

# Influence of foliar chemical compounds on the development of *Spodoptera litura* (Fab.) in interspecific derivatives of groundnut

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**Abstract:** Tobacco armyworm, *Spodoptera litura* (Fab), a polyphagous insect, is an important pest of groundnut (*Arachis hypogaea* L.). It is one of the insect pests which had developed resistance to insecticides. Currently there are no cultivars of groundnut which express high level of resistance to *S. litura*. Wild species of groundnut, which show high levels of resistance, have been identified. *Arachis kempff-mercadoi* is one such wild species, which is reported to be resistant to *S. litura*, and indicated that in wild species three flavonoids chlorogenic acid, quercetin and rutin are involved in the components of resistance. In the present study, although these flavonoids had an effect on larval mortality, statistical analysis revealed that quercetin had a major effect due to high correlation of quercetin with chlorogenic acid and rutin. Interspecific derivatives were obtained as a result of crossing cultivated groundnut with *A. kempff-mercadoi*. *In vitro* studies showed high percentage of neonate larval mortality when fed on the foliage of interspecific derivatives, majority of interspecific derivatives were detrimental to larval development and had considerable effect on its subsequent progeny. Resistant derivatives were found to have high levels of flavonoids and antibiosis mechanism prevented larval growth. Susceptible derivatives and the female parent, *A. hypogaea* have low levels of flavonoids.

**Key words:** *spodoptera litura*, *A. kempff-mercadoi*, wild species, flavonoids, resistance

## 1 Introduction

Groundnut (*Arachis hypogaea* L.) is one of the world's principal oilseed crops. It is attacked by many species of insects which cause damage ranging from incidental feeding to near total plant destruction and yield loss (SMITH and BARFIELD, 1982; STALKER and CAMPBELL, 1983; WIGHTMAN and AMIN, 1988; WIGHTMAN et al., 1989; WIGHTMAN and RANGA RAO, 1994; LYNCH and MACK, 1995). Amongst them, the tobacco armyworm, *Spodoptera litura* (Fab.) is a polyphagous insect, whose reproductive capacity and migration ability over long distances has made it economically an important pest of many agricultural crops, with a wider geographic range throughout Asia, from north Africa to Japan, Australia and New Zealand (FEAKIN, 1973). It has been reported to attack over 112 cultivated plant species and about 60 species are from India (GARAD et al., 1984). In India, it has become particularly notorious in most tobacco-growing regions. In the last three and half decades, however, it has extended its host range to other crops such as cotton, mungbean, soya bean, cabbage and leafy vegetables, including groundnut (MAREE et al., 1999). Groundnut yield losses up to 71% have been reported in the irrigated tracts of Andhra Pradesh, Karnataka and Tamil Nadu, the southern states of India (NAIR, 1986; AMIN, 1988). Yield losses of groundnuts have been directly associated with higher

density of larvae of *S. litura*, and the intensity of defoliation (PANCHBHAVI and NETHRADANI RAJ, 1987).

Adults of *S. litura* lay around 2000 eggs on the abaxial surface of groundnut leaves, in batches of 200–300 each. The larval and pupal periods take 20 and 7–10 days, respectively. The total life cycle is completed in 30 days (GAHUKAR, 1992). There may be as many as 12 generations annually in southern India (WIGHTMAN and AMIN, 1988). During daytime the larvae usually hide under the clods at the plant base, climb the plants only after dusk, and feed in the night and early hours of dawn (SAINI and VERKYA, 1985). They migrate in large numbers in search of new crop(s) or other host plants, when there is a shortage of food. Continuous cropping of summer crops and vegetables provides food for the larvae, and the pupae do not aestivate in extreme temperatures (Ranga Rao et al., 1989).

*Spodoptera litura* is one of the first insect pests of agricultural importance in India to develop resistance to insecticides. In the early 1980s, the pest populations in Andhra Pradesh and further south in Tamil Nadu were highly resistant to lindane, endosulfan, carbaryl and malathion, and synthetic pyrethroids then available to commercial farmers (RAMAKRISHNAN et al., 1984), and mid-1990s (ARMES et al., 1997) and more recently (KRANTHI et al., 2002). Since that time it has become

increasingly an important pest of groundnut, particularly in the east coast of peninsular India.

Currently, no cultivars of groundnut are known to express resistance to *S. litura*. However, some wild relatives of groundnut were found resistant to *S. litura*. Neonate larvae suffer high levels of mortality and the development of older larvae on resistant wild species is severely inhibited (STEVENSON et al., 1993b). Larvae exposed to excised leaves of wild species lose weight, which is not significantly different from that of those deprived of food for 24 h. These results suggest that the leaves are unpalatable and/or detrimental to their growth (STEVENSON et al., 1993a). This has resulted in providing ample research opportunities at ICRISAT to exploit the genetic diversity of wild *Arachis* species. The focus has been shifted to evaluate the wider genetic pool with desirable agronomic traits and identify potential sources of resistance to *S. litura*.

The identification factors in the foliage of wild species of *Arachis* that affect the feeding behaviour and development of *S. litura* may provide plant breeders and biotechnologists with valuable information for the development of cultivars of *Arachis* with high degree of resistance to *S. litura*.

Chlorogenic acid and rutin inhibit the development of neonate lepidopterous larvae and their potential role in the natural resistance in crops (ELLIGER et al., 1980, 1981; WISEMAN et al., 1990; YANG et al. 1993). STEVENSON et al. (1993a) identified that both the physical and chemical factors present in the wild species of groundnut, *Arachis kempff mercadoi* are involved in resistance to *S. litura*. They also reported that the methanol extract of the foliage of wild *Arachis* species such as *Arachis paraguariensis*, *Arachis appresipila* and *Arachis chacoensis* significantly inhibited the larval development indicating that phytochemicals were responsible. Leaves of the resistant wild species have greater biting effect than leaves of susceptible cultivars. In view of the similarity of rutin and chlorogenic acid contents isolated from the foliage of wild species of groundnut, they were used in insect bioassays (STEVENSON, 1992a).

In the present investigation, quercetin, chlorogenic acid, and rutin were assayed both in the parents [*A. kempff-mercadoidi* (resistant) and *A. hypogaea* (susceptible)] as well as in the interspecific derivatives from the cross, *Arachis hypogaea* × *A. kempff-mercadoidi*. The wild resistant progeny as well as *A. kempff-mercadoidi* showed the presence of all the flavonoids in greater proportion than in the susceptible *A. hypogaea* used in this study. This study also confirms that the resistance present in wild species effectively can be transferred to the progeny even after crossing with susceptible *A. hypogaea*.

## 2 Materials and Methods

### 2.1 Insect rearing

*Spodoptera litura* egg masses were collected from the groundnut crop grown in the experimental blocks at the ICRISAT farm. On eclosion, the neonate larvae were reared on a semi-synthetic diet based on chickpea flour and dried

sorghum leaves at 25 ± 2°C and 14L : 10D. Three to four pairs of adults were released for oviposition in a cylindrical cage, and provided with 10% sucrose solution. The neonate larvae hatched from the egg masses were used in the experiments.

### 2.2 Interspecific derivatives

During the rainy season of 2000–01, 23 interspecific derivatives from the cross *A. hypogaea* × *A. kempff-mercadoidi* including resistant check wild species, *A. kempff-mercadoidi* and the susceptible parent, *A. hypogaea*, were propagated by seeds in the screenhouse at 28 ± 2°C, 55 ± 5% RH (table 1). The first, third and seventh leaflets from the base from interspecific derivatives were excised, and arranged in a circle in a round pot (4" diameter), which was kept moist.

### 2.3 Insect bioassays on leaflets

Twelve neonate larvae of *S. litura* were released inside a round pot (4" diameter), and covered with a transparent polythene cover to test their survival on each leaflet. The experimental pots were then transferred to an incubator maintained at 25 ± 2°C, 14L : 10D and 70% RH. The experiment was replicated with three leaflets per pot. Leaflets were observed for mortality and duration of larvae, recorded for weights and duration of pupae, and adult emergence. Previous studies have shown that data from larval growth and behaviour on excised leaves provides information which precisely reflects the effect of the unexcised leaves in the field (STEVENSON, 1992b).

### 2.4 Extraction of chlorogenic acid, quercetin and rutin from groundnut leaflets

Basal first, third and seventh leaflets from interspecific derivatives and their parents were oven-dried for 60 minutes, before powdered. Hundred milligrams of the powder was extracted in 1 ml of 90% methanol overnight. The extractions

**Table 1.** Interspecific crosses of *Arachis* species investigated for resistance to *Spodoptera litura*

Interspecific cross	Identity	Generation
D 1	ICGS 44 × ICG 8959 self	F3
D 2	ICGS 44 × ICG 8959 self	F3
D 5	ICGS 44 × ICG 8959 self	F3
D 7	ICGS 44 × ICG 8959 self	F3
D 11	ICGS 44 × ICG 8959 self	F3
D 16	(ICGS 44 × ICG 8959) × ICGS 44	F2BC1
D 19	(ICGS 44 × ICG 8959) × ICGS 44	F2BC1
D 20	(ICGS 44 × ICG 8959) × ICGS 44	F2BC1
D 21	(ICGS 44 × ICG 8959) × ICGS 44	F2BC1
D 22	(ICGS 44 × ICG 8959) × ICGS 44	F2BC1
D 25	(ICGS 44 × ICG 8959) × ICGS 44	F2BC1
D 26	(ICGS 44 × ICG 8959) × ICGS 44	F2BC1
D 34	(ICGS 44 × ICG 8959) × ICGS 44	F2BC1
D 57	(ICGS 44 × ICG 8959) × ICGS 44	F2BC1
D 69	(ICGS 44 × ICG 8959) × ICGS 44	F2BC1
D 77	(ICGS 44 × ICG 8959) × ICGS 44	F2BC1
D 78	(ICGS 44 × ICG 8959) × ICGS 44	F2BC1
D 85	(ICGS 44 × ICG 8959) × ICGS 44	F2BC1
D 94	(ICGS 44 × ICG 8959) × ICGS 44	F2BC1
D 96	(ICGS 44 × ICG 8959) × ICGS 44	F2BC1
D 104	(ICGS 44 × ICG 8959) × ICGS 44	F2BC1
ICGS 44	<i>A. hypogaea</i> cultivar	Female parent
30085	<i>A. Kempff-mercadoidi</i> ; wild species	Male parent

were repeated with hexane to get rid of waxes and chlorophyll. After centrifugation, the methanolic extract (supernatant) was concentrated to dryness on a water bath. The residue was re-dissolved in 100  $\mu$ l methanol and 3  $\mu$ l of the mixture was spotted on a silica gel thin layer chromatography (TLC) plates and run in butanol : acetic acid : water (BAW) (4 : 1 : 5). Rutin, quercetin and chlorogenic acid were run as standards on TLC. The corresponding spots were scraped and re-extracted in 800  $\mu$ l of methanol. After centrifugation, 600  $\mu$ l of methanolic extract of each of the spots was read at 366.5 nm for quercetin, 352.5 for rutin, and 324 for chlorogenic acid. Later, the chlorogenic acid fractions were used for colorimetric tests at 515 nm using Arnov's reagent. Similarly, the quercetin and rutin fractions were tested colorimetrically using Fast blue B salt. All the samples were estimated thrice.

## 2.5 Biometric analysis

Data on each biological character were subjected to one-way analysis of variance to assess the statistical significance of differences among the 23 genotypes (21 interspecific derivatives and their two parents). The means were separated following Duncan's multiple range test (DMRT) (DUNCAN, 1951). Relationship of mortality with chlorogenic acid (C), quercetin (Q), and rutin (R) was investigated using appropriate regression analysis methods based on data from the 23 interspecific derivatives. Mortality of larvae was highly correlated with C ( $r = 0.82$ ,  $P < 0.001$ ), Q ( $r = 0.91$ ,  $P < 0.001$ ) and R ( $r = 0.83$ ,  $P < 0.001$ ). In addition, there was a significantly high correlation between chlorogenic acid and quercetin ( $r = 0.88$ ,  $P < 0.001$ ), chlorogenic acid and rutin ( $r = 0.92$ ,  $P < 0.001$ ) and quercetin and rutin ( $r = 0.88$ ,  $P < 0.001$ ). This correlation (multi-collinearity) among the independent variables chlorogenic acid, quercetin and rutin tends to inflate the standard errors of the resulting partial regression coefficients, rendering the resulting multiple linear regression equation of mortality on chlorogenic acid, quercetin and rutin unreliable. Path analysis (KEMPTHORNE, 1957) and step-wise regression (DRAPER and SMITH, 1966) were therefore used to assess the relationship of mortality with quercetin, chlorogenic acid and rutin. The latter enabled to identify the important ones among chlorogenic acid, quercetin and rutin. The former, a standardized multiple regression analysis technique, enabled to quantify the direct and indirect effects of each of chlorogenic acid, quercetin and rutin on mortality.

## 3 Results

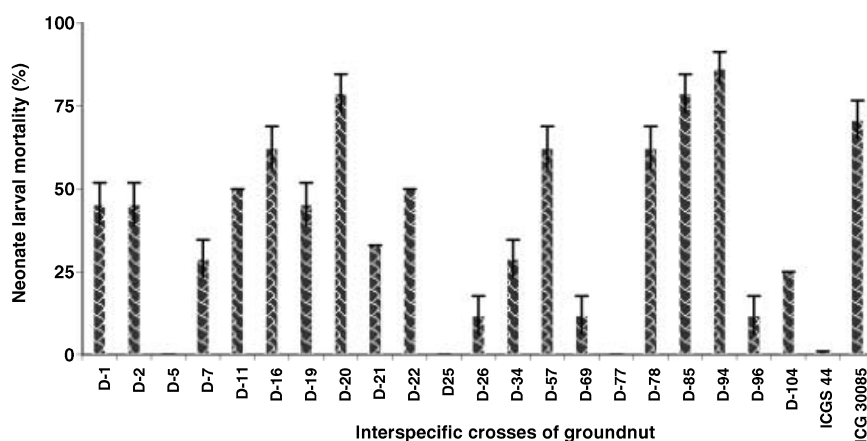
Significant differences were observed between interspecific derivatives of groundnut on the mortality of

neonate larvae of *S. litura*. Among the 23 interspecific derivatives (D), survival of neonate larvae was significantly low on D 20, D 85, and D 94 (fig. 1). In contrast no mortality was noticed on D 5, D 25 and D 77, which were significantly not different from the susceptible check, *A. hypogaea* cv. ICGS-44. However, more than 60% of the neonate larvae failed to survive on D 16, D 57, D 78 and the resistant parent, *A. kempff-mercadoi* 30085 (table 2).

The step-wise regression, both forward and backward, consistently identified quercetin as the major variable to affect larval mortality, alone accounting for 82% of variation in larval mortality (adjusted  $R^2 = 0.82$ ). This is expected due to high correlation of quercetin with chlorogenic acid and rutin, rendering chlorogenic acid and rutin untenable to describe the variation in larval mortality. In fact, addition of either or both rutin and chlorogenic acid in the multiple regression equation produced an adjusted  $R^2$  which was in fact lower when quercetin alone was in the equation.

Based on path analysis, quercetin has shown a direct effect of 0.78, and indirect effect through chlorogenic acid and rutin being  $-0.04$  and  $0.17$ , respectively. Interestingly, despite a strong correlation between larval mortality and chlorogenic acid, the direct effect of chlorogenic acid on larval mortality was only  $-0.04$ , with its indirect effect on larval mortality through quercetin and rutin being  $0.68$  and  $0.18$ , respectively. Similarly, in spite of a strong correlation between larval mortality and rutin, the direct effect of rutin on larval mortality was only  $0.19$ , with its indirect effect on larval mortality through quercetin and chlorogenic acid being  $0.68$  and  $-0.04$ , respectively. This was also strongly supported by the step-wise regression in clearly establishing that quercetin is the major factor accounting for variation in larval mortality.

The development of neonate larvae that fed on D 16, D 20, D 22, D 57, D 78, D 85, and D 94 contained high quantities of chlorogenic acid, rutin and quercetin was severely impeded compared with the susceptible parent, *A. hypogaea* (table 3). Furthermore, the inhibitory effect in D 57 and D 78 in quercetin (fig. 2), D 57, D 78 and D 22 in chlorogenic acid (fig. 3), and D 57 and D 78 in rutin (fig. 4) contents, but D 57 all produced malformed adults. However, quercetin and rutin showed their individual effect on the mortality and



**Fig. 1.** *Spodoptera litura* neonate larval mortality on interspecific derivatives from the crosses *A. hypogaea* ICGS44  $\times$  *A. kempff-mercadoi*

**Table 2.** *Biological characteristics of Spodoptera litura on interspecific derivatives from the crosses Arachis hypogaea × A. kempff-mercadoi*

Interspecific cross	Adults			Adults (malformed)			
	Larval mortality (%)	Larval duration (days)	Pupal weight (mg)	Pupal duration (days)	Larval duration (days)	Pupal weight (mg)	Pupal duration (days)
D 2	45.50 ± 6.36	23.40 ± 0.68 f-h	234.00 ± 2.90 f-g	8.80 ± 0.37 d-g	23.50 ± 0.50 f	140.50 ± 0.50 a-d	7.50 ± 0.50 a-d
D 5	0.00 ± 0.00	–	–	–	–	–	–
D 7	29.00 ± 5.65	24.66 ± 1.22 g-m	172.67 ± 6.74 a-f	7.33 ± 0.33 a-d	–	–	–
D 11	50.00 ± 0.00	21.67 ± 0.33 c-g	217.00 ± 0.57 e-i	7.67 ± 0.33 a-e	–	–	–
D 16	62.50 ± 6.36	20.67 ± 0.33 b-f	196.67 ± 0.33 e-i	7.67 ± 0.33 a-e	–	–	–
D 19	45.50 ± 6.36	24.50 ± 0.50 g-k	220.50 ± 0.50 e-j	8.00 ± 0.00 b-f	–	–	–
D 21	33.00 ± 0.00	20.25 ± 0.75 b-e	226.50 ± 2.98 f-m	9.75 ± 0.47 g	–	–	–
D 22	50.00 ± 0.00	18.00 ± 0.91 a-b	533.50 ± 29.07 q	8.75 ± 0.25 c-g	–	–	–
D 25	0.00 ± 0.00	27.00 ± 0.91 j-m	138.75 ± 7.11 a-c	8.00 ± 0.40 b-f	–	–	–
D 26	12.00 ± 5.65	19.20 ± 0.58 b-c	541.20 ± 17.35 q	9.20 ± 0.20 f-g	–	–	–
D 34	29.00 ± 5.65	23.50 ± 1.04 f-i	223.80 ± 9.34 f-k	9.25 ± 0.25 f-g	–	–	–
D 57	62.50 ± 6.36	–	–	–	25.33 ± 0.67 h-m	127.33 ± 5.61 a	6.33 ± 0.33 a
D 69	12.00 ± 5.65	19.50 ± 0.86 b-d	395.25 ± 8.00 p	9.75 ± 0.48 g	–	–	–
D 78	62.50 ± 6.36	24.00 ± 1.00 g-i	176.50 ± 4.50 a-g	9.50 ± 0.50 f-g	–	–	–
D 85	79.00 ± 5.65	–	–	–	26.50 ± 0.50 i-m	133.50 ± 0.50 a-b	6.50 ± 0.50 a-b
D 94	86.50 ± 4.94	–	–	–	26.50 ± 0.50 i-m	158.00 ± 0.00 a-e	6.50 ± 0.50 a-b
D 96	12.00 ± 5.65	27.75 ± 0.63 m	179.00 ± 4.02 a-h	7.25 ± 4.02 a-c	–	–	–
D 104	25.00 ± 0.00	24.25 ± 0.75 g-j	236.75 ± 2.39 g-o	9.75 ± 0.47 g	–	–	–
ICGS-44 (susceptible)	1.00 ± 0.00	15.00 ± 0.30 a	679.57 ± 24.19 s	8.28 ± 0.18 c-f	–	–	–
30085 (resistant)	71.00 ± 5.65	–	–	–	24.00 ± 0.57 g	224.67 ± 4.66 f-i	9.33 ± 0.33 f-g

Values are given as mean ± SE. Mean values followed by the same letter are not significantly different at  $P > 0.001\%$  using Duncan's multiple range test.

**Table 3.** Thin layer chromatographic analysis of quercetin, chlorogenic acid and rutin compounds extracted from interspecific derivatives, susceptible and resistant parents of *Arachis*

Interspecific cross/parent	Quercetin ( $\mu\text{g/ml}$ )	Chlorogenic acid ( $\mu\text{g/ml}$ )	Rutin ( $\mu\text{g/ml}$ )
D 1	0.66	0.30	0.30
D 2	0.48	0.40	0.22
D 5	0.52	0.34	0.23
D 7	0.47	0.26	0.24
D 11	0.68	0.74	0.60
D 16	0.81	0.71	0.72
D 19	0.56	0.60	0.51
D 20	1.00	0.78	0.80
D 21	0.56	0.57	0.45
D 22	0.71	0.72	0.71
D 25	0.42	0.45	0.41
D 26	0.47	0.48	0.43
D 34	0.43	0.34	0.33
D 57	0.89	0.72	0.72
D 69	0.36	0.37	0.32
D 77	0.31	0.33	0.24
D 78	0.90	0.77	0.80
D 85	0.85	0.81	0.82
D 94	1.10	1.12	0.84
D 96	0.50	0.38	0.12
D 104	0.50	0.50	0.32
ICGS 44 (susceptible)	0.40	0.47	0.21
30085 (resistant)	1.68	1.45	1.06

development of larvae. Forty-five percent larval mortality was observed on D 1, which had  $0.7 \mu\text{g/ml}$  of quercetin, but the levels of rutin and chlorogenic acid were low (table 3). Similar was the case with D 19, which showed 45% larval mortality at  $0.6 \mu\text{g/ml}$  of quercetin and chlorogenic acid, and at  $0.5 \mu\text{g/ml}$  of rutin.

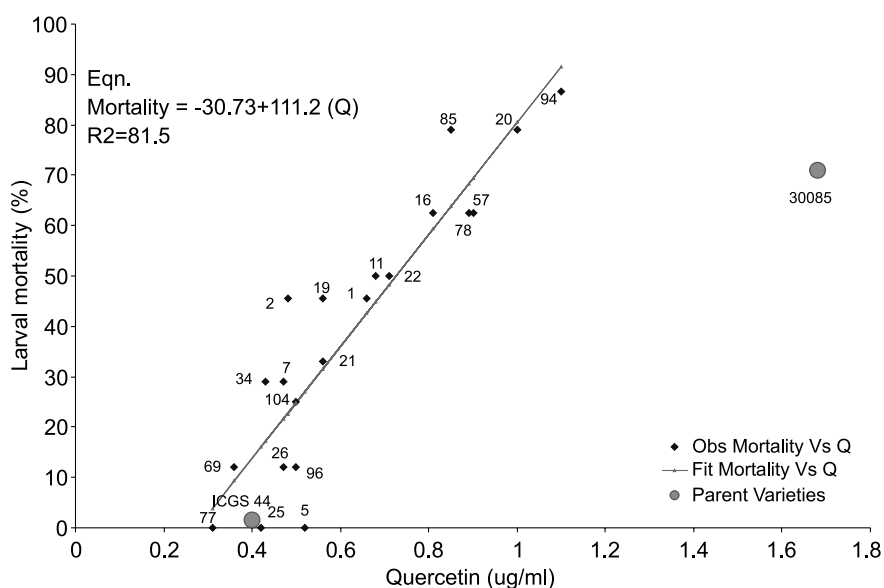
Among the interspecific derivatives, the larval duration was longer on D 25 and D 96, but not different from D 7, D 19, D 78, D104 and the susceptible check, cv. ICGS-44 the duration was only of 15 days. In contrast, *A. kempff-mercadoi* not only showed greater mortality of larvae but also extended the larval

duration to 24 days. Pupal weights were significantly high on the susceptible check, cv. ICGS-44 (679.57 mg) compared with D 7, D 25, D 78, and D 96 with normal adult emergence and D 5, D 57, D 85, and D 94 with lower pupal weights and malformed adults. Interspecific derivatives D 7, D 11, D 16 and D 96 recorded shorter pupal periods with normal adult emergence, followed by D 5, D 57, D 85 and D 94, which gave rise to malformed adults (table 2).

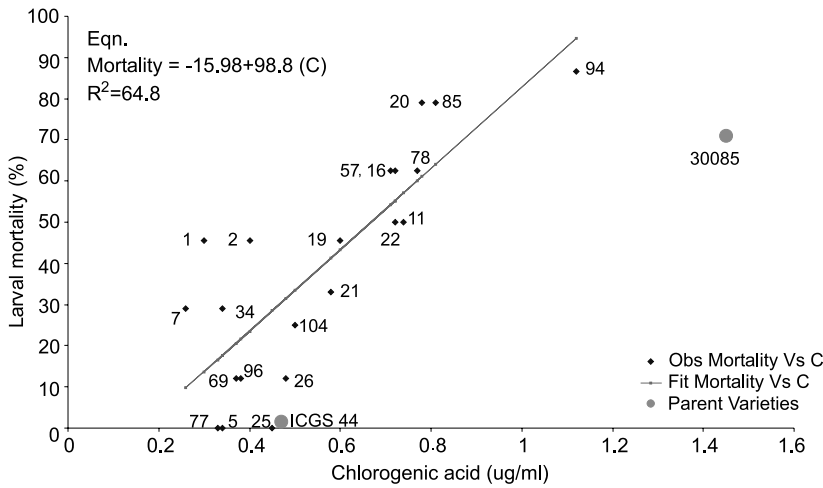
#### 4 Discussion

Studies on the mortality of neonate larvae fed on the foliage of interspecific derivatives from the cross *A. hypogaea*  $\times$  *A. kempff-mercadoi* confirmed the earlier observations of WIGHTMAN and RANGA RAO (1994), who reported neonate mortality on the leaf surface of ICGV 86031. In the present study, 29% of the larvae survived on *A. kempff-mercadoi*, while some of them had extended the larval duration, and others did neither pupate normally nor normal adults were observed (table 2). These results show that the phytochemicals (substances) in the foliage of *A. kempff-mercadoi* (30085-R) may have been inherited to the interspecific derivatives causing mortality at each developmental stage (fig. 5).

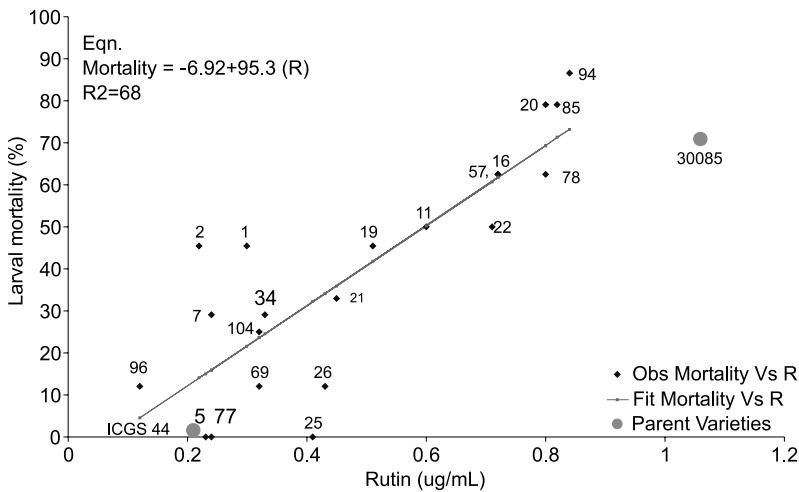
Developmental impediment caused by the presence of high quantities of chlorogenic acid, quercetin and rutin ( $0.7$ – $0.8 \mu\text{g/ml}$ ) in the leaf tissue expressed an effect of  $>60\%$  larval mortality. However, the interspecific crosses D 5 and D 25 showed no mortality of larvae, and possess  $0.52 \mu\text{g/ml}$  of quercetin, and  $<0.45 \mu\text{g/ml}$  of rutin and chlorogenic acid contents (table 3). In *A. kempff-mercadoi* (30085-R) the quantity of these chemicals ranged  $1.06$ – $1.68 \mu\text{g/ml}$ , whereas the quantity was  $<0.50 \mu\text{g/ml}$  in the susceptible female parent (cv. ICGS-44). These results were confirmed by path analysis indicating that quercetin had a direct effect and chlorogenic acid and rutin showed an indirect effect causing larval mortality. In addition, these results also suggest that antibiosis



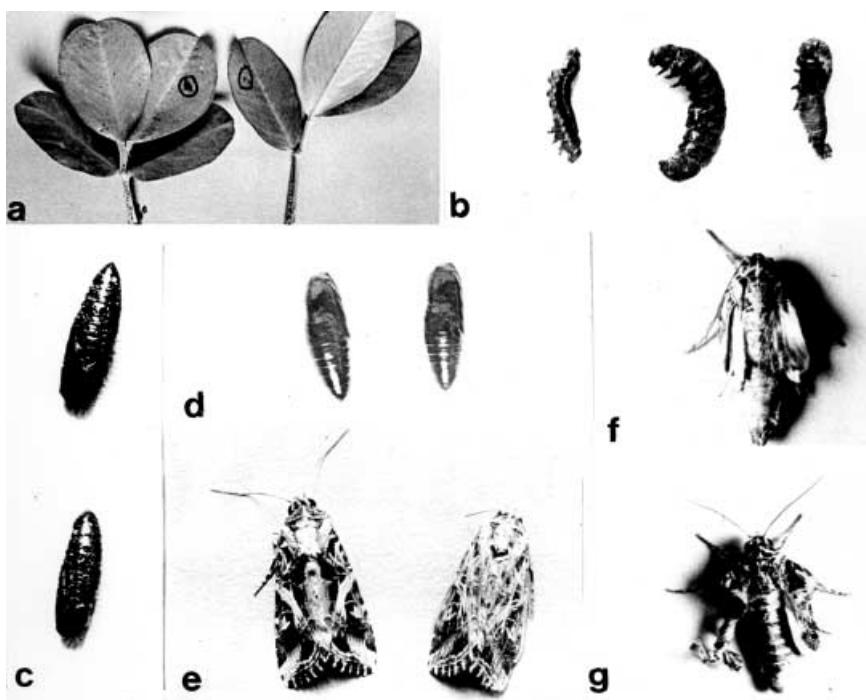
**Fig. 2.** Multiple regression analysis of quercetin against neonate mortality of *Spodoptera litura* in interspecific derivatives of groundnut (numbers correspond to the crosses listed in table 3)



**Fig. 3.** Multiple regression analysis of chlorogenic acid against neonate mortality of *Spodoptera litura* in interspecific crosses of groundnut (numbers correspond to the crosses listed in table 3)



**Fig. 4.** Multiple regression analysis of rutin against neonate mortality of *Spodoptera litura* in interspecific crosses of groundnut (numbers correspond to the crosses listed in table 3)



**Fig. 5.** *Spodoptera litura* growth and development on interspecific derivatives from the *Arachis hypogaea* × *A. kempff-mercadoi*. (a) Neonate larval death on leaves of interspecific derivative. (b) Abnormality in larval-pupal transformation. (c) Normal pupae. (d) Abnormal pupae. (e) Normal adult. (f) Malformed adult. (g) Malformed adult

factors are involved in extending the duration of both larvae and pupae, besides causing mortality of larvae, and reduction in pupal weights. These factors influenced not only abnormal development of larvae but also expressed their continued effect in terms of malformed pupae and adults (fig. 5).

Greater mortality of neonate larvae and retarded development of older larvae was observed on excised leaves of wild *Arachis* species on *S. litura* (STEVENSON et al., 1993a), and fall armyworm, *Spodoptera frugiperda* (LYNCH et al., 1981; GARNER and LYNCH, 1981). The absence of effects of chlorogenic acid contents on the development of *Spodoptera eridania* in larval mortality recorded by LINDROTH and PETERSEN (1988) may be due to testing of older instars.

Antibiosis effect was predominantly noticed against the larvae of *S. litura* among the several interspecific derivatives of groundnut. However, the magnitude in response to survival and duration of larvae, consumption of foliage, and pupal weights varied among the derivatives of interspecific crosses. In the present study, majority of the interspecific derivatives expressed resistance to *S. litura* with leaf surface exudates immobilizing the larvae, while the chemical effects cannot be excluded. Collectively, the data suggest that extended duration and decreased survival of larvae, reduction in pupal size and weights, induction of deformation, reduced fecundity of adults, and non-hatching of the eggs in majority of the leaflets in interspecific crosses are contained within leaflets. Although emergence of normal adults was observed (table 2), they may either have failed to produce progeny due to male sterility or the progeny larvae had prolonged duration to become pupae, which appears to be the transition phase and host sensitivity to nutritional quality. Similar results were obtained with *S. frugiperda* when fed on peanut foliage (LEUCK and SKINNER, 1971) and *Spodoptera littoralis* when fed on wild tomato, *Lycopersicon pennellii* expressing adult deformity (BERLINGER et al., 1997).

The present investigation has clearly demonstrated the involvement of quercetin, chlorogenic acid and rutin, and their significant impact on the development and mortality of neonate larvae of *S. litura* on interspecific derivatives of *Arachis* species. They may also help not only in combating other lepidopteran pests on groundnut, but also in formulating new pest management strategies with greater emphasis on host-plant resistance.

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