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Pollination potential of introduced weevil, *Elaeidobius kamerunicus*, in oilpalm (*Elaeis guineensis*) plantations

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ABSTRACT

Introduction of the pollinating weevil (*Elaeidobius kamerunicus* Faust) of oilpalm (*Elaeis guineensis* Jacq.) in India increased the fruit set from 36.87 to 56.10%, resulting in 40% increase in bunch weight and 11% increase in fruits : bunch ratio. Weevil pollination also decreased the parthenocarpy from 34.3 to 24.3%, resulting in 28.4% reduction in parthenocarpic fruit : weight ratio. Though wind+assisted pollination (60.45%) was more efficient than the wind + weevil pollination (56.10%); the latter produced compact bunches owing to pollination of even the spikelets at the bottom of the inflorescences by weevils.

In West Africa and South America, natural fruit set in oilpalm (*Elaeis guineensis* Jacq.) is adequate due to effective pollination by native insect pollinators (Syed 1979, 1981, Wood 1983, Corrado 1985, Genty *et al.* 1986). In South-East Asia, where oilpalm is a newly introduced crop, no native insect pollinators are available and the pollination is exclusively by wind, resulting in inadequate fruit set and bunch failure (Syed 1981). This necessitated wide-spread use of assisted pollination to increase the fruit set. Therefore the more suitable pollinating weevil, *Elaeidobius kamerunicus* Faust, from Cameroun was introduced into Malaysia during 1981 (Syed *et al.* 1982), and from there to other oilpalm-growing tracts in South-East Asia and South Pacific Islands (Syed 1984). In this study an attempt was made to evaluate the pollinating efficiency of *E. kamerunicus* in the oilpalm plantations of India.

MATERIALS AND METHODS

The experiment was carried out on a 10-year-old oilpalm plantation ('Tenera Hybrid') at Palode, during January 1986–July 1987. During 1986, 120 female inflorescences were randomly selected (10 inflorescences/month) and were subjected to 5 treatments with 24 inflorescences/treatment (2 inflorescences/month/treatment).

For wind pollination alone the inflorescences were covered with fine nylon bags to prevent the entry of the pollinating weevils. For weevil pollination alone the inflorescences were covered with transparent plastic bags with openings at the bottom to facilitate the entry of the weevils alone. For wind + weevil pollination, the inflorescences were left open where the pollination was effected by both wind and weevils. For wind + assisted pollination, the inflorescences were covered with nylon-mesh bags and were given 3 rounds of assisted pollination from first to third day of anthesis. For wind + weevil + assisted pollination the inflorescences were left open to facilitate pollination by both wind and weevils and were supplemented with 2 rounds of assisted pollination.

The developing fruit bunches were covered with wire-net, 100-120 days after fruit set, to prevent damage by birds and

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were harvested 160–188 days after fruit set. Owing to high variability in the number of spikelets/bunch (26-188), number of flowers/inflorescence (898–6 935), number of fruits/bunch (189–2 675) and number of pollinated fruits/spikelet (1.91–21.89), minimum 50% spikelets in each bunch (CV 63%) had to be studied. However, to avoid variability due to the position of the spikelets in the bunch, all the spikelets in each bunch were analysed and the number of pollinated fruits, number of parthenocarpic fruits and number of unpollinated flowers were recorded in all the spikelets along with spikelet weight. From this, percentage of pollinated fruits, percentage of parthenocarpic fruits, average weight of the individual fruit, fruits : bunch ratio (fruit weight/bunch weight) and parthenocarpic fruit weight ratio (parthenocarpic fruit weight : total fruit weight) for each bunch were estimated.

RESULTS AND DISCUSSION

Fruit set

Fruit set was very low (36.87%) in wind-pollinated bunches than in bunches pollinated by *Elaeidobius kamerunicus* alone (48.70%). In the bunches pollinated by wind + weevils, fruit set was significantly higher (56.10%) than that in those pollinated by wind alone (36.87%) and weevils alone (48.70%), but less efficient than the wind+assisted pollination (60.45%). However, a combination of wind + weevil+assisted polination gave significantly higher fruit set (69.97%) than other types of pollination (Table 1). Thus introduction of *E. kamerunicus* increased the fruit set from 36.87 to 56.10%. In Malaysia introduction of *E. kamerunicus* similarly increased the fruit set from 50 to 70–80% (Syed *et al.* 1982, Syed 1984, Weng 1985). In Indonesia also the fruit set increased from 37.8 to 66.8% after the introduction of pollinating weevils (Hutauruk and Ps 1984. Chairani and Taniputra 1985), Macfarlane (1985) from South Pacific Solomon Islands also reported an increase of fruit set from 47–68 to 66–78% after the introduction of *E. kamerunicus*.

Fruit-set pattern

In wind-pollinated bunches, fruit set was high in the top spikelets than in the middle and bottom spikelets. Pollination by weevils alone brought about higher fruit set in the bottom and middle spikelets than in the top spikelets. In the bunches pollinated by wind + weevils, fruit set was higher in the middle spikelets than in the bottom spikelets, and highest in the top spikelets. In wind + assisted pollination, higher fruit set was noticed in the top spikelets than in the middle spikelets, but pollination was higher in both of them than in the bottom spikelets. Combination of wind + weevil + assisted pollination gave higher fruit set in the top and middle spikelets than the bottom spikelets, with no significant difference between the former 2 spikelets (Table 2). Unlike in bunches with wind + assisted pollination, where higher fruit set was noticed only in the top and middle spikelets, in weevil-pollinated bunches the weevils entered and pollinated even the spikelets at the bottom of the inflorescences, thus bringing about a uniform fruit set.

Bunch weight

Oilpalm bunch weight increased with the increase in fruit set, and a positive correlation (r = 0.4787) was evident between fruit set and bunch weight (Table 3). The average bunch weight in the wind-pollinated bunches was 12.12 kg. Pollination by weevils alone increased the bunch weight by 17.8%. The bunches pollinated by wind + weevils and with wind+assisted pollination showed 40 and 50% increase in bunch weight respectively than the wind-pollinated bunches. An increase of 57% in bunch weight was evident in the bunches pollinated by wind + weevils + assisted pollination (Table 1). Thus introduction of *E. kamerunicus* in India increased the bunch weight by 40%. The average bunch weight of the entire plantation increased by 50% after the introduction of weevils. In Little Andamans also, where these weevils were introduced during 1986 from Palode (Kerala), the average bunch weight

Table 1 Fruit set and other bunch characters in relation to type of pollination

Bunch character	Type of pollination					CD (P = 0.01)
	Wind alone	Weevils alone	Wind + weevils	Wind + assisted pollination	Wind + weevils + assisted pollination	
Fruit set (%)	36.87 (36.58)	48.73 (44.13)	56.10 (48.86)	60.45 (51.57)	69.97 (57.26)	6.42
Bunch weight (kg)	12.12	14.28	16.93	18.28	19.10	2.97
Spikelet weight (g)	93.63	116.04	120.92	123.76	124.47	24.84
Fruits : bunch ratio (%)	44.70 (41.88)	50.90 (45.44)	55.50 (48.17)	57.50 (49.59)	60.50 (52.16)	3.03
Parthenocarpy (%)	34.30 (34.51)	28.70 (45.25)	24.30 (28.67)	18.60 (23.48)	13.50 (20.80)	5.76
Parthenocarpic fruits : weight ratio (%)	17.95 (23.07)	8.70 (15.09)	9.50 (17.65)	9.30 (16.97)	3.30 (11.17)	4.37

Figures in parentheses are values tranformed into $\sin^{-1}\sqrt{p}$

Table 2 Fruit set pattern in relation to type of pollination and position of the spikelets

Spikelet position	No. of pollinated fruits(%)†				
	Wind alone	Weevils alone	Wind + weevils	Wind + assisted pollination	Wind + weevils + assisted pollination
Top	39.49	40.15	57.12	57.52	61.01
Middle	36.20	44.26	48.58	52.52	59.71
Bottom	32.33	44.29	43.59	38.41	50.20

CD between :
Type of pollination = 4.37**
Position of the spikelet = 3.38**
Type of pollination × position of the spikelet = 7.57*

†Values transformed to $\sin^{-1}\sqrt{p}$
*P = 0.05, **P = 0.01

increased from 5 to 12 kg (CPCRI, Kasaragod 1987). The average spikelet weight increased with the increase in fruit set (Table 3), and was significantly higher in bunches with wind + weevil + assisted pollination, pollinated by wind + weevils with wind + assisted pollination and pollinated by weevils alone, than the wind-pollinated bunches (Table 1). In 10-year-old oilpalm plantations of Malaysia also, 30-34% increase in the average bunch weight was noticed after the introduction of the weevils (Weng 1985, Wood 1985).

Fruits : bunch ratio

Fruits : bunch ratio was directly proportional to fruit set, and a positive correlation (r = 0.7017) was evident between fruits : bunch ratio and fruit set (Table 3). The fruits : bunch ratio was very low (44.70%) in wind-pollinated bunches than in bunches pollinated by weevils alone (50.90%), wind + weevils

Table 3 Correlation coefficients of oilpalm bunch characters with fruit set

Bunch character	Correlation coefficient
Bunch weight (kg)	0.4787**
Fruits : bunch ratio (%)	0.7071**
Spikelet weight (%)	0.4054**
Parthenocarpy (%)	−0.4562**
Parthenocarpic fruit : weight ratio (%)	− 0.4597**
Total number of flowers/ inflorescence	−0.0685

** (P = 0.01)

(55.70%) and those with wind+assisted pollination (57.50%). Fruits: bunch ratio was highest (60.50%) in the bunches pollinated by wind + weevil+assisted pollination (Table 1). Thus introduction of *E. kamerunicus* increased the fruits : bunch ratio by 11%, but decreased the individual fruit weight from 9.8 g to 8.5 g. In 10-year-old oilpalm plantations of Malaysia also, 12–14% increase in fruits : bunch ratio coupled with reduction in individual fruit weight was recorded after the introduction of weevils (Syed 1981, Syed *et al.* 1982).

Parthenocarpy

The percentage of parthenocarpic fruits as well as parthenocarpic fruit : weight ratio decreased with the increase in fruit set (Table 3). A negative correlation was evident between the percentage of parthenocarpic fruits and fruit set (r = —0.4562) and between parthenocarpic fruit : weight ratio and fruit set (r = 0.4597). In wind-pollinated bunches 34.5% flowers developed into parthenocarpic fruits, resulting in a very high parthenocarpic fruit : weight ratio (17.95%). A significant reduction in the incidence of parthenocarpic fruits was noticed in the bunches pollinated by weevils alone (28.70%), wind + weevils (24.80%) and wind+assisted pollination (18.60%), resulting in 30.8, 23.4 and 29.4% reduction in parthenocarpic fruit : weight ratio respectively. In the bunches pollinated by wind + weevil+assisted pollination, incidence of parthenocarpic fruits was the lowest (13.50%), resulting in 51.6% reduction in parthenocarpic fruit : weight ratio (Table 1). However, there was no significant difference in the percentage of parthenocarpic fruits in relation to the position of spikelets in the bunch. Thus weevil pollination decreased the percentage of parthenocarpy from 34.3 to 24.3%, resulting in 28.4% reduction in parthenocarpic fruit : weight ratio.

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