Studies on management of resistance to some insecticides in the pink sohworm on cotton in egypt

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Studies on management of resistances to some insecticides in the pink rollowrm on cotton in egypt the first part of this study indicates development of monitoring techinique for six insecticides resistance in three field populations of the pink bollworm mothes. the second part included management of bollworms in cotton field in menoufia governorate by using three programs for the pest bollworms control.while , the third , was conducted for detection and biochemical characterization of insecticide resistance mechanism in the pink bollworm. part i development of monitoring techniques for insecticide resistance in field papulations of the pink bollworm these trials were corried out using three techniques to study bioassay on three groups of insecticides i.e. profenofos & chlorpyrifos (organophosphates), carbaryl & thiodicarb (carbamates) and , esfenvalerate 5 ec & esfenvalerate 20ec (pyrithroids) on cotton field colonies from three governorates namely ; (menoufia, kafr el-sheikh, and beni-suef).1.1 topical application technique1.1.1 organophosphate resistant monitorim, data of resistant monitoring in 1998 seoson for profenofos showed that, at ld50 level, kafr ei-sheilsh strain exhibited somewhat studies on management of resistances to some insecticides in the pink bollowrm on cotton in egypt resistance to profenofos by 4.43—times, in comparison with laboratory (reference) strain. also, menoufia and beni- suef colonies seemed to be more tolerant to this compound by 3.54—and 3.02—times, respectively, than laboratory strain.in 1999- late season, the monitoring data for resistance to profenofos in selected field population of pink bollworm from different locations showed an obvious increase in resistant levels in comparison with those reported during 1998 seaason. ld50 values of profenofos on pink bollworm moths from selected field colony: beni-suef (6.78 pig/ moth), menoufia (3.19 pig / moth) , and kafr el—sheikh (2.74gg/ moth) highly increased than that on laboratory (reference) strain (0.39 pig/ moth), indicating resistant ratio by 17.38—, 8.18—, and 7.03— times, respectively.dose-mortality data and resistant ratios (rr) for chlorpyrifos against 1998 and 1999 field pink bollworm. the data of 1998 monitoring showed that all selected strains were more tolerant to chlorpyrifos than profenofos. at ld50 level, resistant ratios (rr) to chlorpyrifos in the selected field collections of pink bollwrom were as low as those observed to profenofos. resistant ratio for kafr el-sheilkh was 4.80— times followed by 3.67—and 1.27—times in menoufia and beni-suef colonies, respectively. monitoring data of 1999- late season indicated that ld50 value in laboratory strain (0.829 pig / moth) was much lower than those observed in field colonies from kafr el—sheikh (9.89gg/ moth), menoufia (7.97 tg / moth) and beni-suef (4.23 pig / moth). consequently, resistant ratios (rr) determined on basis of ld50 level were greater in kafr el-sheikh colony (11.93—times) as compared to menoufia (9.61—times) or beni-suef (5.10—times). studies on management of resistances to some insecticides in the pink bollowrm on cotton in egypt1.1.2 carbamate resistant monitorinrrin 1998, the ld50 values of thiodicarb for selected field colonies(menoufia, kafr el-sheikh and beni- suef) were slightly increased (7.80, 12.13, and 15.86 pg / moth), respectively as compared to that of laboratory strain (6.33 pg/ moth) . consequently, resistant ratios (rr) to thiodicarb for these selected field populations (menoufia, kafr el—sheikh and beni-suet) were rather low (1.23—, 1.91— and 2.51—times).data of resistant montoring to thiodicarb in 1999— late season reported some

increases in resistant levels for this compound, at ld50 level, in selected field populations of menoufia (2.98—times), kafr el—sheikh(4.37—times) and beni-suef (5.56—times). for toxicity data of carbaryl against pink bollworm moths in 1998 season, it appears that all selected strains were more susceptible to this compound as compared to the other carbamate insecticide tested, thiodicarb indicating rather low values of ld50 and ld90. again , beni-suef colony seemed to be more resistant than the other field collections from kafr el—sheikh and menoufia, at ld50 level indicating resistant ratios by 6.83—, 5.10— and 3.30— times, relative to the laboratory reference strain.data of carbaryl toxicity and resistant ratios in pink bollworm moths from different field collections in 1999 season, the toxicity data showed an obvious increase in ld50s (ranged form 6.36 to 16.30 pg/ moth) and ld90s (ranged form 18.05 to 44.84 p.g/ moth) for carbaryl in the three pink bollworm field collections in comparison with that in the laboratory strain (0.40 and 3.33 pg/ moth, respectively). data of resistant ratios for carbaryl in the pink bollwom field collections in 1999 season showed a remarkable increase as compared to that reported during 1998 season. at ld50 level, beni-suef colony, again, showed the highest level of resistance to carbaryl (rr= 40.75—times) followed by kafr el—sheikh (r12--- 22.63—times) and menoufia studies on management of resistances to some insecticides in the pink bollowrm on cotton in egypt(rr=15.90— times) and indicating the same trend as that observed during resistant monitoring in 1998 season.1.1.3 pyrethroid resistant monitorinaat ld50 level, resistant ratios for esfenvalerate 5 % (somi-alpha®) in the selected field collections of pink bollworm moths, in 1998 season were as low as 1.41—times (menoufia strain), 1.41— times (kafr el-sheikh strain), and 4.62—times (beni-suef colony), relative to the laboratory (reference) strain. at ld50, resistant levels reported for esfenvalerate 5 % in the selected field locations, in 1999 season seemed to follow the same trend as those reported in the 1998 season. beni-suef colony was the highest tolerant strain to this compound indicating 9.25—times, greater than that of the laboratory strain, followed by menoufia (4.35—times) and kafr el-sheilkh (3.74—times).the toxicity data and resistant ratios of esfenvalerate 20 %. (sumi-gold®) appeared to be similar to that observed for the other formulation of esfenvalerate tested (sumi-alfa, 5 %.ec). data of resistant monitoring to this compund in the 1998 growing cotton season showed that kafr el—sheikh strain had somewhat resistance level by 3.78—fold greater than that of the laboratory strain. where the other strains, beni-suef and menoufia had slight increase in ld50 values, as compared to that of laboratory strain, indicating resistant ratios of 2.66 — and 1.31—times, respectively. data of resistant monitoring for esfenvalerate (sumi-gold, 20 %ec) in selected field coloniesof pink bollworm, during the 1999 growing cotton season indicated that an increase of resistance level, at ld50 level, for this compound was particularly marked in kafr el-sheikh strain (11.55—fold) in comparison with the other selected strains of beni-suef (4.61—fold) and menoufia (1.90—fold)summary studies on management of resistances to some insecticides in the pink bollowrm on cotton in egypt1.2 glass vial contact film technique: 1.2.1 organophosphate resistant monitoring.in 1998 growing cotton season toxicity data of profenofos indicating resistant ratio in kafr el-sheikh colony 6.37–times. however, the other colonies tested, i.e. menoufia and beni-suef, had low levels of resistance by 3.90–and 1.70 –times greater than the laboratory strain. in 1999 season toxicity data of profenofos indicating resistant ratios of 12.25–and 8.61–times in kafr el-sheikh and menoufia colonys respectively as compared to that in the laboratory strain. also, beni-suef colony had somewhat increase; this was 3.8l–fold as compared to that of the laboratory strain. for toxicity data of chlorpyrifos in 1998 season, resistant ratios, at lcso level were 5.38 – (kafr el–sheikh), 4.27– (menoufia) and 1.72– (beni- suef) times greater that the laboratory strain. toxicity and resistant monitoring data for chlorpyrifos in the 1999 season indicated resistant ratios of 27.05– (kafr el–sheikh), 20.73-(menoufia), and 9.38– (beni- suet) times, as compared to the laboratory strain.1.2.2 carbamate resistant monitoringin 1998, at lcso level , resistant ratios for thiodicarb were 6.01–, 2.93– and 1.75–times in beni- suef, kafr el–sheikh , and menoufia colonys, respectively, as compared to the laboratory strain. in 1999 growing season the determined toxicity data indicated that loss of susceptibility was markedly observed to this compound in all three selected field populations of pink bollworm as compared to that reported in 1998 season. at lc50 level, resistant ratios in 1999 season were 27.70– (beni-suef), 22.15– (kafr el–sheikh), and 14.65-(menoufia) times greater than that of the laboratory strain studies on management of resistances to some insecticides

in the .’ink bollowrm on cotton in egypttoxicity data for carbaryl showed high levels of resistance in the field coloniesof pink bollworm form selected areas during two successive growing cotton seasons (1998 and 1999). in 1998 values of resistant ratios at lc50 level were much higher 24.15— (beni-suet), 15.38— (kafr el—sheikh), and 8.38— (menoufia) times greater than the laboratory strain. in 1999 values of resistance at lcso level indicating high levels of resistance to carbaryl by 77.47—, 59.51—, and 42.31—times in beni-suef, kafr el—sheikh, and menoufia colonies, respectively, greater than the laboratory strain.1.2.3 pyrethroid resistant monitorinj’in 1998 at lc50 level, resistant ratios for esfenvalerate (5 %ec) indicates 11.55—,6.14—,and 3.53—times, for beni-suef menoufia, and kafr el—sheikh colonies, respectively .the toxicity data for esfenvalerate (5 % ec) reported in 1999 season showed a remarkable increase in resistant ratios at lc50 level were 28.0—, 16.5—, and 9.18—times in beni-suef, monoufia, and kafr el—sheikh colonies, respectively, greater than the laboratory strain.data of 1998 season for esfenvalerate (20 %ec) indicated that resistant ratios, at lc50 level, was much lower, than that to esfenvalerate (5 %ec), particularly in menoufia (rr= 1.62—), and beni-suef (rr=2.51—) strains. toxicity data, in 1999 season, showed a remarkable increase in resistant ratios at lc50 level. this indicated of 18.18—times (kafr el—sheikh strain), 11.34—times (beni-suef colony), and 5.51—times (menoufia colony). studies on management of resistances to some insecticides in the pink bollowrm on cotton in at lc50, it was obvious that the selected pyrethroid insecticide, esfenvalerate (either 5 % or 20 % ec), and the carbamate, carbaryl were highly effective (lc50s = 0.11, 0.22, and 0.16 mg a .i./ glass) against the moths in comparison with the other insecticides tested. thiodicarb (carbamate group) seemed to be the least effective compound (lc50 = 0.85 mg/ glass) followed by the organophosphors insecticide; i.e. profenofos (0.46mg/ glass) and chlorpyrifos (0.33 mg / glass). based on estimates of the lc99 of the tested insecticides in susceptible — laboratory strain, we selected 2.2, 1.2, 5.9, 6.3, 0.81, and 2.5mg a.i./glass for profenofos, chlorpyrifos, thiodicarb, carbaryl, esfenvalerate (5 % ec), and esfenvalerate (20 % ec), respectively, for use as a diagnostic concentration. these concentrations consistently killed — 99% of the susceptible- laboratory strain of pink bollworm moths, in contrast with the resistant field coloniestested in the early growing season of 2000. it seems, generally, that moths of pink bollworm collected from menoufia field were more resistant to most insecticides tested, except profenofos and esfenvalerate 20 ec, as compared to those collected from either kafr el—sheikh or beni-suef fields. resistant percentage estimated for chlorpyrifos in field strain from menoufia fields was 12.42 % followed by those from kafr el—sheikh (9.09%)and beni-suef fields(2.32 %). also, similar trend was observed for thiodicarb, at which resistant percentage estimated in the field strain from menoufia was 49.5 % followed by those from kafr el—sheikh (39.4 %) and beni-suef (29.3 %). however, the field strain from beni-suef exhibited resistant percentage to profenofos (19.2 %) studies on management of resistances to some insecticides in the pink bollownn on cotton in egypt more than that estimated in both strains from menoufia (9.10 %) and kafr el—sheikh (2.32 %). indicating that resistant levels in pink bollworm moths to certain insecticides could be varied in different areas. in comparison with resistant levels estimated in samples collected in the early season (may 2000), the data of late season (sept. 2000) showed, generally, high levels of resistance in all samples from three field collections. again, moths collected form menoufia fields seemed to be more resistant to most insecticides tested than those collected from other field collections , i.e. kafr el—sheikh and beni-suef. where resistant percentages estimated were 19.02%, 26.0 %, 29.03 %, and 52.08 % for chlorpyrifos, esfenvalerate 20 ec, esfenvalerate 5 ec, and thiodicarb, respectively.also, field strain from kafr el—sheikh showed high levels of resistance to all insecticides tested in the late season, especially for chlorpyrifos (15.86%resistance), thiodicarb (49.5 % resistance) and esfenvalerate 5 ec (29.3% resistance). for beni-suef colony, the resistant percentages to the insecticides chlorpyrifos (9.09 %), thiodicarb (39.4 %), esfenvalerate 20 ec and esfenvalerate 5 ec (12.83 %) were much lower than those estimated for the other field coloniestested. howerver resistance level to profenofos (29.3 %) in beni-suef colony was higher than that estimated in both menoufia (19.02 %) and kafr el—sheikh (5.76 %).studies on management of resistances to some insecticides in the pink bollowrm on cotton in egyptpart ii three different programs were evaluated for controlling of bollworms on cotton in 1997 and 1998 seasons in menoufia governorate. the first program depends on using bollworms lures only; the second one

depends on using pheromone integrated with insecticides (profenofos + esfenvalerate 5 % ec + thiodicarb), whereas the third one depended on using b.t. (basillus thuringiensis) in rotation with insecticides (chlorfluazuron 5 %ec + profenofos + esfenvalerate 5 ec + thiodicarb). the compartive evaluation between these programs was based on the percentage infestation of cotton green bolls with pink and spiny bollworms larvae, reduction in infestation levels, estimate of percentage yield losses, mean seed cotton boll weight and seed cotton yield.2.1 boll infestation 2.1.1 1997 seasonin general, the percentage of bollworm larvae infestation in all treated field were lower during the first four inspections (from 7 july to 25 july). mean percentage of bollworms infestation with bollwrom larvae during the first four inspection were 1.0 % (1 1/3 field rate of pheromone alone), 2.75 % (2/3field rate of pheromone + three insecticides), and 4.75% (agrin + four insecticides), whereas, 9.0% (in the untreated (contral) fields studies on management of resistances to some insecticides in the pink bollowrm on cotton in egypt during the last six inspections (form 31 july to 30 august) all the three programs conducted for bollworms control seemed to be effective in reducing the rate of infestation with bollworm larval, (6.5 % infestation) in fields treated with pheromone + three insecticides, (10 % infestation) in fields which were subjected to b.t. (agrin®) + four insecticides, and (12 % infestation) in fields which received pheromone alone, in comparison with mean infestation percent observed in the untreated fields (28.83 % infestation).in conclusion it was obvious that based on overall mean infestations and reduction percentages, the effectiveness of the three different programs implemented for bollworms control could be in descending order as follows : 2/3 dose of pheromone integrated with insecticidal application (program ii) > 1 1/3 dose of pheromone alone (program i) > b.t. with four insecticidal applications (program iii). the corresponding mean percentages of boll infestation were 5.00, 7.60 and 7.90 %; respectively, as compared to infestation percent in the untreated field (20.9 %), indicating reduction percentages of 69.38, 70.65 and 55.42 % respectively.2.1.2 1998 season infestation levels of bollworm larvae in all treated field were lowre during the first four inspection (from 7 july to 25 july). mean percentage of bollworms infestation with bollworm larvae during the first four inspection were 1.0 % (1 1/3 field rate of pheromone alone, 1.75 % (2/3 field rate of pheromone + three insecticides), and 3.75 % (agrin + four insecticides), whereas, 10 % (in the untreated fields). during the last six inspection (from july to 30 august) all the three programs conducted for bollworms control seemed to be effective in reducing the rate of infestation with bollworm larval, (9.33studies on management of resistances to some insecticides in the pink bollowrm on cotton in l: pt% infestation) in field treated with pheromone + three insecticides), 12.33 %infestation) in fields which were subjected to b.t. (agrin’ + four insecticedes, and (13.5 % ifestation) in field which received pheromone alone, in comparison with mean infestation percent observed in the untreated fields (34.17 % infestation.in conclusion it was obvious that, based on overall mean infestations and reduction percentages, the effectiveness of the three different programs implemented for bollworms control could be in descending order as follows: 2/3 dose of pheromone integrated with insecticidal application > 1 1/3 dose of pheromone alone > b.t. formulation (agrin) with four insecticidal applications. the corresponding mean percentages of boll infestation were 7.0, 8.5 and 8.90 %; respectively, as compared to infestation percent in the untreated field (24.5 %), indicating reduction percentages of 77.61, 72.85 and 61.34 % respectively. 2.in 1997 the average weight of seed cotton collected from fields subjected to those programs were 3.02g/boll (program i) pheromone only, 2.60g/ boll (program ii) 2/3 field rate of pheromone + three insecticidal, and 2.50g/boll (program iii) agrin4’ in rotation with four insecticides, as compared to 2.80w boll for seed cotton boll form untreated fields .in 1998 mean weight values of seed cotton bolls recorded 3.0g (program i), 2.6g/boll (program ii), and 2.55 g/ boll (program iii) as compared to 2.8g/boll in bolls collected from untreated fields.2-3 average yield and yield lossthe estimates of yield in 1997 cotton season were 7.22kentar/feddan (program i), 6.80 kentar/feddan (program h), andstudies on management of resistances to some insecticides in the pink bollowrm on cotton in egypt6.24 kentar/feddan (program iii) where average yield estimated in the untreated fields were (4.0 kentar/feddan),in 1998 cotton season the estimates of yield was 6.26 kentar/feedan (program i), 5.lkentar/feddan (program h), and 4.5 kentar/feddan (program iii). all treatments exhibited somewhat increase in cotton yield in comparison with that form untreatd fields (3.8 kentar/feddan). mean percent of yield loss estimated in 1997 cotton season was 13.5 % (program ii), 15.17 % (program i),

and 16 % (program iii) as compared to less percent in yield for the untreated field (39.22 %) . also in 1998 cotton season the mean percent of yield loss was 16.2 % (program ii), 16.3 % (program i), and 17.6 % (program iii). all treatments exhibited somextent decrease in mean percent of yield loss in comparison with that untreated (check)fields (43.6 %).studies on management of resistances to some insecticides in the pink bollowrm on cotton in egypt part iii esterases activity and associated resistance to insecticides in the pink bollworm 3.1 selection for profenofos resistancedata for the f0 generation (parents) were used as reference points to follow the progression of resistance. selection for profenofos resistance at the adult stage, at about lc50, resulted in significantly higher lc50 values as selection progressed reaching 10.07— fold increase in resistance of adults by the f17 generation. the resistance of the selected strain was 29.22—fold higher than the susceptible laboratory strain. the progression of resistance in the adult stage was gradual during most of the selection process. by the f17 generation, the resistant ratio increased about 2.8—fold relative to f7 generation.3.2 esterases activity3.2.1 profenofos - selected strainit was clear that esterase activity was elevated gradually in profenofos - resistant moths through 17 successive generations selected with profenofos. the activity of estrases measured in the parent moths (f0) was 2.35—fold higher than that found in the susceptible, and gradually. elevated to 3.22—, 4.67—, and 5.26—fold, in moths from f7, f12, and fi7, respectively. it seems that resistance to profenofos in pink bollworm moths was obviously correlated with elevation to esterases activity towards a - naphthyl acetate.studies on management of resistances to some insecticides in the pink bollownn on cotton in egypt 3.2.2 field coloniesresults of esterase activity in each of laboratory—susceptible strain and field collections of pink bollworm moths was significantly higher than that measured from laboratory — susceptible .in 1998 assays, the highest esterase activities were measured in field colonies. menoufia and beni-suef and were 2.75— and 2.25—fold higher than those of laboratory—susceptible moths. esterase activities also were elevated in both field colony, i.e. menoufia and beni-suef, collected in 1999 season indicating 3.29—and 3.62—fold higher than those of susceptible moths.3.2.3 inheritance of esterases activitythe data show that esterases activities measured in the two f1 crosses, i.e. ysx d’r and rxd s, were 3.22—and 3.54—times, respectively, higher than that measured in the susceptible pink bollworm moths. the results also show that no significant differences in esterases activities were observed between the two reciprocal f1 generations, at which activities measured towards a na were 109.67and 120.46 1.t mol a —naphthol / min / mg protein for f1 hybrids, y s x r and yr x ds, respectively.3.3 esterase native polyacrylamide gel electro- phoresis (page)only three esterase bands, with rf values of 0.149 , 0.225 —and 0.383, were detected in the susceptible strain whereas the other bands detected in field —or —resistant—strains were completely absent. comparisons between the esterases profile in the 1999- collected fieldcolonies and profenofos - resistant strain show that specifically bands e3 and e14 (rfs: 0.369 and 0.601, respectively) were visible only in the profenfos—resistant strain and completely absent in all three fieldstudies on management of resistances to some insecticides in the pink bollowrm on cotton in egyptcolonies. in addition, bands e6, e8 and e9 (rf: 0.443, 0.476, and 0.501, respectively) were more intense (volume values: 558.2, 690.1, and 637.7, repectively) in the profenofos - resistant strain than those detected in the field colonies of kafr -elsheikh (band volumes: 164.7, 212.3, and 210.9, respectively) or of beni - suef (band volumes 245.5, 379.4, and 272.5, respectively).only four bands e5, e7, e9 and e10, with rf values of 0.425, 0.457, 0.501 and 0.534 respectively), were detected in the menoufia colony. three additional bands: e6, e8, and e12 (rf values: 0.443, 0.476, and 0.569, respectively) were visible in the other strains of kafr-elsheikh and beni-suef, whereas were completely absent in the menoufia colony.