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# Evaluation of French Bean (*Phaseolus vulgaris* L.) Cultivars and Breeding Lines for Resistance to Thrips (Thysanoptera: Thripidae) Pests in Kenya

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**Abstract:** Nine French bean commercial varieties and over ninety breeding lines were assessed to ascertain their susceptibility to thrips (*Megalurothrips sjostedti* Trybom and *Frankliniella occidentalis* (Pergande). Samples of thrips infestation were collected after anthesis at weekly intervals for four weeks. Evidence from the study showed significant differences among the French bean cultivars and breeding lines in thrips infestation. The cultivars had higher thrips infestations compared to the breeding lines. Pod damage score also differed significantly among the varieties with cultivar Harricot 05 recording the highest thrips damage score (2.84).

**Key words:** French beans, *Frankliniella occidentalis*, *Megalurothrips sjostdeti*, cultivars, breeding lines

## INTRODUCTION

French bean (*Phaseolus vulgaris* L.) is the second major export crop in Kenya and accounts for up to 60% by value of all export vegetables and about 21% by value of the horticultural exports (Anonymous, 2001). It is grown as a monocrop mostly by small scale farmers on farm sizes of between 0.25 and 1 ha. (Nderitu *et al*., 1997). The year round production of French beans is hindered by insect pests and diseases which are a major constraint. Thrips are second in importance among the French bean insect pests (Lohr and Michalik, 1995). Their feeding on the flowering parts causes abscission of flower buds, opens flower peduncles and causes curling of pods, leading to quality losses. The silvery lesions made on the pods render the product unfit for export market (Kibata and Anyango, 1996). Losses of 40-60% of pods in pre-sorting at the farm level and another 20% at collection points have been reported (Lohr, 1996). Various thrips control methods that include cultural, biological, chemical and host plant resistance have been evaluated and are in use in various parts of the world (Lewis, 1997). Host plant resistance against thrips pests of legume crops has been reported in several countries (Owusu *et al*., 1998; Salifu, 1992). Some cultivars of cowpea have been reported to register resistance mechanisms against thrips (Owusu *et al*., 1998). In Kenya, study by Anyango (1990) reported significant differences in the level of thrips infestation amongst various dry common bean varieties. This study was carried out to evaluate the commonly grown French bean cultivars and breeders lines for their resistance and tolerance to thrips infestation.

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## MATERIALS AND METHODS

The study was carried out from October 2001 at Kabete Campus Field Station farm, University of Nairobi. French bean cultivars (certified seeds) were obtained from the local market while breeder's lines were sought from National Horticultural Research Centre, Thika and Moi University. All seeds were treated with Imidacloprid (Gaucho 350 FS) before planting to prevent bean stem maggot (*Ophyiomyia* sp.) and other soil borne pests' infestation. Land was ploughed and harrowed to fine tilth using a disk harrow tractor. Furrows were made manually for seed sowing. At planting, diammonium phosphate (DAP) was applied at the rate of 494 kg $ha^{-1}$ but was mixed well with the soil before placing any seed. Calcium Ammonium Nitrate (CAN) was applied at the same rate as DAP at second and fourth week after crop emergence. Sprinkler irrigation and weeding were done to provide enough water to the plant and keep the field clean of weeds, respectively.

### Comparison of Cultivars and Breeding Lines

Nine cultivars (Amy, Samantha, Lexus, Impala, Paulista, J12, Jasmin, Julia and Monel) and eleven breeding lines (Haricot 04, J4, Wacron, Piant, A21, Wacret, Mae, Haricot 03, R0855, Haricot 05 and A17) were planted in October 2001 to screen them for resistance to thrips under field conditions. The experiment was laid in a Randomized Complete Block Design (RCBD) with three replicates. Each cultivar and breeding line was sown in furrows of 3 m long within the blocks to form a plot. Paths of 1 m between the plots and 3 m between the blocks were maintained. Intra-row spacing was maintained at 15 cm. Sampling for thrips infestation was done weekly after anthesis and continued for four weeks. Five open flowers and five leaves were randomly picked from each of the cultivar and breeding line. The samples were put in 70% alcohol in separate bottles in the field and taken to the laboratory for thrips counting. The counting of both the adult thrips and larvae was done under a dissecting microscope using a tally counter. Each of the species was recorded separately for each of the varieties. Pod damage by thrips was also assessed from samples of ten pods per plot harvested weekly after their formation. The damage was rated on a scale of 1-5 where 1 = no damage, 2 = 1-25%, 3 = 26-50%, 4 = 51-75% and 5= over 76% damage.

### Evaluation of Breeding Lines

Another Ninety three breeding lines were planted in March 2002 to study their resistance and tolerance to thrips infestation under green house conditions. Completely Randomized Design (CRD) was used to lay out the experiment. Three seeds were sown in one pot for each line to represent a plot and were replicated three times. Sampling for thrips infestation was done one week after the onset of flowers and continued weekly for four weeks. Three open flowers were randomly picked from each of the plot. The samples were put in 70% alcohol in separate bottles and taken to the laboratory for thrips counting. The number of each of the species and larvae was recorded separately.

### Evaluation of Cultivars

Nine cultivars; Samantha, Julia, J12, Paulista, Impala, Jasmin, Monel, Amy and Lexus were planted in the field and evaluated for thrips infestation in January 2002. Planting was done twice with second planting done two weeks after the first planting. The experiment was laid in a Randomized Complete Block Design (RCBD) with four replicates. Plots of 2 by 2 m were established with 1 m paths between plots and 2 m between blocks. Seeds were sown in furrows at a spacing of 30 cm inter-row and 15 cm intra-row. Sampling of thrips was done as earliear.

All the data collected from the three experiments was subjected to analysis of variance (ANOVA) using GENSTAT Statistical package version 6.1. Means were compared and F-test was used to test significance while SED was used to separate means. Data was transformed where possible by use of square root method.

## RESULTS

### Comparison of Cultivars and Breeding Lines

There was significant difference among the varieties in the total thrips count and separately for *F. occidentalis* and *M. sjostedti* (Table 1). Monel (cultivar) had the highest mean number of thrips but the pod damage was just slightly above the average. Piant (breeding line) recorded the least thrips population as well as pod damage. Cultivar J12 was the most tolerant as it recorded high thrips number but low pod damage. Haricot 05 (breeding line) recorded few thrips number but the damage was very high.

Thrips numbers varied significantly ($p<0.05$) over the sampling period. The general trend in all varieties and breeders' lines showed increased numbers of thrips from first to the last sampling period across all the varieties (Fig. 1). The figure also shows that the density of *F. occidentalis* was higher than *M. sjostedti* during the sampling period.

### Evaluation of Breeding Lines

There was significant difference ($p<0.05$) among the breeding lines in the overall number of thrips counted and also separately for *F. occidentalis* and larvae (Table 2). However many breeding lines were not infested by *M. sjostedti*. Line 804.2 had the highest mean total thrips number whereas lines 1169.1, 1182.2, 756.1, 486.1, 485.2, 769.2 and 825.2 had the lowest mean thrips number. Lines 913.2, 804.2 and 950.1 had the highest infestation levels of *M. sjostedti*, *F. occidentalis* and larvae, respectively. Several lines had similar lower mean number for both thrips species and larvae.

### Evaluation of Cultivars

During the first planting, there were significant differences ($p<0.05$) among the cultivars in the mean number of thrips counted and also separately for *M. sjostedti* and *F. occidentalis* (Table 3). Monel variety recorded the highest thrips numbers whereas Impala recorded the least. During the second planting, there was no significant difference in mean numbers of *F. occidentalis* though there was for *M. sjostedti* and total thrips numbers. Monel recorded overall the highest thrips numbers whereas Impala recorded the least. Pod damage score differed significantly ($p<0.05$) among the varieties during the first planting. Julia and Lexus recorded the highest score (2.46) whereas Impala recorded the least score (2.15). Pod damage and number of thrips was positively correlated ($r = 0.57$).

Lower thrips density was recorded in the second planting (Table 4). The highest thrips count recorded was 28.19 compared to first planting of 80.40. Still monel and impala had the highest and lowest thrips count, respectively, just as in the first planting. However, pod damage score was not significant unlike the first planting.

During the first planting, there was significant difference ($p<0.05$) among the varieties in the total number of thrips and larvae counted from the leaves (Table 5). There was however no significant difference for either *F. occidentalis* or *M. sjostedti* on their own. Monel recorded the highest mean total thrips numbers whereas Impala had the least.

During the second planting, there was no significant difference among the cultivars in the overall thrips numbers and also for the different species separately (Table 6). However, Lexus had the highest thrips count while Julia had the lowest.

Generally, the population trend of mean thrips numbers increased significantly from 1st to 3rd sampling and then dropped during the 4th sampling (Fig. 2). The trend was the same for *F. occidentalis* and *M. sjostedti* separately during the first and second planting.

Table 1: Mean numbers of thrips infesting flowers and pod damage score among the cultivars and breeding lines of French beans at Kabete, Kenya in 2001

| Cultivar/breeding lines | Larvae | *M. sjostedti* | *F. occidentalis* | Total thrips | Pod damage score |
|---|---|---|---|---|---|
| Monel (v) | 0.28 | 31.84 | 38.40 | 70.2 | 2.46 |
| J12 (v) | 9.00 | 16.67 | 29.75 | 55.4 | 2.10 |
| A 17 | 14.33 | 10.17 | 24.75 | 49.2 | 2.20 |
| Julia (v) | 16.17 | 15.58 | 15.08 | 46.8 | 2.56 |
| J4 | 18.56 | 5.31 | 16.20 | 44.7 | 2.46 |
| Amy (v) | 14.50 | 10.50 | 19.17 | 44.2 | 2.20 |
| Harricot 03 | 7.92 | 15.33 | 19.50 | 42.7 | 2.30 |
| Wacron | 12.58 | 10.17 | 18.92 | 41.7 | 2.33 |
| A21 | 9.08 | 9.97 | 22.58 | 41.5 | 2.50 |
| Lexus (v) | 14.04 | 8.29 | 18.65 | 40.8 | 2.37 |
| Samantha (v) | 15.35 | 4.39 | 18.60 | 38.4 | 2.23 |
| Harricot 04 | 10.17 | 12.00 | 16.17 | 38.3 | 2.33 |
| Paulista (v) | 12.58 | 8.50 | 17.08 | 38.2 | 2.10 |
| Mae | 7.95 | 15.23 | 14.14 | 37.4 | 2.30 |
| Jasmin (v) | 10.59 | 6.86 | 19.84 | 37.4 | 2.17 |
| Wacret | 7.15 | 9.90 | 19.81 | 36.9 | 2.07 |
| R0855 | 10.53 | 9.27 | 16.23 | 36.3 | 2.43 |
| Impala (v) | 10.08 | 9.92 | 16.33 | 36.3 | 2.37 |
| Harricot 05 | 7.58 | 11.33 | 16.42 | 35.4 | 2.84 |
| Piant | 6.85 | 6.25 | 14.87 | 28.9 | 1.37 |
| Total cultivars | 11.40 | 12.51 | 21.43 | 45.3 | 2.28 |
| Total breeders line | 10.47 | 10.45 | 18.15 | 39.36 | 2.28 |
| SED | 4.07 | 3.67 | 4.49 | 8.57 | 0.19 |
| Significance | *** | *** | *** | *** | ** |

v-cultivar; The unlabelled are all breeders line

Table 2: Mean number of thrips infesting flowers of French bean breeding lines at Kabete, Kenya in 2002

| Breeding line | *M. sjostedti* | *F. occidentalis* | Larvae | Total thrips |
|---|---|---|---|---|
| 804.2 | 0.71 | 1.25 | 1.26 | 3.22 |
| 922.1 | 0.71 | 1.11 | 1.38 | 3.2 |
| 950.1 | 0.71 | 1.02 | 1.43 | 3.16 |
| 917.1 | 0.71 | 1.04 | 1.34 | 3.09 |
| 1288.1 | 0.76 | 0.99 | 1.34 | 3.09 |
| C3 | 0.71 | 1.14 | | 2.94 |
| C4 | 0.71 | 1.17 | 0.96 | 2.84 |
| C2 | 0.71 | 1.15 | 0.97 | 2.83 |
| 940.1 | 0.71 | 0.86 | | 2.83 |
| 932.1 | 0.82 | 0.92 | 1.08 | 2.82 |
| 946.1 | 0.71 | 0.71 | | 2.81 |
| 952.1 | 0.71 | 0.88 | 1.21 | 2.8 |
| 1325.1 | 0.76 | 0.93 | | 2.79 |
| 495.2 | 0.76 | 1.02 | 0.98 | 2.76 |
| 933.1 | 0.71 | 0.89 | 1.15 | 2.75 |
| 1113.2 | 0.71 | 1.1 | 0.92 | 2.73 |
| 496.2 | 0.71 | 1.02 | 0.98 | 2.71 |
| 482.2 | 0.71 | 0.9 | 1.09 | 2.7 |
| 903.2 | 0.71 | 0.93 | 1.05 | 2.69 |
| 783.1 | 0.76 | 0.82 | 1.1 | 2.68 |
| 1101.2 | 0.71 | 0.89 | 1.08 | 2.68 |
| 1186.1 | 0.71 | 0.8 | 1.11 | 2.62 |
| 534.1 | 0.71 | 0.95 | 0.96 | 2.62 |
| 913.2 | 0.86 | 0.92 | | 2.62 |
| 491.1 | 0.71 | 0.94 | 0.94 | 2.59 |
| 522.1 | 0.76 | 0.76 | 1.06 | 2.58 |
| 526.1 | 0.76 | 0.92 | 0.9 | 2.58 |
| 959.1 | 0.71 | 0.71 | 1.15 | 2.57 |
| 661.1 | 0.71 | 0.94 | | 2.57 |
| 686.1 | 0.71 | 0.82 | 1.03 | 2.56 |
| 530.2 | 0.71 | 0.98 | 0.86 | 2.55 |
| C1 | 0.71 | 0.84 | 1 | 2.55 |
| 525.1 | 0.71 | 0.8 | 1.03 | 2.54 |

Table 2: Continued

| Breeding line | *M. sjostedti* | *F. occidentalis* | Larvae | Total thrips |
|---|---|---|---|---|
| 1174.2 | 0.8 | 0.82 | 0.92 | 2.54 |
| 1262.2 | 0.71 | 0.76 | | 2.54 |
| 1329.1 | 0.71 | 0.8 | 1.02 | 2.53 |
| 897.1 | 0.71 | 0.96 | 0.86 | 2.53 |
| 784.1 | 0.76 | 0.88 | 0.93 | 2.52 |
| 1269.2 | 0.71 | 0.82 | 0.99 | 2.52 |
| 1325.2 | 0.71 | 0.86 | 0.95 | 2.52 |
| 739.1 | 0.71 | 0.71 | 1.08 | 2.5 |
| 683.1 | 0.71 | 0.96 | 0.82 | 2.49 |
| 486.2 | 0.76 | 0.88 | 0.84 | 2.48 |
| 713.1 | 0.71 | 0.71 | 0.9 | 2.47 |
| 891.1 | 0.71 | 0.82 | 0.88 | 2.46 |
| 665.1 | 0.71 | 0.8 | 0.94 | 2.45 |
| 943.1 | 0.71 | 0.82 | 0.92 | 2.45 |
| 729.1 | 0.76 | 0.82 | 0.86 | 2.44 |
| 912.1 | 0.71 | 0.95 | 0.77 | 2.43 |
| C5 | 0.71 | 0.71 | 1.01 | 2.43 |
| 522.2 | 0.71 | 0.76 | 0.95 | 2.42 |
| 496.1 | 0.71 | 0.89 | 0.82 | 2.42 |
| 489.2 | 0.71 | 0.89 | 0.82 | 2.42 |
| 904.1 | 0.71 | 0.84 | 0.86 | 2.41 |
| 813.1 | 0.71 | 0.84 | 0.86 | 2.41 |
| 898.1 | 0.71 | 0.89 | 0.8 | 2.4 |
| 527.2 | 0.71 | 0.82 | 0.86 | 2.39 |
| 535.2 | 0.71 | 0.86 | 0.82 | 2.39 |
| 1324.1 | 0.71 | 0.82 | 0.84 | 2.37 |
| 712.2 | 0.71 | 0.76 | 0.89 | 2.36 |
| 694.1 | 0.71 | 1.05 | 0.71 | 2.35 |
| 533.1 | 0.71 | 0.82 | 0.82 | 2.35 |
| 1403.1 | 0.71 | 0.86 | 0.77 | 2.34 |
| 1182.1 | 0.71 | 0.76 | 0.86 | 2.33 |
| 533.2 | 0.71 | 0.76 | 0.86 | 2.33 |
| 1495.1 | 0.71 | 0.76 | 0.84 | 2.31 |
| 524.1 | 0.71 | 0.8 | 0.8 | 2.31 |
| 1403.2 | 0.71 | 0.76 | 0.82 | 2.29 |
| 714.1 | 0.71 | 0.8 | 0.77 | 2.28 |
| 664.1 | 0.71 | 0.71 | 0.86 | 2.28 |
| 789.1 | 0.71 | 0.71 | 0.86 | 2.28 |
| 733.1 | 0.71 | 0.8 | 0.77 | 2.28 |
| 959.2 | 0.71 | 0.76 | 0.8 | 2.27 |
| 493.1 | 0.71 | 0.76 | 0.8 | 2.27 |
| 812.2 | 0.71 | 0.76 | 0.8 | 2.27 |
| 495.1 | 0.71 | 0.71 | 0.84 | 2.26 |
| 769.1 | 0.71 | 0.71 | 0.84 | 2.26 |
| 712.1 | 0.71 | 0.84 | 0.71 | 2.26 |
| 686.2 | 0.71 | 0.76 | 0.77 | 2.24 |
| 818.1 | 0.71 | 0.76 | 0.77 | 2.24 |
| 1269.1 | 0.71 | 0.76 | 0.77 | 2.24 |
| 672.1 | 0.71 | 0.76 | 0.77 | 2.24 |
| 746.1 | 0.71 | 0.71 | 0.8 | 2.22 |
| 921.2 | 0.71 | 0.71 | 0.8 | 2.22 |
| 825.1 | 0.71 | 0.71 | 0.77 | 2.19 |
| 530.1 | 0.71 | 0.71 | 0.77 | 2.19 |
| 894.2 | 0.71 | 0.76 | 0.71 | 2.18 |
| 1169.1 | 0.71 | 0.71 | 0.71 | 2.13 |
| 769.2 | 0.71 | 0.71 | 0.71 | 2.13 |
| 1182.2 | 0.71 | 0.86 | 0.71 | 2.13 |
| 825.2 | 0.71 | 0.71 | 0.71 | 2.13 |
| 486.1 | 0.71 | 0.71 | 0.71 | 2.13 |
| 756.1 | 0.71 | 0.71 | 0.71 | 2.13 |
| LSD | 0.07 | 0.26 | 0.36 | 0.51 |
| Significance | - | *** | *** | *** |

Data transformed by (x+0.5)0.5

Table 3: Mean numbers of thrips infesting flowers and pod damage score among French bean varieties during first planting at Kabete, Kenya in 2002

| Cultivars | Larvae | *M. sjostedti* | *F. occidentalis* | Total thrips | Pod damage score |
|---|---|---|---|---|---|
| Monel | 12.25 | 15.00 | 62.10 | 89.40 | 2.22 |
| J12 | 10.31 | 13.50 | 57.10 | 80.90 | 2.19 |
| Julia | 10.50 | 9.56 | 55.50 | 75.60 | 2.46 |
| Samantha | 20.69 | 7.56 | 44.40 | 72.70 | 2.42 |
| Lexus | 16.12 | 8.50 | 45.90 | 70.60 | 2.46 |
| Amy | 13.81 | 9.19 | 43.40 | 66.40 | 2.29 |
| Paulista | 14.31 | 7.56 | 43.20 | 65.10 | 2.35 |
| Jasmin | 8.44 | 7.25 | 38.10 | 53.80 | 2.20 |
| Impala | 2.56 | 2.75 | 32.80 | 38.30 | 2.15 |
| $LSD_{0.05}$ | 6.16 | 4.64 | 14.64 | 18.59 | 0.25 |
| SED | 3.08 | 2.34 | 7.38 | 9.37 | 0.12 |
| Significance | *** | *** | *** | *** | * |

*Significance at 95%; *** Significance at 99% level

Table 4: Mean numbers of thrips infesting flowers and pod damage among French bean cultivars during second planting at Kabete, Kenya in 2002

| Cultivars | Larvae | *M. sjostedti* | *F. occidentalis* | Total thrips | Pod damage score |
|---|---|---|---|---|---|
| Monel | 10.50 | 2.87 | 14.81 | 28.19 | 2.26 |
| Samantha | 9.37 | 1.13 | 14.00 | 24.50 | 2.13 |
| J12 | 4.00 | 3.00 | 13.19 | 20.19 | 2.16 |
| Lexus | 4.25 | 2.26 | 11.62 | 18.50 | 2.23 |
| Amy | 5.31 | 1.25 | 11.31 | 17.87 | 2.07 |
| Paulista | 4.87 | 1.56 | 10.69 | 17.12 | 2.14 |
| Julia | 3.69 | 2.06 | 10.94 | 16.69 | 2.21 |
| Jasmin | 5.12 | 0.69 | 10.87 | 16.69 | 2.16 |
| Impala | 5.44 | 0.74 | 9.58 | 15.74 | 2.23 |
| $LSD_{0.05}$ | 5.37 | 1.26 | 4.11 | 6.80 | 0.19 |
| SED | 2.71 | 0.633 | 2.07 | 3.43 | 0.09 |
| Significance | - | *** | - | *** | - |

-Not significant; ***Significance at 99% level

Table 5: Mean numbers of thrips infesting five French bean leaves during the first planting at Kabete, Kenya in 2002

| Cultivars | Larvae | *M. sjostedti* | *F. occidentalis* | Total thrips |
|---|---|---|---|---|
| Monel | 2.09 | 1.27 | 0.97 | 4.33 |
| Samantha | 2.24 | 0.71 | 1.12 | 4.07 |
| Jasmin | 1.67 | 0.71 | 1.06 | 3.44 |
| Lexus | 1.71 | 0.75 | 0.94 | 3.40 |
| J12 | 1.66 | 0.79 | 0.91 | 3.36 |
| Paulista | 1.42 | 0.75 | 0.91 | 3.08 |
| Amy | 1.37 | 0.71 | 0.92 | 3.00 |
| Julia | 1.28 | 0.75 | 0.88 | 2.91 |
| Impala | 1.28 | 0.71 | 0.91 | 2.90 |
| $LSD_{0.05}$ | 0.53 | 0.38 | 0.29 | 0.72 |
| Significance | *** | * | - | *** |

-Not significant; *Significance at 95%; ***Significance at 99% level

Table 6: Mean numbers of thrips infesting French bean leaves during the second planting at Kabete, Kenya in 2002

| Cultivars | Larvae | *M. sjostedti* | *F.occidentalis* | Total thrips |
|---|---|---|---|---|
| Lexus | 1.36 | 0.71 | 1.09 | 3.16 |
| J12 | 1.44 | 0.75 | 0.95 | 3.14 |
| Impala | 1.57 | 0.71 | 0.84 | 3.12 |
| Amy | 1.47 | 0.71 | 0.91 | 3.09 |
| Monel | 1.31 | 0.71 | 0.91 | 2.93 |
| Samantha | 1.29 | 0.71 | 0.79 | 2.79 |
| Paulista | 1.24 | 0.71 | 0.84 | 2.79 |
| Jasmin | 1.21 | 0.75 | 0.79 | 2.75 |
| Julia | 1.01 | 0.71 | 0.75 | 2.45 |
| $LSD_{0.05}$ | 0.47 | 0.06 | 0.23 | 0.49 |
| SED | 0.24 | 0.03 | 0.12 | 0.25 |
| Significance | - | - | - | ** |

-Not significant; **Significant at 95% level

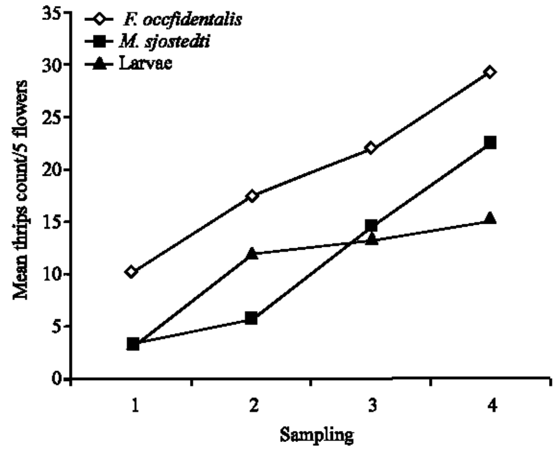


Fig. 1: Mean thrips numbers on flowers of French bean cultivars and breeding lines over the sampling period at Kabete, Kenya in 2001

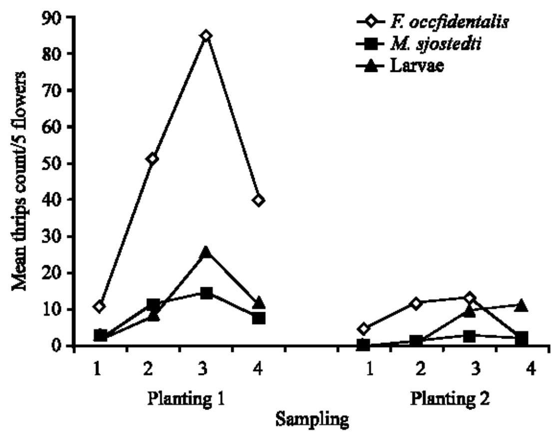


Fig. 2: Mean number of thrips on flowers of French bean cultivars over the sampling period at Kabete, Kenya

## DISCUSSION

Significant differences in thrips infestation were observed in both French bean cultivars and breeding lines. Among the breeding lines, 1169.1, 1182.2, 756.1, 486.1, 769.2 and 825.2 were found to have lower thrips infestations and could be considered for use in breeding programes to develop thrips resistant cultivars. However, they need to be screened further for their sensitivity to pod damage. Piant was the most resistant breeding line when compared to the cultivars as it had both low infestation and lower pod damage. It can be considered cultivar development. Among the cultivars, Impala had the lowest thrips infestation level. Awareness on Impala as a less susceptible variety to thrips should be created especially to the exporters who in most cases determine the varieties grown by the farmers. Cultivar J12 can also be encouraged to plant as it was the most tolerant cultivar, with high count of thrips but low pos damage score. The differences in thrips resistance observed among the cultivars and breeding lines is in agreement with earlier work done on cowpeas and dry common bean varieties that were found to differ in thrips infestation (Owusu *et al*., 1998; Anyango, 1990). The study also established that flowers had higher adult thrips numbers than the leaves in all cases. This is similar to findings by Cho *et al*. (2001) who found that adult thrips were more dorminant on flowers than on leaves in cucumber. The larvae were more than adults on leaves. *Frankliniella occidentalis* was more abundant than *Megalurothrips sjostedti* among the commercial varieties. This was attributed to the fact that sampling coincided with the warm periods of the crop season, a time when this species thrives best. Farmers can use this information in planning their production to coincide with the cooler months of the year in order to reduce infestation by *F. occidentalis,* a difficult species to control. If production must be done during the hot periods, then profitability of the enterprise must be critically assessed. Use of resistant or torelant cultivars is advantageous given the stringent quality requirements in the export market. Furthermore, a resistant/tolerant cultivar poses no technical difficulties to the farmer and hence they are user friendly. Such varieties should however be selected guided by market and consumer preference.

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