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RELATIVE SUSCEPTIBILITY OF SOME PROMISING FENNEL VARIETIES TO *LASIODERMA SERRICORNE* FAB.

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ABSTRACT

Eight varieties of fennel *viz*., UF-205, UF-206, JF-376, HF-118, HF-125, GF-2 RF-101 and the local were tested for their preference by *L. serricorne*. The influence on developmental period, adult emergence, ovipositional response, incubation period, grain damage (%) and weight loss (g), growth index and the physico-chemical characters were studied. On the basis of different parameters, GF-2 and UF-206 were comparatively less susceptible; RF-101, HF-125 and local were moderately susceptible, whereas, JF-376, HF-118 and UF-205 were among the highly susceptible varieties.

Key word: cigarette beetle, *Lasioderma serricorne* Fab.

The cigarette beetle (*Lasioderma serricorne* Fab) is a serious pest of several stored commodities. Apart from main host tobacco and cigarettes, it has also been recorded on turmeric, ginger, castor beans, wheat, coconut meal, pepper, cardamom, mustard, chilli, fennel, cumin and opium leaves (Chatterjii, 1963; Gahukar, 1975; Hussain and Khan, 1966; Samuel *et al.*, 1984 and Sharma, 2007). It is a well-known fact that food constituents play a vital role in the survival and reproduction potential of the insects. The seed characters and physico-chemical characters of the variety also interfere the normal physiology or feeding of the insect, affects adversely the biology of the pest and these make a variety less preferred to insect attack. Keeping this in view an attempt has been made to study the growth and development of this pest on some promising fennel varieties.

MATERIALS AND METHODS

For determining the relative susceptibility of the different varieties, only sound and healthy seeds were selected after mechanical separation. The seeds were sterilized in oven at 60 ± 5°C for 8 hours to avoid any hidden infestations. Prior to the experiment, the seeds of each variety were conditioned at least for a week in an incubator maintaining 30 ± 2°C and 70 ± 5 relative humidity in which the tests were carried out. The moisture content of the seeds was determined by moisture meter. All the varieties were inoculated simultaneously and there were three replications for each variety. The experiment was conducted at 30 ± 2°C temperature and 70 ± 5 per cent relative humidity. The observations on developmental period (eggs to adults), adult emergence, ovipositional response, incubation period, grain damage, weight loss and growth index were taken. For the study of ovipositional response, 5 pairs of freshly emerged adults were introduced in glass vials (15 × 5 cm) separately on each variety for oviposition. The total number of eggs laid by the female were counted daily till 15 days after release. For incubation period, a random sample of twenty freshly laid eggs were taken in small specimen tubes. The dates of eggs laying and hatching were also recorded to find out the incubation period in each variety. Twenty newly emerged larvae were released in specimen tubes containing 20g sample of each variety and the number of seeds in each sample was counted. The specimen tubes were covered with muslin cloth. From the day fresh emergence started, the dates and number of adults emerged were noted twice (morning and evening) daily to work out the total developmental period (egg to adult) and per cent adult emergence on the basis of larvae placed in each specimen tube. Growth index was calculated by dividing percentage of adult emergence by total developmental period in days. The damaged grains and weight loss were recorded 90 days after the release of eggs. For this purpose, the sample of seeds was spread upon a white sheet and damaged seeds were counted. The percentages of damaged seeds were calculated. The loss in weight was obtained after removing all insect stages and frass. It was worked out by subtracting the final weight from the initial weight and converted into percentage. The morpho-biochemical characters *viz.*, size of grains, moisture, protein, volatile oil, crude fibre and total soluble sugar contents were also determined.

RESULTS AND DISCUSSION

a. Growth and development on different fennel varieties

The developmental period of *L. serricorne* was greatly influenced by different fennel varieties (Table-1). The developmental period of beetles varied from 46.3 to 64.2 days, being shortest on JF-376 and longest on GF-2. The work on relative susceptibility of fennel varieties to *L. serricorne* is not available, however, the same type of work on other commodities have been discussed. The present observations corroborate with that of Viayalakshmi *et al.* (1990) who reported that the developmental period of *L. serricorne* was greatly influenced by different turmeric varieties. Similarly, Sachan and Chandel (1991) reported significant variation in developmental period of *L. serricorne* on different groundnut varieties. Sharma and Bhattacharya (1994) also found that the developmental period of this pest ranged from 49.00 to 53.00 days on different soybean varieties. The variation in the developmental period amongst test varieties may be due to different in physico-chemical nature of the varieties that might be nutritionally inadequate for the development of insect. These results are in conformity with the earlier findings of Padmavathamma and Rao (1989).

Behaviour of different varieties towards successful emergence of adults differed significantly. The maximum percentage of adult emergence was recorded on the variety JF-376 (79.21%), which was at par with HF-118 (78.33%), while minimum in GF-2 (45.49%). Emergence of beetles in the rest of varieties ranged from 49.78 to 68.92 per cent (Table-1). The work on adult emergence on different fennel varieties is not available, however Viayalakshmi *et al.* (1990); Sharma and Bhattacharya (1994) and Singh and Prasad (2001) also found variation in adult emergence of this pest on different turmeric, soybean and mustard varieties, respectively.

Table 1: Growth and developmental of *L. serricorne* on different fennel varieties*

Varieties	Developmental period (days)	Adult emergence (%)	Oviposition response (eggs/female)	Incubation period (days)	Grain damage (%)	Weight loss (%)	Growth index
UF-205	48.6	68.92 (56.12)	38.00	6.30	57.12 (49.09)**	12.15 (20.38)	1.42
UF-206	59.5	49.78 (44.87)	25.30	8.00	26.02 (30.66)	6.42 (14.66)	0.84
JF-376	46.3	79.21 (62.88)	41.20	5.20	65.05 (53.76)	16.00 (23.57)	1.71
HF-118	46.9	78.33 (62.27)	40.30	5.80	63.65 (63.94)	15.43 (23.07)	1.67
HF-125	54.0	53.13 (46.79)	32.40	7.20	36.16 (36.96)	10.90 (19.24)	0.98
GF-2	64.2	45.49 (42.71)	24.30	8.50	22.00 (27.96)	2.30 (8.56)	0.71
RF-101	56.6	56.46 (48.71)	28.50	7.90	30.15 (33.30)	9.35 (17.78)	1.00
Local	53.4	66.50 (54.64)	36.00	6.80	40.95 (39.79)	11.85 (20.13)	1.25
SEm±	0.84	0.50	0.72	0.71	3.92	0.86	
CD at 5%	2.50	1.49	2.16	2.14	11.74	2.59	
CV %	2.69	1.74	3.76	17.77	16.18	8.11	

* Data based on three replications.

** Percentage transformed to angles; outside values are its back transformation to percentages

The maximum number of eggs were deposited on the fennel variety JF-376 (41.2), which was at par with HF-118 (40.3) showing suitable for oviposition followed by UF-205 (38.0), local (36.0), HF-125 (32.4), RF-101 (28.5) and UF-206 (25.3). The GF-2 (24.3) was being unfavorable for oviposition (Table-1). The variation in fecundity could be due to the softness/hardness of the varieties. No work is available on the egg laying capacity of *L. serricorne* on different fennel varieties and varieties of other commodity; however, Sudhakar and Pandey (1982) reported significant variation in egg laying capacity of *Sitophilus oryzae* on different wheat varieties. Gupta *et al.* (2000) and Uttam *et al.* (2004) observed similar variation in fecundity of *S. oryzae* on maize and barley varieties, respectively. The incubation period of *L. serricorne* varied from 5.2 to 8.5 days in different fennel varieties being minimum on JF-376 (5.2 days) and maximum on GF-2 (8.5 days). Results of the present study in respect of incubation period are in close conformity with the findings of Kurup and Parkhe (1961)

who reported that incubation period of *L. serricorne* on tobacco leaves of different varieties ranged from 5 to 8 days.

The percentage of damaged grains and loss in weight of different fennel varieties due to infestion of the beetle ranged from 22.00 to 65.05 and 2.30 to 16.00, respectively, with maximum damaged grains and weight loss in JF-376 and minimum in GF-2 (Table-1). Not much work is available on the grain damage and weight loss in different fennel varieties due to infestation of *L. serricorne*, however, Viayalakshmi *et al.* (1990) found that the weight loss in different turmeric varieties due to infestation of *L. serricorne* varied from 0.68 to 3.42 per cent support the present findings. The growth index of *L. serricorne* varied from 0.77 to 1.71 in different fennel varieties, being minimum in GF-2 (0.71) while maximum in JF-376 (1.71). Jha and Yadav (1994) reported that preferred varieties of crop produced higher growth index, while less preferred varieties had lesser growth index, support the present findings.

b. Physico-chemical characteristics of fennel varieties

The volatile oil in different fennel varieties ranged from 1.83 to 2.20, being minimum in JF-376 while maximum in GF-2 (Table-1). Thus, it was clear from these results that the fennel varieties having less volatile oil were much susceptible in comparison to other varieties having higher volatile oil. Similar to the present finding, Singh and Prasad (2001) also observed that the mustard varieties associated with high oil content was most susceptible to *L. serricorne* Sugar content of different fennel varieties varied from 0.82 to 1.35, however, no significant difference was observed among these varieties. However, fennel varieties having higher sugar content were more susceptible as compared to the varieties having lower sugar content. The per cent crude fibre content varied from 15.16 per cent in JF-376 to 19.67 per cent in GF-2. Viayalakshmi *et al.* (1990) and Singh and Prasad (2001) also reported that the mustard varieties associated with lower fibre content were most susceptible to *L. serricorne.*

The highest percentage of protein was observed in the variety JF-376 (9.00%) while lowest percentage in GF-2 (5.00%). In remaining varieties the protein content ranged from 5.25 to 8.00 per cent. From the observation it was obvious that increase in protein percentage was maximum in susceptible varieties of fennel due to infestation of *L. serricorne* and *vice-versa* (Table-2). Lakshmi and Sudhakar (2003) reported that the adult emergence, index of susceptibility and weight loss due to *L. serricorne* increased with increase in protein content of turmeric cultivars, which supports the present findings. The results obtained by Sudhakar and Pandey (1981) are also in support of the present study, who found the increase of protein in damaged wheat grains due to infestation of *S. oryzae*. Similarly, Rao and Sharma (2003) reported that susceptible varieties had more protein content. The length and width of the grains in different fennel varieties ranged from 0.62 to 0.72 cm. and 0.18 to 0.22 cm, respectively. However, no significant difference existed among the varieties. Moisture percentage in different varieties of fennel varied from 3.16 to 6.60, being maximum in JF-376 (6.60%) and minimum in GF-2 (3.16%). It could be noted that higher per cent of moisture induces higher infestation of seeds, while lower moisture represented least infestation (Table-2). Singh *et al.* (1991) found that grains of different barley varieties containing maximum moisture, were highly susceptible to

Table 2: Physico-chemical characters of different fennel varieties*

Varieties	Volatile oil	Sugar	Crude fibre	Protein	Size of grain (cm)		Moisture
	(%)	(%)	(%)	(%)	Length	Width	(%)
UF-205	1.90 (7.86)	1.02 (5.74)	16.32 (23.82)	8.00 (16.42)	0.66	0.18	5.56 (13.61)**
UF-206	2.17 (8.45)	1.03 (5.74)	18.27 (25.30)	5.25 (13.23)	0.68	0.18	3.45 (10.67)
JF-376	1.83 (7.73)	1.35 (6.58)	15.16 (22.90)	9.00 (17.45)	0.62	0.20	6.60 (14.87)
HF-118	1.87 (7.83)	1.26 (6.40)	15.17 (22.91)	5.50 (13.56)	0.64	0.20	5.00 (12.90)
HF-125	2.03 (8.15)	0.94 (5.46)	17.02 (24.36)	6.25 (14.46)	0.68	0.22	4.33 (11.98)
GF-2	2.20 (8.51)	0.82 (5.17)	19.67 (26.32)	5.00 (12.91)	0.66	0.18	3.16 (10.21)
RF-101	2.13 (8.36)	1.02 (5.73)	18.00 (25.10)	5.90 (14.04)	0.72	0.20	3.96 (11.45)
Local	1.93 (7.89)	1.06 (5.85)	16.54 (23.99)	7.75 (16.14)	0.64	0.18	5.33 (13.33)
SEm±	0.61	0.66	0.47	0.50	0.20	0.09	0.60
CD at 5%	NS	NS	1.40	1.51	NS	NS	1.79
CV %	12.98	19.56	3.32	5.75	52.89	80.12	8.35

* Data based on three replications.
** Percentage transformed to angles; outside values are its back transformation to percentages
NS = Non-significant

Table 3: Linear relationship between physico-chemical characters and growth development parameters for *L. serricorne* on different fennel varieties

X Variable	Y Variable	r	Regression equations
Volatile oil	Growth index	–0.873**	Y=9.002–0.022X
	Damaged grains	–0.893**	Y=9.141–0.057X
	Loss in weight	–0.855**	Y=8.628–0.489X
Sugar	Growth index	0.832*	Y=4.552+0.031X
	Damaged grains	0.823*	Y=4.405+0.078X
	Loss in weight	0.677	Y=5.209+0.576X
Protein	Growth index	0.907**	Y=9.888+0.127X
	Damaged grains	0.897**	Y=9.276+0.321X
	Loss in weight	0.835**	Y=12.268+2.702X
Moisture	Growth index	0.810*	Y=7.881+0.101X
	Damaged grains	0.819*	Y=7.288+0.263X
	Loss in weight	0.721*	Y=9.862+2.088X

r=Correlation coefficient; * Significant at 5 percent; ** Significant at 1 percent

the attack of *S. oryzae*. Gupta *et al.* (1999) and Uttam *et al.* (2004) also opined that the varieties with higher moisture content were most susceptible in comparison to varieties with lower moisture content.

c. Correlation studies on physico-chemical characters of fennel varieties

The relationship of volatile oil with growth index, grain damage and loss in weight was found to be significant having negative correlation. Thus it is determined that the increase in volatile oil decreased the infestation of this pest and *vice-versa*. The relation of sugar, protein and moisture contents of grain was found to be significant having positive correlation with growth index, grain damage and loss in weight. Overall performance of the varieties which were having higher sugar, protein and moisture contents have shown maximum growth index, grain damage and loss in weight (Table-3). In the present study, the relationship of protein content was found to be significant having positive correlation. Victoria *et al.* (1987) reported a highly significant positive correlation between protein content and loss in weight of grains due to cigarette beetle. Similarly, Laxmi and Sudhakar (2003) also reported that the adult emergence, index of susceptibility and weight loss increased with increase in protein content of turmeric cultivar. The present results are not in conformity with that of Ram and Singh (1996) who reported that protein content was negatively correlated with weevil susceptibility though non-significant. This may be due to some other factors associated with protein contents, which ultimately affect the susceptibility of grains. Sudhakar (1980) observed that the correlation of moisture content with fecundity and F_1 progeny of *S. oryzae* on wheat grains was significant and positive, which is in accordance with the present results. Similarly, Uttam (1992) also observed that the correlation of moisture content was highly significant and positive with the fecundity, F_1 progeny and index of susceptibility, which showed that barley varieties, having higher moisture content, were observed to be highly infested with *S. oryzae* and *vice-versa*.

REFERENCES

Chatterjii, S. (1963). *Lasioderma serricorne* Fab. As a pest of mustard seeds in storage. *Indian Oil Seeds Journal,* **4**: 287-291.

Gahukar, R.T. (1975). Occurrence of *Lasioderma serricorne* Fab. on coconut meal. *Indian Journal of Entomology,* **37**: 308-309.

Gupta, A.K.; Behal, S.R.; Awasthi, B.K. and Verma, R.A. (1999). Screening of some maize genotypes against *Sitophilus oryzae*. *Indian Journal of Entomology,* **61**: 265-268.

Gupta, A.K; Behal, S.R.; Awasthi, B.K. and Verma, R.A. (2000). Reaction of protein, starch and ash constituent of different varieties of maize on growth and development of *Sitophilus oryzae*. *Indian Journal of Entomology,* **62**: 375-381.

Hussain, M. and Khan, K.M. (1966). Record of *Lasioderma serricorne* Fab. (Anobiidae) : Coleoptera) on stored caster beans, *Science of Culture,* **32**: 212.

Jha, A.N. and Yadav, T.D. (1994). Host suitability of spice mixture to *Lasioderma serricorne* Fab. and *Stegobium paniceum* (Linn.). *Indian Journal of Entomology*, **56**: 332-336.

Kurup, A. and Parkhe, D.P. (1961). Some observations on the biology of the cigarette beetle, *Lasioderma serricorne* Fab. *Indian Journal of Entomology,* **23**: 274-278.

Lakshmi, K.V. and Sudhakar, T.R. (2003). Role in certain chemical constituents on the development of cigarette beetle, *Lasioderma serricorne* Fab. in turmeric. *Indian Journal of Plant Protection*, **31**: 122-124.

Padmavathamma, K. and Rao, P.K. (1989). A new host record of cigarette beetle, *Lasioderma serricorne* Fabricius. *Indian Journal of Entomology,* **51**: 223-224.

Ram, C. and Singh, V.S. (1996). Resistance to *Sitophilus oryzae* (L.) in wheat and associated grain characteristics. *Indian Journal of Entomology,* **58**: 1-11.

Rao, N.S. and Sharma, K. (2003). Screening of wheat germplasms for resistance against rice weevil, *Sitophilus oryzae* (L.) and physico-chemical grain characters. *Annals of Plant Protection Science,* **11**: 250-254.

Sachan, G.C. and Chandel, S.K. (1991). Susceptibility of some groundnut varieties to *Lasioderma serricorne* (Fabricius). *Indian Journal of Entomology*, **53**: 559-563.

Samuel, R.; Prabhu, V.K.K. and Narayana, C.S. (1984). Influenced of spice essential oil on the life history of *Lasioderma serricorne*. Entomon, 209-215.

Sharma, S. and Bhattacharya, A.K. (1994). Susceptibility of some varieties of soybean to *Lasioderma serricorne* (Fabricius). *Bulletin of Grain Technology,* **31**: 220-224.

Sharma, S.R. (2007). Host preference and management of cigarette beetle, *Lasioderma serricorne* Fab. on cumin. M.Sc. (Ag.) Thesis Submitted to Rajasthan Agricultural University, Bikaner pp. 69.

Singh, D.K.; Singh, B.; Singh, U.P.; Pandey, N.D. and Malik, Y.P. (1991). Relative resistance of some barley varieties to rice weevil, *Sitophilus oryzae* (Linn.). *Indian Journal of Entomology*, **53**: 280-285.

Singh, S. and Prasad, S.K. (2001). Development of *Lasioderma serricorne* on seeds of some rapeseed and mustard varieties/species. *Indian Journal of Entomology,* **63**: 92-95.

Sudhakar, T.R. (1980). Relative resistance of wheat, raw and parboiled rice varieties to *Sitophilus oryzae* L. in relation to their physical and biochemical parameters. Ph.D. Thesis Submitted at C.S. Azad University of Agriculture and Technology, Kanpur.

Sudhakar, T.R. and Pandey, N.D. (1981). Fluctuations of chemical constituents in wheat varieties due to infestation on rice weevil, *Sitophillus oryzae* L. *Bulletin of Grain Technology,* **19**: 99-103.

Sudhakar, T.R. and Pandey, N.D. (1982). Relative resistance and influence of wheat varieties on the rice weevil, *Sitophilus oryzae* (L.). *Bulletin of Grain Technology,* **20**: 79-85.

Uttam, J.R. (1992). Study the effect of some barley varieties on the growth and development of *Sitophilus oryzae* Linn. and relative resistance in respect of their physical and chemical characters. Ph.D. Thesis Submitted at C.S. Azad University of Agriculture and Technology, Kanpur.

Uttam, J.R.; Pandey, N.D.; Verma, R.A. and Singh, D.R. (2004). Reaction of different barley varieties on growth and development of *Sitophilus oryzae* Linn. *Indian Journal of Entomology,* **66**: 149-159.

Victoria, Y. Yokoyama and Mackey, C. (1987). Relation of plant protein and suitability of cotton foliage for cigarette beetle (Coleoptera : Anobiidae) growth. *Journal of Economic Entomology,* **80**: 830-883.

Viayalakshmi, K.; Ayyanna, T. and Sudhakar, T.R. (1990). Relative susceptibility of turmeric varieties to *Lasioderma serricorne* Fab. During storage under laboratory conditions. *Bulletin of Grain Technology,* **28**: 124-127.