Entomological studies on phaseolus (Mung bean) (Vigena radiata)

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Mung bean or green gram or lentil) as named in Egypt[is a legumine crop early mature producing seeds contains 22 - 24 % protein, also when mixing with cereal flour result a complete nutritive diet. This crop needs less amount of water for irrigation than other many crops. Recently this crop was introduced in Egypt by Agricultural Research Center to be used as a human food.Entomological data under the Egyptian field conditions are very important to protect mung bean plants in the proper time. Present study was conducted in the farm of Sirs El-layan Agricultural Research Station throughout 1995 / 96 and 1996 / 97 fall seasons aiming to:1-Regular surveys of insects and mites inhabiting mung bean plants in the field, classifying them to pests, natural enemies and visitors.2-Study of the population densities and dynamics of the most important insect pests and some of their natural enemies using direct and indirect inspections. Also some phytochemical components were correlated with the pest population.3-Evaluating the effect of certain weather factors on these insects during the growing season.4-Study of the role of some traditional and nontraditional treatments, (Chemical insecticides, Mineral and Vegetative oils and Plant extract) in reducing the population of some pests in the field.Obtained results could be summarized in the following points:Survey:Survey studies by using sweeping net during two successive seasons 1995 and 1996 revealed the occurrence of 96 insects and animal species inhabiting mung bean plant in the field during the periods from 22nd of Jul. to the end of Sep. 1995 and from 26th of Jul. to the 4th of Oct. 1996. The identified species are classified to 3 groups as follow :The first group comprised 43 species considered as pests infesting mung bean plants in the field, 40 species out of them were (insect pests) and other three species were mites infesting plants. The second group contain 11 species as insect visitors while the third group included 39 species considered as natural enemies (32 predator species and 7 species as parasites), and two species as common pollinators and one species of debatable feeding habit and considered a saprophytic mite.Yellow sticky traps for surveying the attracted insects in mung bean field:The attracted insects to the yellow sticky traps were arranged into the following:1-Insect pests :Nine species of insect pests were attracted to the traps, these species were: five leaf hoppers Empoasca decipiens; Asymmetrasca decedns; Balclutha hebe; Cicadulina chinai ; Empoasca lybicae; the cotton and tomato white fly, Bemisia tabaci; the onion thrips Thrips tabaci; The cowpea pod borer Etiella zinckenella and the cowpea aphid Aphis craccivora arranged descendingly according to the attracted numbers which were higher in 1996 than 1995.2-Natural enemies:Six predator species were attracted to trap, the most abundant of them were Scymnus interruptus; Paederus alfierii; Scymnus syriacus and two parasites Tachina larvarum and Pimpla roborator, also the numbers of attracted natural enemies were higher in 1996 than 1995. except for S syriacus3-Visitors and pollinators :Insect visitors included five species may be arranged descendingly according to the attracted numbers were: house fly, Musca spp.; the mosquito, Culex pipenes; the chironomid, Chironomus pilosus and two pollinators Andrea spp. and Apis mellifera. The above mentioned attracted numbers were higher in 1996 than in 1995 season.Ecological studies on some important insect pests:The following insect pests were considered as important insect pests causing significant damage to mung bean plants in the field: the white fly; the potato leaf hopper; leaf miners (Three species) and the cowpea pod borer. Results of the population density studies for the above mentioned insect pests indicated the following:I - The

white fly, Bemisia tabaci (Genn.): Egg stageThe population of the white fly eggs ranged between 7.25 to 44.5 eggs/10 sq. inches with two peaks, the first was 31.5 eggs in 31 - 8 and the second 44.5 eggs in 20 - 9 — 1995, with overall mean reached 23.14 eggs/10 sq. inches .In 1996 season, eggs density was higher than in 1995 season. No. of eggs ranged between 12.25 to 210.25 eggs / 10 sq. inches with three peaks 42; 143.25 and 210.25 eggs / 10 sq. inches in the dates 26-7; 25-8 and 4-9-1996 with overall mean 60.67 eggs / 10 sq. inches.Nymphal stage:The population of this stage followed the same trend as shown in the case of eggs. In1995, its numbers ranged between 4.5 to 62.0 nymphs / 10 sq. inches. giving two peaks, the first was 41.25 nymphs / 10 sq. inches in 31-8 and the second 62.0 nymphs in 20-9-1995. The overall mean was 22.64 nymphs /10 sq. inches. In 1996, nymphal population ranged between 3.25 and 224.5 nymphs / 10 sq. inches, three peaks were recorded 22.25 nymphs in 5-8; 224.5 in 4-9 and 131.25 nymphs in 24-9-1996, giving 63.08 nymphs / 10sq. inches as a general mean .Effect of some weather factors on the population density of (Eggs and nymphal) stages of B. tabaciDuring the two examined years, the maximum; minimum temperature and relative humidity correlated positively with the egg and nymphal stages of Bemisia tabaci. These correlations were strongly significant with the maximumtemperature and relative humidity. This correlation also was positive but weakly significant for the effect of minimum temperature. The evaluated explained variances proved that the three weather factors had strong effect on the eggs and nymphal stages of B. tabaci, which reached 79.2 and 92.55 % in 1996 for the egg, and nymphal stages, respectively. These effects were less (55.1 %, 54.9 %) on the same two stages during 1995.Effect of phytochemical components of mung bean leaflet on the population of egg and nymphal stages of Bemisia tabaci.In plant vegetative stage:During this stage population density of eggs was correlated significantly and negatively with the total carbohydrates % (r = - 0.121) and insignificantly negative with the soluble sugars % (r = - 0.303). Also the effect of nonreduced sugars % was significant and negative giving (r = - 0.960) while the reduced sugars % and the crude protein had a positive and highly significant effect on eggs population where ” r ” values were 0.863 for the reduced sugars and 0.910for the crude protein.Nymphal stage of the insect correlated insignificantly and negatively with the soluble sugars %, nonreduced sugars % and the crude protein, but correlated in highly significant positive manner with total carbohydrates % and insignificantly with the reduced sugars %. from the obtained results, crude protein proved that it was important significantly for B. tabaci egg stage and the total carbohydrates % was an important factor for the nymphal stage.In plant flowering stage:Total carbohydrates % and soluble sugars % had insignificant and negative effect on B. tabaci eggs population while the nonreduced sugars % and crude protein were significantly and negatively affective. On the other hand, reduced sugars % effected insignificantly and positively. Nymphal population received a very clear negative significant effect by the evaluated phytochemical components .In plant fruiting stage:During this stage effect of total carbohydrates %, soluble sugars % and crude protein on the eggs population was insignificantly positive while the reduced sugars % gave clear strong significantly positive effect on eggs population. The nonreduced sugars % affected insignificantly and positivelyB. tabaci egg stage population.For nymphal stage of B. tabaci, carbohydrates %, the reduced sugars % and crude protein affected the population significantly and positively, while the soluble sugars % gave insignificantly positive effect; the nonreduced sugars % had strong insignificant negative effect. It is clear that the reduced sugars % played a very important role on both egg and nymphal stages density during the fruiting period of plant life and the crude protein affected strongly the population of the insect nymphal stage.The population density of the potato leaf hopper Empoasca decipiens egg stage:The population of the potato leaf hopper eggs ranged between 1.25 and 37.25 eggs / 10 sq. inches during 1995 growing season showing two peaks, the first one (37.25 eggs) in 12 - 7 and the second was smaller (11.25 eggs) in 31-8-1995, recording overall mean 12.14 eggs /10 sq. inches. In 1996 season eggs population was higher than in the first year ranging between 9.25 to 58.25 eggs /10 sq. inches with two peaks, the first one (58.25 eggs) in 16-7 and the second was (19.25 eggs) in 4-9-1996, recording general mean of 23.56 eggs /10 sq.inches.Effect of some weather factors on egg population density:Eggs population in 1995 and 1996 seasons correlated insignificantly and in a positive way with the three examined weather factors. The recorded were” r ” values in 1995 were 0.032; 0.449 and 0.364 for the maximum& minimum temperatures and relative humidity compared

with 0.111; 0.409 and 0.082 for the same factors, respectively in 1996. ’The E. V. % proved that the testedfactors affected the egg population density in1995 by33.49 % compared with less effect of 28.04 % during 1996 season.Leaf miners infesting mung bean plants.a. The broad bean leaf miner, Liriomyza trifoliiMines density in leafletsMung bean plants received a general mean of 3.4 mines /10 leaflets during 1995 season. Mines ranged between 0.5 to 7.5 mines/101eaflets. One peak was recorded reached (7.5 mines) in the 31 of Aug.. In 1996 season, mines /10 leaflets ranged between 1.3 to 4.0 mines. The general mean reached 2.58 mines; it was lower than in the former year of study. Two peaks were recorded, the first one (3.8 mines) in 15-8 and the second was (4.0 mines) /10leaflets in 14-9-1996. Larval density:The population density of the broad bean leaf miner larvae /10 leaflets in 1995 was very close to that obtained in the second year of study recording a general mean of 1.97 larvae in the first year and 1.91 larvae in the second year. Larvae /10 leaflets ranged between 0.5 and 3.8 in 1995 and 0.5 - 3.3 in 1996 season. One peak of 3.8 larvae was recorded in 31-8-1995 compared to two peaks of 2.5 larvae in 15-8 and 3.3 larvae / 10 leaflets in 4-9 in the second year1996Pupal density:The population density of pupae /10 leaflets in 1995 ranged between 0.0 and 4.0 pupae, with overall mean of 1.63 pupae recording one peak of 4.0pupae/10 leaflets at the end of August.In 1996 season, mean number of pupae /10 leaflets ranged between 0.0 to 1.5 pupae recording its highest population of 1.5 pupae at 25th of August. The general mean number recorded lower value than the former season (0.71pupa /10 leaflets).Effect of some weather factors on the population density of larval and pupal stages of Liriomyza trifolii.Maximum temperature affected the population density of the broad bean leaf miner L. trifolii larvae insignificantly and negatively in 1995 season (” r ” = - 0.6). This effect was significantly positive in 1996 season. The minimum temperature gave the same insignificantly negative effect on the larval density in 1995; that effect became significantly positive in 1996. That may be attributed to the effect of other unconsidered environmental factors in 1996 season. The relative humidity had clear strong significant and positive effect during 1995 and insignificantly positive in 1996 season.In the case of the pupal stage, relative humidity gave significant and positive effect in 1995 where ” r ” = 0.667, and insignificantly positive in 1996 season (r = 0.141), while the minimum temperature affected insignificantly and positively the pupal density during the examined seasons 1995 and 1996. Maximum temperature correlated negatively with pupal density in 1995 and positively in 1996 but without any significance during the two examinedseasons.The total E. V. % was 33.87 % in 1995 and 27.11 % in 1996 concerning the larval stage with more effect on the pupal stage reaching 47.05 % in 1995 and 37.88 % in 1996 season indicating that the total E. V. % case of pupae wasmore than in larval stage.Relationship between mung bean leaflet phytochemical component and the population density of (larval and pupal) stages of the broad bean leafminer.In plant vegetative stage:The population density of larval and pupal stages of L. trifolii correlated significantly and positively with the total carbohydrates % where ” r ” values were 0.866 for larvae and 0.855 for pupae, while the total soluble sugars % correlated significantly but negatively with the two stages (r = - 0.866 for166larvae 0.877 for pupae). Larval and pupal population densities correlated significantly positive with the reduced sugars %, while that correlation was significantly negative during the two examined insect stages with the nonreduced sugars %. The crude protein correlated insignificantly positive with the two stages (” r ” values 0.198 for the larvae and 0.148 for the pupae). The above mentioned results indicated that the total carbohydrates % and the reduced sugars % were the most effective chemical components in the leaflet during this plant stage on the population density of larval and pupal stages.In plant flowering stage:Population density of L. trifolii larval stage expressed significantly negative relationship with all the tested chemical components in the leaflets of mung bean except the reduced sugars % where ” r ” values were - 0.817, -0.909 ; -0.371; -0.908 and - 0.982 for the total carbohydrates %; total soluble sugars % ; reduced sugars % ; nonreduced sugars % and crude protein,respectively.All the tested phytochemical components correlated significantly andpositively with the population density of pupae.In plant fruiting stage:The observed relationship between the larval stage of L. trifolii and the total carbohydrates % was insignificantly positive; the same result was observed in the case of total soluble sugars % and the crude protein.This relationship was significantly positive with the reduced sugars %. The relation between larval density and nonreduced sugars % was insignificantly negative. For the pupal stage,

the total carbohydrates % and crude protein correlated positively without any significance, this relation was insignificant and negative with total soluble sugars %, and it was significantly negative with the nonreduced sugars %, Finally the reduced sugars %. correlated with the pupal stage density significantly and positively where ” r ” values were 0.554; 0.052; 0.998; 0.655 and 0.545 with the total carbohydretes167%; total soluble sugars %; reduced sugars %; nonreduced sugars% and crude protein, respectively.b. The melon leaf miner Liriomyza bryoniaeMines density in leaflets:In 1995 season, mean number of mines /10 leaflets ranged between 0.3 to 2.8 mines. With two peaks the first one 2.0 mines / 10 leaflets at the 11th of August and the second 2.8 mines at 10th of September, with overall mean 1.3 mines /10 leaflets. In 1996 season, the mean number of mines / 10 leaflets ranged between 0.5 to 2.8 mines, with one peak 2.8 mines / 10 leaflets at the 4thof September, with overall mean of 1.4 mines / 10 leaflets.Larval densityThe mean number of larvae / 10 leaflets in 1995 ranged between 0.0 to 2.0 larvae recording two peaks, the first one 1.3 larvae at the 11th of August and the second 1.3 larva at the 10th of September, with overall mean 0.8 larva / 10 leaflet during the season. In 1996 season, the larval population ranged between 0.3 to 2.0 larvae / 10 leaflets with one peak (2.0 larvae) at the 4th of September1996, with overall mean 0.9 larva / 10 leaflets.Pupal density:In 1995 pupal, population ranged between 0.0 to 1.6 pupae / 10 leaflets recording two peaks the first one was 0.8 pupa at the ng of August and the second 1.6 pupae at 10’h of September, with overall mean 0.49 pupae / 10 leaflets. In 1996 season, pupal population ranged between 0.0 to 1.3 pupae / 10 leaflets recording two peaks the first one 1.3 pupa at the 25th of August and the second 1.00 pupa at the 14th of September 1996, with overall mean 0.54 pupae/10 leaflets.168 Effect of some weather factors on the population density of larval andpupal stages of Liriomyza bryoniae:In 1995 season, larval population density correlated insignificantly and negatively with maximum temperature; the minimum temperature and the relative humidity where the ” r ” values recorded (- 0.148); (-0.255) and (-0.368) respectively. On the other hand, pupal density correlated with the three weather factors insignificantly and positively where ” r ” values were (0.212); (0.063) and (0.060) for the maximum; minimum and relative humidity,respectively.In 1996 season, larval population density correlated with maximum temperature insignificantly and negatively but it correlated positively with the minimum temp. and relative humidity where ” r” values were (-0.160); (0.499) and (0.204), respectively. But the pupal density correlated with the maximum temperature and relative humidity positively and negatively with the minimum temperature without any significance where ” r ” values were (0.534); (0.204)and (- 0.266) respectively.The total explained variances % of the three weather factors indicated that they affected stronger on the larval and pupal population, in 1996 than in 1995 season, where the evaluated percentages reached 56.7 % for larvae and32.04 % for pupae in 1996 season.Relationship between phytochemical content and population density oflarval and pupal stages of cucurbit leaf miner.In plant vegetative stage:The population density of larvae of L. bryoniae correlated significantly and negatively with total carbohydrates % and reduced sugars %, but that correlation was significantly positive with crude protein and insignificantly positive with total soluble sugars % and nonreduced sugars % where ” r ” values were (-0.945); (-0. 655); (0.619); (0.189) and (0.232) respectively. On the other hand, pupal density correlated significantly and positively with totalcarbohydrates % and reduced sugars %, but significantly negatively with crude protein and nonreduced sugars % where ” r ” values were (0.866); (0.500); (-0.756) and (- 0.044), respectively.In plant flowering stage :The mean number of larvae / 10 leaflets correlated in this period of plant lifeinsignificantly and negatively with the total carbohydrates % where” r ” was(- 0.545), but siginificantly with total soluble sugars % ; the nonreduced sugars % and crude protein where ” r ” values were (-0.069) ; (-0.999) and (-0.982) , respectively . In the case of pupal population, the correlation was significantly positive with total carbohydrates % ; total soluble sugars % ; reduced sugars %and crude protein where ” r ” values were (0.971) ; (0.910) ; (0.945) and(0.500) , respectively . That correlation was insignificantly positive withnonreduced sugars % (” r ” = 0.277) .In plant fruiting stage :The larval mean number / 10 leaflets correlated significantly andnegatively with total carbohydrates % ; reduced sugars % and crude protein where ” r” values were (-0.954) ; (-0.808) and (-0.954) , respectively . but correlated significantly in positive way with total soluble sugars % and nonreduced sugars%, ” r ” values were (0.676) and (0.986) , respectively . Correlation between the mean number of pupal population and the total

carbohydrates % ;total soluble sugars % and crude protein were insignificantpositively where ” r ” values were (0.434) ; (0.075) and (0.434), respectively. That correlation was significantly positive with reduced sugars % (” r 0.983)and it was in contrast with nonreduced sugars % (insignificantly negative,” r ”-0.553) .C. The bean fly stem miner Ophiomyia phaseoliMines density in stems :In 1995, the bean fly mines number / 10 plants ranged between 0.0 to 8.0 mines / 10 stems , one peak was recorded (8.0 mines / 10 stems) at the endof September , with overall mean 4.7 mines / 10 stems . In 1996 season, the mines number was similar as in the former year ranging between 0.0 to 8.0 mines / 10 stems , two peaks were observed , the first one (3.3 mines /10 stems) at the mid of August and the second (8.0 mines /10 stems) at the 24th of September 1996 , with overall mean 2.93 mines / 10 stems .Larval stageThe mean number of larval density / 10 stems of mung bean plants in 1995 season ranged between 0.0 to 4.8 larvae recording two peaks, the first one 4.8 larvae in 11th of August and the second 4.3 larvae in the 20th of September 1995 , giving overall mean of 2.96 larvae / 10 stems . In 1996, larval population density was lower than that observed in 1995 season ranging between 0.0 to 2.6 larvae / 10 stems , recording two peaks, the first one 2 larvae at the mid. of August and the second 2.6 larvae at the 4th of September 1996 ,with overall larval mean 1.31 larvae / 10 stems .Pupal stage :Pupal population density in 1995 season ranged between 0.0 to 4.0 pupa / 10 stems recording the highest number (peak)of 4.0 pupae / 10 stems at the end of September , with overall mean 1.43 pupae / 10 stems .In 1996 season, the number of pupae / 10 stems ranged between 0.. and 4.2 pupae / 10 stems . The highest number (peak) was 4.2 pupae / 10 stems at 4th of October 1996, with overall mean 1.04 pupae .Effect of some weather factors on larval and pupal stages of Ophiomyiaphaseoli .Results of 1995 season shows insignificant positive correlation between larval density and maximum & minimum temperatures where ” r ” recorded (0.168) and (0.077) , respectively but that correlation was significantly positive (r = 0.716) with the relatively humidity . Pupal population density correlated significantly and positive with relative humidity where r was 0.729and insignificantly and positively with maximum and minimum temperature where ” r ” values were (0.055) and (0.333), respectively .In 1996 season, larval population density correlated significantly positive with the relative humidity and minimum temperature where ” r ” values were (0.767) and (0.729) , respectively . But that correlation was insignificantly positive with maximum temperature (” r ” value 0.439) . Pupal population density correlated insignificantly and positively with max. temp. C’ r ” = 0.022) and significantly positively with minimum and relative humidity were C’ r ” values were 0.833 and 0.695 , respectively) .The total explained variances % of three weather factors for larval and pupal populations were higher in 1996 than 1995 season , where the percentages were 27.34 % for larvae and 41.89 % for pupae in 1996 season compared to 25.16% for larvae and 34.00 for pupae in 1995 season.The cowpea pod borer Etiella zinckenellaa. Infestation in green pods :In 1995 season, the mean number of the infested pods ranged between 24.3 to 54.5 green pods / 100 pods recording the highest infested number 54.0 green pods / 100 pods at the end of September 1995 , with overall mean 35.5 green pods / 100 pods. The larval population density ranged between 28.0 to 74.0 larvae / 100 green pods during 1995 season .In 1996 season, the mean number of infested green pods ranged between 45.5 to 85.5 green pods / 100 pods , the highest number recorded 85.5 infested green pods / 100 pods at the 4th of October 1996 , with overall mean 67.5 infested green pods / 100 pods . Larval population density ranged between 52.0 to 119.2 larvae /100 green pods , recording the highest number of larvae 119.2 larvae at the 4th of October 1996 , with overall mean 87.0 larvae / 100 green pods .b. Infestation in dried pods :The percentage of the infested dried pods in 1996 season was higherthan in 1995 season , recording 61.1 % and 52.8 % , respectively . These results indicated that the cowpea pod borer may be considered an important insect pest on mung bean in Egypt .172 PCEvaluation of some treatments to control the cotton and tomato white flyBemisia tabaci (Genn.) on mung bean plants :An experiment was carried out under field condition to evalute the efficacy of six treatments against B. tabaci nymphal stage by three spray applications at the dates 4th ; 14th and 24th of September 1996 , the control(check) was sprayed with water only .The following treatments were used :1-Actellic 50 % E. C. at rate 375 cm3./100 liters of water .2-Mineral oil (Super masrona) at rate 1.5 liters / 100 liters water .3-Jojoba oil (plant oil) at rate 1.0 liter / 100 liters water .4-Applaud (I G R) at rate 150 cm3. / 100 liters water .5-M- Pede (potassium soap) at rate 2

liters / 100 liters water .6-Zanzalakht (aqueous extract) at rate 5 Kg. / 100 liters water .Generally in respect to the reduction in nymphal population of white fly the previous measures can be arranged descendingly as following depending onHenderson and Tilton equation (1955) :FirstInitial mortality Residual effect1-Actellic 50 % E. C.0.58379.962-Mineral oil0.83890.77713-Jojoba oil0.8710.72894-Applaud0.697870.77 ')/05-M- pede22.080.5536-Zanzalakht0.64950.4958173 k b. The mean number of three spraysInitial mortalityResidual effect1-Actellic 50 % E. C.0.81990.82312-Mineral oil0.79830.79813-Jojoba oil0.75180.74644-Applaud0.69390.72035-M-pede0.23530.52586-Zanzalakht63 .48%0.4963According to the obtained reductions, the tested treatments could be arranged descendingly to the following groups :1-Treatments had high efficiency in reduction . (Actellic 50 % and mineral oil) more than 75 % .2-Treatments had moderate efficiency in reduction . (Jojoba oil and Applaud) from 65 % to 75 .3-Treatments had lower efficiency in reduction . (M- pede and Zanzallcht) less than 65 .