
Calculation of beetle population per male flower cluster anthesis, with each taking 3 spikelet flowers that sits at the end of bunches (above). Spikelet were put into plastic bags and given a cotton wool dipped 20 drops ethyl alcohol grading 96%. Calculation of the population of beetles per flower cluster receptive females, done by counting the number of E. kamerunicus caught the female flowers.

Data analysis
Data were analyzed using SPSS version 22 o'clock and then do the T-test, Test Significant, and Correlation between E. kamerunicus against germplasm, and sex ratio.

Supporting data
As the data supporting the measurement of environmental data consist of air humidity, air temperature, wind speed, precipitation, and light intensity.

Population and Sex Ratio E. kamerunicus on Flower Males
Results of research on male flowers palm of eight oil palm germplasm collection PPKS Riau showed that E. kamerunicus total population of 9,123 head/0.5ha with a sex ratio that is higher female population of 5,963 head/0.5ha than the male population of 3,160 head/0.5ha (Tables 1 and 2). E. kamerunicus highest male population of 1,244 head/0.5ha and female high of 2,241 head/0.5ha germplasm contained in V3 (Accession Wild Angola) while the population of E. kamerunicus lowest male and female tail 0/0.5ha contained in the germplasm V7 (E. oleifera). Backed by the research results (11) states that if the palm oil is not blooming, the beetle. E. kamerunicus as consumers will not get the level 1 feed so that the beetle population decreased E. kamerunicus. This study shows that the population differences of E. kamerunicus on germplasm due to the availability of different flowers that are a food source and as a place at copulation of E. kamerunicus .

RESULTS AND DISCUSSION

Table 1. *Population of E. kamerunicus male on male flowers*

Germplasm	Population of E.kamerunicus male/ 0.5 ha								Total	Average
	Time (week)									
	I	II	III	IV	V	VI	VII	VIII		
V1	7713	2999	7722	0	10715	17501	11549	720	58919	818.31
V2	442	13439	3891	6230	2205	0	1566	0	27773	385.73
V3	3936	12724	8370	12373	14819	17632	15955	3750	89559	1243.875
V4	1431	0	6246	2430	0	0	1485	9567	21159	293.875
V5	0	1200	0	0	0	0	0	0	1200	16.66
V6	3532	3059	4674	531	0	770	3693	1440	17699	245.81
V7	0	0	0	0	0	0	0	0	0	0
V8	3072	3692	300	624	0	0	3510	0	11198	155.52
Total	20126	37113	31203	22188	27739	35903	37758	15477	227507	3159.81
Average	2515.75	4639.125	3900.375	2773.5	3467.375	4487.875	4719.75	1934.625	28438.4	394.97

Table 2. *Population of E. kamerunicus female on male flowers*

Germplasm	Population of E. kamerunicus female/ 0.5 ha								Total	Average
	Time (week)									
	I	II	III	IV	V	VI	VII	VIII		
V1	12143	9656	21477	0	20844	13491	12836	750	91197	1266.625
V2	936	30022	13942	28630	14535	0	2607	0	90672	1260.583
V3	13392	17226	13765	30548	19849	28500	29438	8650	161368	2241.222
V4	2014	0	9768	4968	0	0	2640	10703	30093	417.9583
V5	0	3600	0	0	0	0	0	0	3600	50
V6	7596	3312	4845	885	0	4070	5957	1536	28201	391.6806
V7	0	0	0	0	0	0	0	0	0	0
V8	6768	11736	930	960	0	0	3750	0	24144	335.333
Total	42849	75552	64727	65991	55228	46061	57228	21639	429275	5963.403
Average	5356.13	9444	8090.88	8248.875	6903.5	5757.625	7153.5	2704.875	53659.38	745.425

Results of t-test on the research showed that the sex ratio (T = 3,808), observation time (t = 22 133), and total E. kamerunicus (t = 7,841) in the male flower significantly different at p <0.000 (Table 3).

Table 3. *T-test in the male flowers of E. kamerunicus*

Parameter	Test Value = 0		
	T	df	Sig. (2-tailed)
Germplasm	22.133	127	.000
Sex Ratio	33.808	127	.000
Time	22.133	127	.000
Total E. kamerunicus	7.841	127	.000

In total E. kamerunicus significant test on the male flower to the value of F = 14 802, the P <0.05 indicates significant difference to the germplasm (Table 4).

Table 4. *Significant Test in male flowers of E. kamerunicus*

Parameter	Sum of Squares	df	Mean Square	F	Sig.
Sex Ratio	.000	7	.000	.000	1.000
Time	.000	7	.000	.000	1.000
Total E. kamerunicus	3228158405.000	7	461165486.429	14.802	.000

In correlation test showed that the germplasm collection Riau PPKS of r = 0476, at p <0:01 and sex ratio of r = 0214, at p <0.05 was significantly affected the total E. kamerunicus the male flowers (Table 5).

Table 5. *Correlation test of the male flowers of E. kamerunicus*

Parameter	Uji Korelasi	Germ plasm	Sex Ratio	Time	Total E. kamerunicus
Germplasm	Pearson Correlation	1	.000	.000	.476(**)
	Sig. (2-tailed)	.	1.000	1.000	.000
	N	128	128	128	128
Sex Ratio	Pearson Correlation	.000	1	.000	.214(*)
	Sig. (2-tailed)	1.000	.	1.000	.015
	N	128	128	128	128
Time	Pearson Correlation	.000	.000	1	-.074
	Sig. (2-tailed)	1.000	1.000	.	.409
	N	128	128	128	128
Total E. kamerunicus	Pearson Correlation	.476(**)	.214(*)	.074	1
	Sig. (2-tailed)	.000	.015	.409	.
	N	128	128	128	128

Based on the results of research on E. kamerunicus population of males and females in male flowers palm is known that both are mutual influence, because E. kamerunicus males will help of E. kamerunicus females in the process of providing pollen as a food source for E. kamerunicus settling on oil palm flowers to pollinate. This is in accordance with (6) which states that the male beetles can carry pollen beetles more than the females, because males larger body size and more feathers on its wings than females so advantageous to conduct the process of pollination.

Population and Sex Ratio E. kamerunicus in Female Flower in Oil Palm Plantation

The study of population

E. kamerunicus the female flowers of the eight palm oil palm germplasm collection Riau PPKS obtained a total population of 433 head/0.5ha with a population of male sex ratio which amounted to 182 head/0.5ha and female population of 251 head/0.5ha (Table 6 and 7). Population of E. kamerunicus females is higher than the male population that exist in female flowers. This is in accordance with (5) which states that the E. kamerunicus females are most active insects visit flowers females than males, therefore

E. kamerunicus female population will be higher also in the female flowers.

E. kamerunicus highest male population by 41 heads/ 0.5ha and E. kamerunicus high of 65 female head/0.5ha contained in the germplasm V1 (E. guineensis) while the lowest population both males and females by 0 tail/0.5ha contained in the germplasm V7 (E. oleifera) (Figure 2). This is due to each of germplasm used to have the availability of pollen and pollen differently so that interest E. kamerunicus will be different for each plasma The germ. As stated (13) that the availability of male flowers will meet the needs of pollen for pollination process to be performed by the population of E. kamerunicus the female flowers.

Table 6. *Population of E. kamerunicus male on male flowers*

Germplasm	Population of E. kamerunicus male/ 0.5 ha								Total	Average
	Time (week)									
	I	II	III	IV	V	VI	VII	VIII		
V1	242	681	509	75	528	207	574	165	2981	41.402
V2	447	303	207	54	632	413	343	163	2562	35.583
V3	392	480	618	454	206	0	0	0	2150	29.861
V4	451	535	306	327	615	0	506	0	2740	38.055
V5	942	38	22	448	0	0	0	0	1450	20.138
V6	118	16	113	0	0	0	0	0	247	3.430
V7	0	0	0	0	0	0	0	0	0	0
V8	322	0	357	218	91	0	0	0	988	13.722
Total	2914	2053	2132	1576	2072	620	1423	328	13118	182.194
Average	364.25	256.625	266.5	197	259	77.5	177.875	41	1639.75	22.774

Table 7. *Population of E. kamerunicus female on male flowers*

Germplasm	Populasi of E.kamerunicus female/ 0.5 ha								Total	Average
	Time (week)									
	I	II	III	IV	V	VI	VII	VIII		
V1	729	803	1192	82	562	284	793	205	4650	64.583
V2	672	447	227	109	701	517	432	377	3482	48.361
V3	566	738	705	543	345	0	0	0	2897	40.236
V4	489	658	584	481	825	0	598	0	3635	50.486
V5	1146	43	47	457	0	0	0	0	1693	23.513
V6	184	20	147	0	0	0	0	0	351	4.875
V7	1	0	0	0	0	0	0	0	1	0.013
V8	403	0	368	273	314	0	0	0	1358	18.861
Total	4190	2709	3270	1945	2747	801	1823	582	18067	250.930
Average	523.75	338.62	408.75	243.12	343.37	100.12	227.87	72.75	2258.37	31.366

E. kamerunicus highest male population by 41 heads/ 0.5ha and E. kamerunicus high of 65 female head/0.5ha contained in the germplasm V1 (E. guineensis) while the lowest population both males and females by 0 tail / 0.5ha contained in the germplasm V7 (E. oleifera) (Figure 2). This is due to each of germplasm used to have the availability of pollen and pollen differently so that interest E. kamerunicus will be different for each plasma the germ. As (13) that the availability of male flowers will meet the needs of pollen for pollination process to be performed by the population of E. kamerunicus the female flowers. Results of t-test on the research showed that the sex ratio (T = 33 808), the time of observation (T = 22 133), and total of E. kamerunicus (T = 9.700) in the female flowers are significantly different at p<0.000 (Table 8).

Table 8. *t-test in the female flowers of E. kamerunicus*

Parameter	Test Value = 0		
	T	Df	Sig. (2-tailed)
Germplasm	22.133	127	.000
Sex Ratio	33.808	127	.000
Time	22.133	127	.000
Total E. kamerunicus	9.700	127	.000

Significant test results in total E. kamerunicus with a value of F = 8604 at P <0.05 indicates significant difference to the total of E. kamerunicus the female flowers (Table 9).

Table 9. *Significant test in the female flowers of E. kamerunicus*

Parameter	Sum of Squares	df	Mean Square	F	Sig.
Sex Ratio	.000	7	.000	.000	1.000
Time	.000	7	.000	.000	1.000
Total E. kameruicus	3431711.117	7	490244.445	8.604	.000

In correlation test showed that the germplasm from PPKS collection, Riau of r = 0.503 and r = observation time of 0372, at p <0:01 significant effect on total E. kamerunicus the female flowers (Table 10).

Table 10. *Correlation test in the female flowers E. kamerunicus*

Parameter	Uji korelasi	Germ Plasm	Sex Ratio	Time	Total E. kameruicus
Germplasm	Pearson Correlation	1	.000	.000	.503(**)
	Sig. (2-tailed)	.	1.000	1.000	.000
	N	128	128	128	128
Sex Ratio	Pearson Correlation	.000	1	.000	.136
	Sig. (2-tailed)	1.000	.	1.000	.126
	N	128	128	128	128
Time	Pearson Correlation	.000	.000	1	.372(**)
	Sig. (2-tailed)	1.000	1.000	.	.000
	N	128	128	128	128
Total E. kamerunicus	Pearson Correlation	.503(**)	.136	.372(**)	1
	Sig. (2-tailed)	.000	.126	.000	.
	N	128	128	128	128

Based on the survey results revealed that the male population of E. kamerunicus very significant effect on the female population. This shows that if high population of E. kamerunicus male then female population will be high anyway, because the behavior of E. kamerunicus will look for partners to carry out copulation. As stated by (11) that when E. kamerunicus older, she will take the male flower stalk juice that had bloomed and then it will look for the opposite sex to perform copulation happens during the day, between 2-3 days after developing into adult beetles, population of E.kamerunicus relationship with environmental parameters. Correlation test results showed that the air temperature at r = 0763 real effect on P <0.05 against the male population of E. Kamerunicus (Table 11). In contrast to other environmental parameters are not significant and has a weak correlation the population of E. kamerunicus. This happens because the air temperature fluctuated during the observation.

Table 11. *The correlation test population of males and females of E. kamerunicus with environmental factors in male flower*

Parameter	Correlation	Air Temperature	Rain Fall	Light Intensity	Humidity	Wind Velocity	Male	Female
Air Temperature	Pearson Correlation	1	.205	.952(**)	.958(**)	.222	.763(*)	.531
	Sig. (2-tailed)	.	.627	.000	.000	.598	.028	.176
	N	8	8	8	8	8	8	8
Rain Fall	Pearson Correlation	.205	1	.288	.124	.216	.167	.249
	Sig. (2-tailed)	.627	.	.490	.770	.607	.694	.552
	N	8	8	8	8	8	8	8
Light Intensity	Pearson Correlation	.952(**)	.288	1	.886(**)	.022	.668	.389
	Sig. (2-tailed)	.000	.490	.	.003	.959	.070	.341
	N	8	8	8	8	8	8	8
Humidity	Pearson Correlation	.958(**)	.124	.886(**)	1	.237	.683	.471
	Sig. (2-tailed)	.000	.770	.003	.	.572	.062	.239
	N	8	8	8	8	8	8	8
Wind Velocity	Pearson Correlation	.222	.216	.022	.237	1	.185	.207
	Sig. (2-tailed)	.598	.607	.959	.572	.	.662	.623
	N	8	8	8	8	8	8	8
Male	Pearson Correlation	.763(*)	.167	.668	.683	.185	1	.874(**)
	Sig. (2-tailed)	.028	.694	.070	.062	.662	.	.000
	N	8	8	8	8	8	64	64
Female	Pearson Correlation	.531	.249	.389	.471	.207	.874(**)	1
	Sig. (2-tailed)	.176	.552	.341	.239	.623	.000	.
	N	8	8	8	8	8	64	64

Results from Pearson correlation test between population of males and females of E. kamerunicus with environmental factors in male flowers showed that the air temperature, humidity, intensity, light, rainfall, and wind speed does not have real influence and weak correlation to population E. kamerunicus. but population E. Kamerunicus males of r = 0.947 at p <0:01 has a significant effect on the female population (Table 12). So, the higher the population of E. kamerunicus the higher male population of E. kamerunicus females that will give effect to the production of oil palm bunches for successful pollination process flowers palm conducted by E. kamerunicus is influenced by population. It is powered by (12) which states that the pollination of plants by insects is one key to the success of agricultural production, then according to (16) will improve the quality and amount of pollination services over time and space.

Table 12. *Correlation test population of males and females of E. kamerunicus with environmental factors in female flowers*

Parameter	Correlation	Male	Female	RainFall (mmHg)	Air Temperature (^{o}C)	Humidity (%)	Light Intensity (Cd)	Wind Velocity (m/s)
Male	Pearson Correlation	1	.947(**)	.131	.244	.455	.424	.241
	Sig. (2-tailed)	.	.000	.758	.561	.258	.295	.565
	N	64	64	8	8	8	8	8
Female	Pearson Correlation	.947(**)	1	.162	.377	.640	.627	.312
	Sig. (2-tailed)	.000	.	.702	.358	.088	.096	.452
	N	64	64	8	8	8	8	8
Rain Fall	Pearson Correlation	.131	.162	1	.230	.133	-.114	.082
	Sig. (2-tailed)	.758	.702	.	.583	.753	.789	.847
	N	8	8	8	8	8	8	8
Air Temperature	Pearson Correlation	.244	.377	.230	1	.788(*)	.829(*)	.679
	Sig. (2-tailed)	.561	.358	.583	.	.020	.011	.064
	N	8	8	8	8	8	8	8
Humidity	Pearson Correlation	.455	.640	.133	.788(*)	1	.970(**)	.336
	Sig. (2-tailed)	.258	.088	.753	.020	.	.000	.415

	N	8	8	8	8	8	8	8
Light Intensity	Pearson Correlation	.424	.627	.114	.829(*)	.970(**)	1	.318
	Sig. (2-tailed)	.295	.096	.789	.011	.000	.	.443
	N	8	8	8	8	8	8	8
Wind velocity	Pearson Correlation	.241	.312	.082	.679	.336	.318	1
	Sig. (2-tailed)	.565	.452	.847	.064	.415	.443	.
	N	8	8	8	8	8	8	8

CONCLUSIONS

[1] E. kamerunicus male population of 1,244 head/0.5ha and females amounted to 2,241 heads/0.5ha highest in germplasm V3 (Accession Wild Angola) while the population of E. kamerunicus males and females the lowest at 0 head / 0.5ha present in plasma nutfah V7 (E. oleifera).

[2] E. kamerunicus male population by 41 heads/0.5ha and females by 65 heads/0.5ha highest in germplasm V1 (E. guineensis) and the lowest population 0 tail/0.5ha contained in the germplasm V7 (E. oleifera).

[3] T-test germplasm showed the effect on the sex ratio (t = 33 808), observation time (t = 22 133) and total E. kamerunicus (t = 7,841) in the male flowers and (t = 9.700) in the female flowers at p <0.000.

[4] Total E. kamerunicus the male flowers to the value of F = 14 802 and female flowers with a value of F = 8604 indicates significant to germplasm at P <0.05.

[5] Comparison of sex ratio of E. kamerunicus the male and female flowers are 1 : 2.

[6] Environmental factors that significantly affect the male population of E. kamerunicus in male flower was temperatures of r = 0763 at P <0.05, while other environmental factors (humidity, light intensity, rainfall, and wind speed) did not significantly affect the population of E. kamerunicus males and females.

Suggestion

Further research is needed to determine the amount of interest from any germplasm collection of PPKS Riau that would affect the population of E. kamerunicus which pollinate the plant oil palm.

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