Ghana J. Sci. **46** (2006), 55-65

EFFECT OF PUBESCENCE ON THE OVIPOSITION AND FEEDING BEHAVIOUR OF *M. VITRATA* (FAB.) ON *VIGNA* SPECIES

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Abstract

The ovipositional and feeding behaviour of *Maruca vitrata* (Fab.) were studied in the screenhouse and field on two wild *Vigna* species, namely *V. vexillata* (Rich.) (accession TVnu 72) and *V. oblongifolia* (Rich.) (accession TVnu 42), one wild cowpea, *V. unguiculata* ssp. *dekindtiana* (Harms) Verdcourt (accession TVnu 863), one cowpea, *V. unguiculata* ssp. *unguiculata* (L. Walp) landrace (TVu 13731) and two cowpea breeding lines (IT84S-2246 and IT91K-180) at the International Instutite of Tropical Agriclture (IITA), Ibadan, Nigeria. The density and length of the trichomes on the stem, leaves and pods of the *Vigna* species were studied using scanning electron microscopy. The effect of the trichomes on oviposition and feeding by *M. vitrata* was studied in the screen-house and field, respectively. Significant ($P < 0.05$) differences were observed on the density of glandular and non-glandular trichomes as well as length of the non-glandular trichomes, on the stems, leaves and pods of the *Vigna* species. Gravid *M. vtrata* females laid significantly ($P < 0.05$) fewer eggs on TVnu 42 plants under free choice and TVu 13731 under no choice condition compared with other treatments. The density of glandular trichomes on leaves reduced oviposition and accounted for 70.89 per cent of viable eggs liad under free choice. Flower damage was highest on IT84S-2246, IT91K-180 and TVnu 863 while pod load was significantly ($P < 0.007$) higher on TVnu 72 compared with IT84-2246 and TVnu 863. Similarly, TVnu 863, IT84S-2246 and IT91K-180 had significantly ($P < 0.0001$) higher pod damage compared with TVnu 72 and TVu 13731. Pod load and pod damage were dependent on flower damage, accounting for almost 100 per cent of viable eggs but pod damage was also influenced by the density of glandular trichomes on the pods. The pubescence of *Vigna* species did not affect damage to the flower by *M. vitrata* larvae. The implication of these findings in the development of resistant cowpea varieties against *M. vitrata* damage is discussed.

Résumé

Oigiangbe O. N., Jackai L. E. N., Ewete F. K., Lajide L. & Hughes J. d'A.: *Effets de la pubescence sur la ponte et la manière de s'alimenter de* M. vitrata *Fabricius sur l'espèce* Vigna Les manières de ponte et de s'alimenter de *Maruca vitrata* Fabricius étaient étudiées en cage de Faraday et sur le terrain sur deux espèces de *Vigna* sauvages à savoir *V. vexillata* (A. Richard) (accession TVnu 72) et *V. oblongifolia* (A. Richard) (accession TVnu 42), un dolique sauvage *V. unguiculata ssp. dekindtiana* [Harms Verdcourt] (accession TVnu 863), un dolique [*V. unguiculata ssp. Unguiculata* (L. Walp)] Variété de pays (TVu 13731) et deux lignées de variété de dolique (IT84S – 2246 et IT91K-180) à l'Intitut International d'Agriculture Tropicale (IIAT), Ibadan, Nigéria. La densité et la longueur de trichomes sur la tige , les feuilles et les cosses des espèces de *Vigna* étaient étudiées en employant la microscopie électronique à balayage. L'effet des trichomes sur la ponte et l'alimentation par *M. vitrata* était étudié respectivement en cage de faraday et sur le terrain. Des différences considérables ($P < 0.05$) étaient observées de la densité des trichomes glandulaires et non-glandulaires ainsi que de la longueur de trichomes non-glandulaires sur les tiges, les feuilles et les cosses de l'espèce *Vigna*. Les femelles gravides de *M. vitrata* pondaient considérablement ($P< 0.05$) moins d'œufs suivant le régime de plante TVnu 42 étant libre de choisir et de TVu 13731 sous la condition de choix nul comparé aux autres traitements. La densité de trichomes glandulaires sur les feuilles reduisaient la ponte et représentait 70.89 pour cent de la variabilité en nombre d'œufs pondus étant libre de choisir. Les dégâts causes aux fleurs étaient plus élevés sous IT84S – 2246, IT91K – 180 et TVnu 863 alors que la charge de cosse était considérablement ($P< 0.007$) plus élevée sous TVnu 72 comparée à IT84-2246 et TVnu 863. De la meme façon, TVnu 863, IT84S-2246 et IT91K -180 avaient des dégâts causés aux cosses considérablement ($P< 0.0001$) plus élevés comparés avec TVnu 72 et TVu 13731. La charge de cosse et les dégâts causés aux cosses dependent en grandes parties de dégâts causés à la fleur représentant.

Presque 100 pour cent de la variabilité, mais les dégâts causés aux cosses étaient aussi influencés par la densité de trichomes glandulaires sur les cosses. La pubescence des espèces de *Vigna* n'a pas eu un effet sur les dégâts causés à la fleur par les larves de *M. vitrata*. L'implication de ces résultats pour le développement de variétés de dolique résistantes aux dégâts de *M. vitrata* est discutée.

Introduction

The behaviour of phytophagous insects is dependent on several plant characteristics, including chemical, colour, shape and pubescence. Those characteristics which elicit or inhibit oviposition play important roles in the survival of Lepidopterans, because the neonate larvae are immobile and rely on the right choice of the food plant by the adult female (Renwick & Chew, 1994). Two stage are, therefore, critical in the successful exploitation of food resource by this group of insects. The first is the ability of the female to lay eggs where the larvae can easily find food and the second is the ability of the larvae to feed on the available food. Ramaswamy (1988) and Gall (1990) reported that majority of moth species prefer hairy or rough surfaces as oviposition sites, but Navasero & Ramaswamy (1991) suggested that trichome type (i.e. glandular or non-glandular) may not influence oviposition. The resistance of a maize cultiv\ar to *Chilo partellus*, however, was reported to be due to the high density of trichomes on the leaf surface (Kumar, 1992).

Maruca vitrata Fab. (Lepidoptera: Pyralidae) is a mojor pest of cowpea in sub-Saharan Africa (Taylor, 1978; Jackai *et al.*, 1985; Singh *et al.*, 1990). The larvae damage young stems, flower buds, flowers and pods (Taylor, 1967; Jackai, 1982) causing yield loses of 20-80 per cent (Singh & Jackai, 1985; Singh *et al.*, 1990) of all the cultivated cowpea varieties. High levels of resistance have been found in some wild *Vigna* species, notably *V. vexillata* (A. Richard) and *V. oblongifolia* (A. Richard) (Singh *et al.*, 1990; Jackai, Padulosi & Ng, 1996). There is need to develop resistant cowpea varities with the possible use of genes from wild *Vigna* species with the aid of new biotechnological techniques (Fatokun, Perriho & Ng, 1997).

The importance of pubecsence on the stems, leaves and pods of *Vigna* species in conferring resistance against *M. vitrata* attack had been highlighted by Jackai & Oghiakhe (1989), Oghiakhe *et al.* (1992b) and Oghiakhe (1995, 1996), but little is known of the mechanism(s) by which trichomes reduce oviposition and larval damage to flowers and pods. Experiments were conducted in the screen house and field to test the hypothesis that trichome types and position affect the ovipositional behaviour of *M. vitrata* and the consequent flower or pod damage.

Experimental

Source of seeds

Two wild *Vigna* species, namely *V. vexillata* (A. Rich..) (accession TVnu 72) and *V. oblongifolia* (A. Rich.) (accession TVnu 42), one wild cowpea, *V. unguiculata* ssp. *dekindtiana* [(Harms) Verdcourt] (accession TVnu 863), one cowpea, *V. unguiculata* ssp. *unguiculata* (L. Walp) landrace (TVu 13731) and two cowpea breeding lines (IT84S-2246 and IT91K-180) were used in the experiments. The wild *Vigna* and cowpea seeds were obtained from the International Institute of Tropical Agriculture (IITA) Germplasm Bank while seeds of the cowpea landrace and breeding lines were obtained from the IITA Breeding Programme.

Trichome study

Stem, leaf and pod samples were collected from plants, grown in pots filled with top-soil (collected from the IITA Farm Yard) at the podding stage and fixed immediately in formo-acetic acid (FAA). Dehydration, critical point drying and coating of the samples were done using the methods of Oigiangbe *et al*. (2002). The samples were dehydrated briefly through a series of FAA, ethanol and amyl-acetate mixtures and dried in a critical point dryer CPD 030 (Bal-Tec) for 12 h.. Araldite® adhesive was used to mount each smaple on stubs. The samples, addhesive and stubs were coated with a thin layer of gold-palladium alloy for 5 min to obtain a thickness of 380 nm in a Polaron SC 7610 Sputer Coater (Fisons Instruments). Each sample was scanned with a Philips 20XL scanning electron microscope at 10 kilovolts accelerating voltage. The density of glandular and non-glandular trichomes and length of the non-glandular trichome were taken from five different areas of each sample.

Oviposition study

Oviposition by *M. vitrata* was assessed in the screenhouse using potted plants under free choice and no-choice conditions. Under the free choice condition, six pots containing one or two plants at the flowering stage of each of the six *Vigna* species were rendomly arranged in a nylon-mesh cage measuring (77.61 × 77.61 × 77.61 cm^3 and replicated three times. Thirty *M. vitrata* females, reared on artificial diet (Jackai & Raulston, 1988) were released at the centre of the cage in the evening. Under the no choice condition, one pot containing one or two plants of a particular *Vigna* species was put in a nylon-mesh cage measuring 56.42 × 65.42 × 61.00 cm^3 and replicated six times. Ten gravid *M. vitrata* females were released in each cage in the evening. In both choice situations, female were allowed to lay eggs on the plants for two nights. The number of eggs laid on the vegetative and floral parts of the plants was recorded. Data were log transformed and analysed using the analysis of variance (ANOVA) and means were separated with Student-Newman-Keuls (SNK) test, where the F-value was significant. The relationships between the variables were assessed using correlation and regression analysis.

Field study

The field experiment was conducted between April and July 1997 at IITA, Ibadan. The *Vigna* species were each planted in plots arranged in a randomized complete block design. Each plot had five rows of 5 m long with a spacing of 1.50 m between plots, 0.75 m between rows, and 0.20 m within rows. Thinning to one seedling per stand was done 2 weeks after planting (WAP). Two weeks prior to planting the test materials, a highly susceptible cultivar (IT86D-889) was planted in a perpendicular manner to every range of rows within the plot to serve as multiplication foci (spreader row) for the insect. Monocrotophos (Nuvacron® 40EC) was sprayed at the onset of flower bud initiation at a rate of 200 g a.i./ha to control leaf feeding beetles, aphids, thrips and pod sucking bugs later during the podding. This was to ensure that these pests did not mask the effect of *M. vitrata* on the crop. Monocrotophos had been reported to be non-toxic to *M. vitrata* (Jackai, 1983).

Flower damage was evaluated twice weekly for 3 weeks from one week after flower bud initiation, using the rapid visual evaluation (RVE) method of Oghiakhe, Jackai & Makanjuola (1992a). This method involves a random selection of 20-50 flowers per plot, opening them immediately and recording the number of damaged flowers (with *M. vitrata* larvae or frass). The average flower damage for each week was calculated from the two records. Scoring the treatments at pod filling stage on pod load and pod damage (Jackai & Signh, 1988; Jackai, 1995) was used to assess pod production and damage. Both scores were based on a scale of 1-9, one the reverse of the other (Jackai, 1995). The data were log (for pod load) or square root (for pod damage) transformed and analyzed using the analysis of variance (SAS System for Windows®). Means were separated by SNK test where the F-value was significant. Correlation, as

TABLE 1

Mean density (mm²) of glandular and non-glandular trichomes and length (ìm) of non-glandular trichomes of stems of wild and cultivated Vigna *species*

Vigna *species*	*Accession No.*	*Density*		*Length of non-glandular tichomes*
		Glandular trichomes	*Non-glandular trichomes*	
V. vexillata	TVnu 72	1.00 ± 0.24b	2.60 ± 0.11c	2064.00 ± 63.33a
V. oblongifolia	TVnu 42	5.40 ± 0.30b	7.80 ± 0.36a	455.40 ± 25.30b
V. unguiculata ssp. *dekindtiana*	TVnu 863	7.80 ± 0.38b	5.20 ± 0.30b	119.90 ± 4.64c
V. unguiculata ssp. *unguiculata*	IT84S-2246	1.80 ± 0.17b	0.00d	0.00c
V. unguiculata ssp. *unguiculata*	IT91K-180	21.60 ± 1.80a	0.00d	0.00c
V. unguiculata ssp. *unguiculata*	TVu 13731	7.60 ± 0.30b	1.80 ± 0.17c	80.20 ± 2.33c

Means followed by the same letter(s) in columns are not significantly different ($P < 0.05$; SNK).

TABLE 2

Mean density (mm²) of glandular and non-glandular trichomes and length (ìm) of non-glandular trichomes of leaves of wild and cultivated Vigna *species (± SE)*

Vigna *species*	*Accession No.*	*Density*		*Length of non-glandular tichomes*
		Glandular trichomes	*Non-glandular trichomes*	
V. vexillata	TVnu 72	6.60 ± 0.36d	2.40 ± 0.23bc	447.40 ± 37.56a
V. oblongifolia	TVnu 42	21.00 ± 0.40a	5.60 ± 0.36a	398.80 ± 26.11ab
V. unguiculata ssp. *dekindtiana*	TVnu 863	7.40 ± 0.23cd	3.80 ± 0.18b	295.50 ± 28.88bc
V. unguiculata ssp. *unguiculata*	IT84S-2246	9.40 ± 0.11c	1.40 ± 0.27c	89.30 ± 2.46d
V. unguiculata ssp. *unguiculata*	IT91K-180	13.40 ±0.54b	1.20 ± 0.17c	99.52 ± 13.01cd
V. unguiculata ssp. *unguiculata*	TVu 13731	15.00 ± 0.14b	5.20 ± 0.33a	77.80 ± 5.39d

Means followed by the same letter(s) in columns are not significantly different ($P < 0.05$; SNK).

well as simple and stepwise regressions, was used to investigate the relationship between the variables.

Results and discussion

Significant variations ($P < 0.05$) were found in the density of glandular and non-glandular trichomes, as well as the length of the non-glandular trichomes of stems, leaves, and pods of the *Vigna* species (Tables. 1, 2 and 3). Significantly ($P < 0.05$) fewer eggs were laid on TVnu 42 and TVu 13731 under free choice and TVu 13731 under no choice compared with other treatments (Table 4). The density of glandular and non-glandular trichomes on leaves had significant negative correlations with the number of eggs laid under free choice (Table 5) with glandular trichomes accounting for 73.78 per cent of viable eggs (Fig. 1).

Flower damage was highest on IT84S-2246, IT91K-180 and TVnu 863 (Fig. 2) while pod load was significantly ($P < 0.007$) higher on TVnu 72 compared with IT84S-2246 and TVnu 863 (Fig. 3). Pod damage was significantly ($P < 0.0001$) higher on TVnu 863, IT84S-2246 and IT91K-180 (which

TABLE 3

Mean density (mm²) of glandular and non-glandular trichomes and length (ìm) of non-glandular trichomes of pods of wild and cultivated Vigna *species*

Vigna *species*	*Accession No.*	*Density*		*Length of non-glandular trichomes*
		Glandular trichomes	*Non-glandular trichomes*	
V. vexillata	TVnu 72	8.60 ± 0.36a	5.00 ± 0.19a	1082.60 ± 29.98a
V. oblongifolia	TVnu 42	7.00 ± 0.24ab	4.40 ± 0.18a	683.40 ± 31.37b
V. unguiculata ssp. *dekindtiana*	TVnu 863	2.60 ± 0.11c	10.80 ± 0.11a	68.14 ± 0.98c
V. unguiculata ssp. *unguiculata*	IT84S-2246	5.00 ± 0.31bc	9.00 ± 0.20a	80.78 ± 4.68c
V. unguiculata ssp. *unguiculata*	IT91K-180	7.40 ± 0.18ab	9.00 ± 0.28a	71.38 ± 2.60c
V. unguiculata ssp. *unguiculata*	TVu 13731	7.60 ± 0.41ab	9.80 ± 0.36a	58.52 ± 1.77c

Means followed by the same letter(s) in columns are not significantly different ($P < 0.05$; SNK).

TABLE 4

Mean number of eggs laid by M. vitrata *females on wild and cultivated* Vigna *species*

Vigna *species*	*Free choice*	*No choice*
TVnu 72	434.00 ± 20.83 a	420.00 ± 22.53a
TVnu 42	35.75 ± 4.790b	283.00 ± 49.98ab
TVnu 863	492.70 ± 77.31a	838.00 ± 115.97a
TVu 13731	91.30 ± 29.73b	50.30 ± 5.97bc
IT91K-180	374.30 ± 56.02a	366.70 ± 43.54a
IT84S-2246	608.70 ± 75.10a	793.30 ± 21.32a

Means followed by the same letter(s) in rows are not significantly different ($P < 0.05$; SNK).

TABLE 5

Correlation coefficients of the relationship between oviposition of M. vitrata *and pubescence of wild and cultivated* Vigna *species*

Variable	*Free choice*	*No choice*
DGTP	-0.4787	0.1543
DNGTP	0.3633	-0.4921
LNGTP	-0.1700	0.5529
DGTL	-0.8590*	-0.4589
DNGTL	-0.8157*	-0.6018
LNGTL	-0.1586	0.3841
DGTS	-0.1175	-0.3385
DNGTS	-0.5050	0.2585
LNGTS	-0.0601	0.0321

* = Significant at $P = 0.05$.
DGTP = density of glandular trichomes on pods; DNGTP = density of non-glandular trichomes on pods; LNGTP = length of non-glandular trichomes on pods; DGTL = density of glandular trichomes on leaves; DNGTL = density of non-glandular trichomes on leaves; LNGTL = length of non-glandular trichomes on leaves; DGTS = density of glandular trichomes on stem; DNGTS = density of non-glandular trichomes on stem and LNGTS = length of non-glandular trichomes on stem.

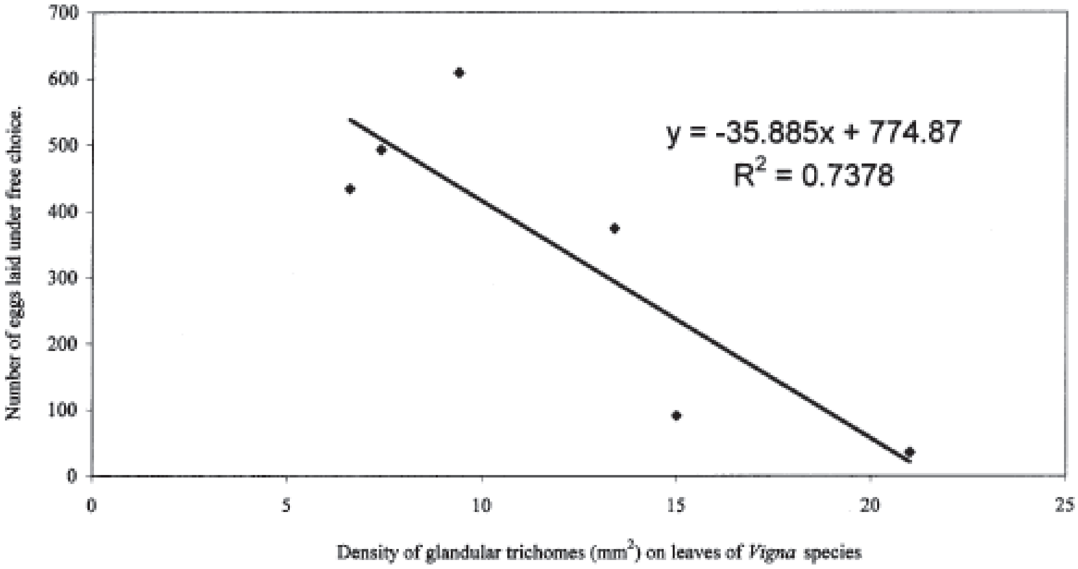

Fig. 1. Regression of number of eggs laid by *M. vitrata* females against density of glandular trichomes on leaves of wild and cultivated *Vigna* species

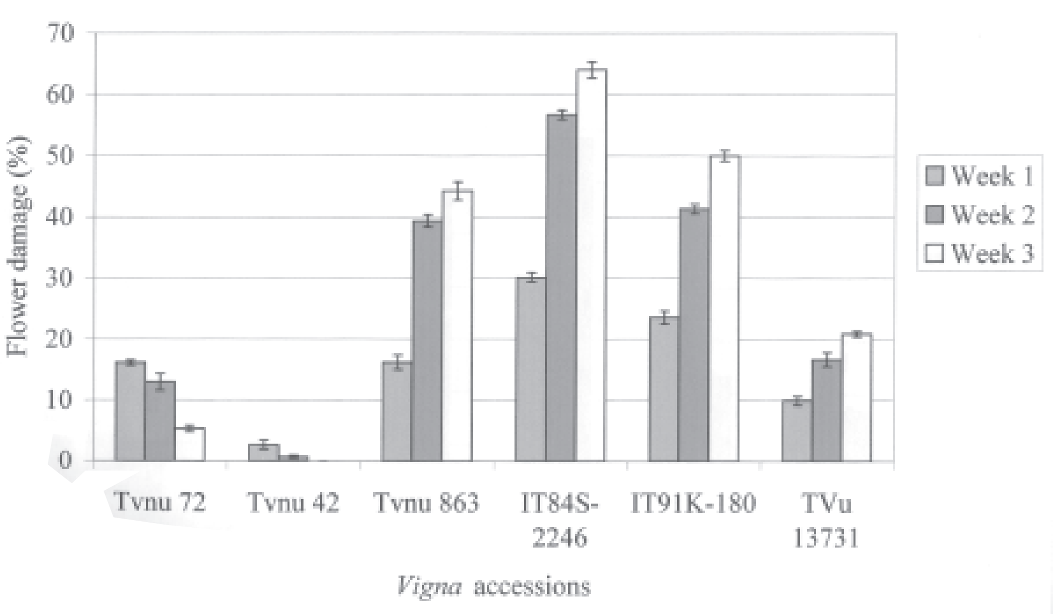

Fig. 2. Mean flower damage of wild and cultivated *Vigna* species by *M. vitrata*

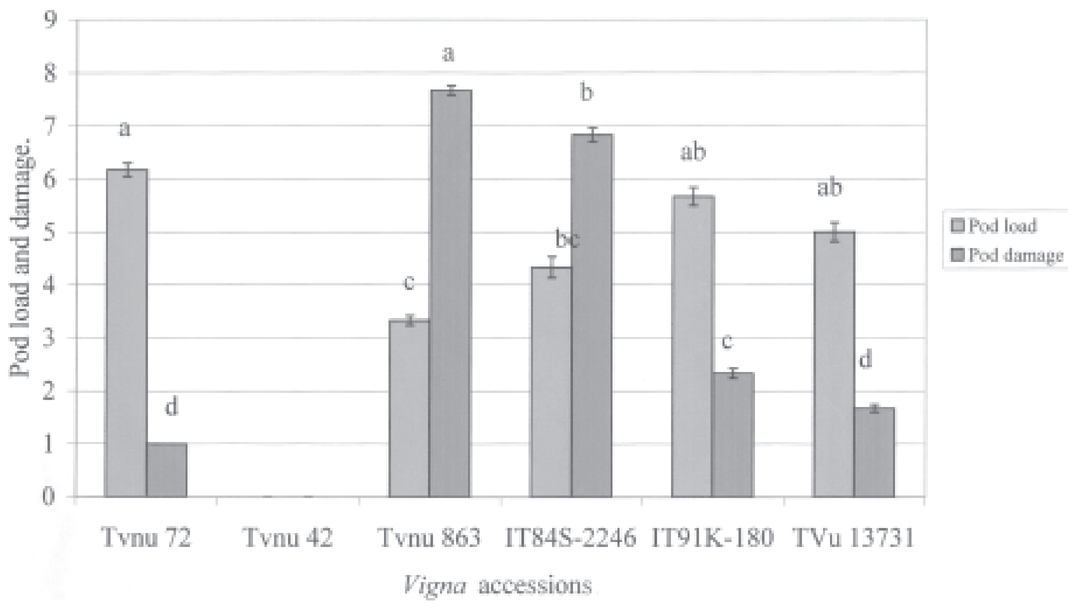

Fig. 3. Mean pod load and damage by *M. vitrata* of wild and cultivated *Vigna* species

TABLE 6

Stepwise regression procedures for the dependent variable mean pod load of wild and cultivated Vigna *species under field infestation by* M. vitrata

Variable	*Model R-squared*	*F-value*	*Probability of F*
FDWK1	0.0120	0.01	0.9302
FDWK2	0.9168	11.01	0.1863
FDWK3	0.9998	4580.12	0.0094**
DGTS	0.6821	2.15	0.3814
DNGTS	0.6345	1.74	0.4133
LNGTS	0.6411	1.79	0.4090
DGTL	0.0002	0.00	0.9905
DNGTL	0.1680	0.20	0.7312
LNGTL	0.0989	0.11	0.7964
DGTP	0.9308	13.46	0.1694
DNGTP	0.8006	4.01	0.2947
LNGTP	0.6500	1.86	0.4030

** = Significant at P = 0.01

FDWK1 – 3 = Flower damage at weeks 1 – 3 after the initiation of flowering; DGTS = Density of glandular trichomes on stem; DNGTS = Density of non-glandular trichomes on stem; LNGTS = Length of non-glandular trichomes on stem; DGTL = Density of glandular trichomes on leaves; DNGTL = Density of non-glandular trichomes on leaves; LNGTL = Length of non-glandular trichomes on leaves; DGTP = Density of glandular trichomes on pods; DNGTP = Density of non-glandular trichomes on pods; LNGTP = Length of non-glandular trichomes on pods.

TABLE 7

Stepwise regression procedures for the dependent variable mean pod damage of wild and cultivated Vigna *species under field infestation by* M. vitrata

Variable	*Model R-squared*	*F-value*	*Probability of F*
FDWK1	0.1818	0.22	0.7195
FDWK2	0.9985	681.55	0.0244*
FDWK3	0.9033	9.34	0.2013
DGTS	0.3574	0.56	0.5921
DNGTS	0.9021	9.21	0.2026
LNGTS	0.3164	0.46	0.6197
DGTL	0.1149	0.13	0.7798
DNGTL	0.0083	0.01	0.9419
LNGTL	0.0001	0.00	0.9929
DGTP	0.9958	237.19	0.0413*-
DNGTP	0.4915	0.97	0.5054
LNGTP	0.3251	0.48	0.6137

* = Significant at $P = 0.05$
FDWK1 – 3 = Flower damage at weeks 1 – 3 after the initiation of flowering; DGTS = Density of glandular trichomes on stem; DNGTS = Density of non-glandular trichomes on stem; LNGTS = Length of non-glandular trichomes on stem; DGTL = Density of glandular trichomes on leaves; DNGTL = Density of non-glandular trichomes on leaves; LNGTL = Length of non-glandular trichomes on leaves; DGTP = Density of glandular trichomes on pods; DNGTP = Density of non-glandular trichomes on pods; LNGTP = Length of non-glandular trichomes on pods.

TABLE 8

Stepwise regression procedures for the dependent variable mean flower damage at week 3 of wild and cultivated Vigna *species under field infestation by* M. vitrata

Variable	*Model R-squared*	*F-value*	*Probability of F*
DGTS	0.4425	1.59	0.3348
DNGTS	0.0237	0.05	0.8461
LNGTS	0.2870	0.80	0.4643
DGTL	0.2553	0.69	0.4947
DNGTL	0.0132	0.03	0.8850
LNGTL	0.2021	0.51	0.5504
DGTP	0.7314	5.45	0.1448
DNGTP	0.8626	12.56	0.0712
LNGTP	0.6128	3.16	0.2172

DGTS = Density of glandular trichomes on stem; DNGTS = Density of non-glandular trichomes on stem; LNGTS = Length of non-glandular trichomes on stem; DGTL = Density of glandular trichomes on leaves; DNGTL = Density of non-glandular trichomes on leaves; LNGTL = Length of non-glandular trichomes on leaves; DGTP = Density of glandular trichomes on pods; DNGTP = Density of non-glandular trichomes on pods; LNGTP = Length of non-glandular trichomes on pods.

were also significantly different from each other) compared with TVnu 72 and TVu 13731 (Fig. 3). There was no data for TVnu 42 bacause the plants remained vegetative throughout the period, perhaps, due to day-length sensitivity or photo-periodism. The pod load depended significantly ($P < 0.05$) on the flower damage by *M. vitrata* during the third week of flowering accounting for

TABLE 9

Stepwise regression procedures for the dependent variable mean flower damage at week 2 of wild and cultivated Vigna *species under field infestation by* M. vitrata

Variable	*Model R-squared*	*F-value*	*Probability of F*
DGTS	0.2124	0.54	0.5392
DNGTS	0.0501	0.11	0.7762
LNGTS	0.0979	0.22	0.6871
DGTL	0.4853	1.89	0.3034
DNGTL	0.1257	0.29	0.6454
LNGTL	0.0796	0.17	0.7179
DGTP	0.6572	3.83	0.1893
DNGTP	0.7134	4.98	0.1554
LNGTP	0.3727	1.19	0.3895

DGTS = Density of glandular trichomes on stem; DNGTS = Density of non-glandular trichomes on stem; LNGTS = Length of non-glandular trichomes on stem; DGTL = Density of glandular trichomes on leaves; DNGTL = Density of non-glandular trichomes on leaves; LNGTL = Length of non-glandular trichomes on leaves; DGTP = Density of glandular trichomes on pods; DNGTP = Density of non-glandular trichomes on pods; LNGTP = Length of non-glandular trichomes on pods.

99.98 per cent of the variability (Table 6). Similarly, the pod damage was influenced by the flower damage during the second week of flowering and the density of the glandular trichomes on the pods accounting for almost 100 per cent of viable eggs (Table 7). Flower damage by *M. vitrata* larvae was not affected by the pubescence of the *Vigna* species (Tables 8 and 9).

The results of the oviposition experiment show clearly that pubescence can affect the ovipositional behaviour of gravid female *M. vitrata* on *Vigna* species. That density of the trichomes on leaves reduced oviposition disagrees with the report of Navasero & Ramaswamy (1991) on *Heliothis virescens* which indicated that trichome type did not influence oviposition, but agrees with that of Plourde, Goonewardene & Kwolek (1985) which suggested that leaf pubescence was an oviposition rather than a larval barrier. Similarly, the results agree with those of Malakar & Tingey (1991) which suggested that glandular trichomes were responsible for the reluctance of potato tuber moth, *Phthorimaea operculella* Zeller to oviposit on foliage of *Solanum berthaultii*. Haddad & Hicks (2000) showed that female *Papilio troilus* (L.) discriminated against pubescence *Sassafras albidum* (Nuttall). It is possible that exudates from these glandular trichomes discouraged *M. vitrata* females from laying eggs on the leaves. Kellogg, Taylor & Krings (2002) noted that several authors have shown that secondary metabolites produced by glandular trichomes are effective in discouraging many insect pests due to their odour, taste, stickiness or toxicity. In most cases, such secretions inhibit feeding, but they can also prohibit oviposition or reduce larval development. Non-glandular trichomes can interfere with female insect movement and anchorage while laying eggs.

The field experiment shows that flower damage contributes significantly to pod damage and production. This is as a result of direct damage to flower buds and flowers as well as increased survival of the larvae, which migrate to the pods. The suitability of *Vigna* species for oviposition by female *M. vitrata* appears to be the major determinant of the flower damage as the latter was not affected by the pubescence of the plants. Barre *et al.* (2002) observed that although female insects discriminate between plant species, their choice was not linked with the development of their offspring. Thus, *M. vitrata* neonate larvae were able to move from the leaves or other oviposition sites (after hatching) to the flowers. These findings are in agreement with previous reports by Rausher (1979) and Thompson (1988) which explained that the choice of an oviposition site was not related to the suitability of the host for larval development.

Although it was easy for the larvae to exploit the flowers as food resource, feeding became difficult with the appearence of pods 2 weeks into the flowering period on some of the treatments. The laevae, now at the second to fourth instar stages, were faced with some resistance from the glandular trichomes on the pods. Haddad & Hicks (2000) argued that pubescence appears to be effective in lowering larval survivorship in the first two instars since the increase in damage is exponential with larval developoment. *M. vitrata* larvae spend only little time on the surface of the pods as they feed on the developing seeds within the pod. Substances from the glandular trichomes may cause then to spend more time on the pod surface. The pods and flower buds of TVu 13731 were reported to show antibiosis to *M. vitrata* larvae by IITA (1995). It is possible to develop cowpea varieties with acceptable levels of resistance to *M. vitrata* if efforts are concentrated on the factors controlling the oviposition choice of the adult female and larval feeding.

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Receivd 28 May 05; revised 10 Jan 06.