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# Effects of Individual Selection Based on Cocoon Weight on Performance of 32, 104 and 110 Silkworm Parental Lines During Three Successive Generations

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**Abstract:** Pure parental three lines of Iran silkworm has been individual recording and forty best male and female individual selected in each of these parental three lines. Then these lines has fed according conditions of lines increasing system of Line lines, parent-parent and silkworm mother and during three successive generations, silkworm egg each of three lines 32, 104 and 110 generated without performance of new selection. For each of line formed two groups (random parents group and selective parents group) in each of line compared each other performance of two groups and analyzed obtained result of individual selection system of parental lines on the performance of these lines. In this project used of present on records in Iran silkworm research center that are relative to actions and performances of this system and had taken 2000-2003 during successive for years. In this study, tools of record and data collection were standard form of economical characters recording in the silkworm and Excel software and for statistical analysis is used method of Generalized Lined Models (GLM), SAS software edition 6.12. Studied characteristics were generation characteristics, pupae characteristics, larval duration and cocoon weight. Pupae vitality percentage (middle cocoon) in three lines 32, 104 and 110 was for selective groups 85.091, 91.001, 88.012% and for random groups 91.258, 82.450, 88.107%, respectively. Produced in cocoon number in three lines 32, 104 and 110 was for selective groups 213.63, 263.42, 282.42 and for random groups 247.96, 240.46, 243.91, respectively. Total best cocoon weight in three lines 32, 104 and 110 was for selective groups 372.77, 324.80, 295.86 g and for random groups 308.00, 298.51, 236.96 g, respectively. Hatched larvae number in three lines 32, 104 and 110 was for selective groups 588.92, 500.33, 561.83 and for random groups 520.25, 503.54, 489.74, respectively. Un-hatched egg number in three lines 32, 104 and 110 was for selective groups 18.958, 20.750, 7.458 and for random groups 11.958, 25.083, 13.826, respectively. Total produced egg number in three line 32, 104 and 110 was for selective group 617.17, 532.50, 582.46 and for random groups 551.46, 541.38, 522.22, respectively. These characters had included more significant in relation to other studied characters in this study and respond positive to selection. With due, attention to in each line there is significant difference in response to selection so the selection can cause to increase economical characters performance in silkworm.

**Key words:** Silkworm, selection, response to selection, cocoon economical characters, heritability, Iran

## INTRODUCTION

The aim of silkworm breed improvement is genius development of characters for increase of silkworm feeders advantage and other parts of Seri-cultural industry consequently. In sericulture is important numerous characters and importance of these characters in different parts of this industry is different (Singh *et al*., 1998).

Germplasm of wild silkworm has more changed unwished via selection during successive generations and in the way of become domestic because of changes, germplasm has achieved to present variety in modern species for purposes of existing characters. At present for silkworm has recorded more than four hundred and fifty morphological, physiological and biochemical specification that in the middle of those has specified the place of three hundred specifications on the 27 goups of chromosomes (Cristina *et al*., 2007).

Now a days simple methods for silkworm breed improvement are common in the world with high sericulture potential areas. Now in Iran silkworm research center placed in Rasht has equipped to genius bank that can say, this is incomparable in region level and few part

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of genius existing resources in the world level that act in the field of silkworm breed improvement (Seidavi and Bizhannia, 2008).

Govindan *et al*. (1991) and Seidavi *et al*. (2004) reported that both cocoon weight characters and cocoon shell weight are effective increasing energy and overcome and genius variance of increase is more than overcome variance. Heritability of cocoon weight characters has reported between 0.03-0.49%, cocoon shell weight between 0.14-0.60% and cocoon shell percentage between 0.15-0.9%. More researcher among them Satenahalli *et al*. (1990), Singh *et al*. (1998) and Seidavi *et al*. (2004) emphasized correlation assessment and heritability of silkworm economical characters to increase selection efficiency and do best silkworm egg produce system and fresh cocoon. At the present in all of line lines of silkworm line increasing and protection centers take particular care to above characters and accomplish based on them choice of line groups and parents. There is a contradictory report positive to negative phenotype correlation between cocoon characters with laying eggs specifications and to resist diseases in different breeds of silkworm (Datta *et al*., 2001; Seidavi *et al*., 2004). Therefore, affect of parents selection on the basis of cocoon weight on generation specifications and offspring resistance of these lines must study separately in any country and with attention to administrable system and regional conditions of the same place and for lines of same countries as much as on the basis of that take decision proportionate to system conditions (Seidavi *et al*., 2004). Rangaiah *et al*. (1995), Bhargava *et al*. (1995) and Jayaswal *et al*. (2000) also reported heritability of cocoon weight and cocoon shell weight.

Breeding system of Iran silkworm parental lines is based on using standard conditions of breeding and then visual selection of persons based on external phenotype. In this system don't accomplish no recording and selection based on record whatsoever. It is expectation that recording of pure parental lines and selection of best individuals based on highest individual records. Cause to increase offspring function of future generations and produce mixed of them. Therefore, the aim of this research was study possibility of silkworm lines production increasing with the choice of best individual as paternal lines.

## MATERIALS AND METHODS

This research was accomplished on basis of collected data of Iran Silkworm Research Center (ISRC). Tools of record and collection data was standard forms of silkworm economical recording and Excel software and to statistical analysis used method of Generalized Lined Model (GLM), SAS software edition 6.12. Data recording in Excel extra sheet software, analyzed with SAS software is used t-student test and completely random project and is used Duncan test for comparison of average. In this research, Iran silkworm three pure parental lines became individual recording and in any of parental three lines was selected forty best male and female individual. Then these lines has bred according to conditions of lines increasing system of line lines, parents-parents and silkworm mother and during three successive generations was produced silkworm egg in any of three line 32, 104 and 110. Any of these silkworm eggs has produced and bred in two groups (selective parental lines and random parental lines). Function of these two kinds of lines has compared to each other and result of individual selection system of parental lines analyzed on the function of these lines. Data of this project of existing records was provided in country (Iran) silkworm research center that is related to acts of this system and has collected during four successive years 2000-2003.

Each line in zero generation placed in two selective and random groups and three successive generations were protected and increased as pure Lines. These three lines kinds in two random and selective method has bred in frame of eight repetition and became recording their functions.

Studied characters included alive larvae number, alive pupae number, pupae vitality percentage (total cocoon), pupae vitality percentage (best cocoon), pupae vitality percentage (middle cocoon), produced cocoon number, best cocoon number, middle cocoon number, low cocoon number, double cocoon number, best cocoon percentage, middle cocoon percentage, low cocoon percentage, double cocoon percentage, total best cocoon weight, double cocoon weight, single best cocoon weight, 10000 larvae cocoon weight, larval duration, hatched larvae number, un-hatched eggs number, unfertilized eggs number, hatched eggs percentage, un-hatched eggs percentage, un-fertilized eggs percentage, hatchability percentage and total produced eggs number.

## RESULTS AND DISCUSSION

Response of alive larvae number against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation increase amount of alive larvae number from 255.42 for random population to

286.08 for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant ($p>0.05$).

Response of alive pupae number against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation increase amount of alive pupae number from 235.46 for random population to 255.46 for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant ($p>0.05$). Response of pupae vitality percentage (total cocoon) against individual selection for cocoon weight in base generation.

From obtained results, it is showed that individual selection for cocoon weight in base generation decrease amount of pupae vitality percentage (total cocoon) from 91.906% for random population to 89.528% for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant ($p>0.05$).

Response of pupae vitality percentage (best cocoon) against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation decrease amount of pupae vitality percentage (best cocoon) from 91.339% for random population to 89.528% for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant ($p>0.05$). Response of pupae vitality percentage (middle cocoon) against individual selection for cocoon weight in base generation.

From obtained results, it is showed that individual selection for cocoon weight in base generation decrease amount of pupae vitality percentage (middle cocoon) from 91.258% for random population to 85.091% for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were significant ($p<0.05$). Response of produced cocoon number against individual selection for cocoon weight in base generation.

From obtained results, it is showed that individual selection for cocoon weight in base generation increase amount of produced cocoon number from 247.96 for random population to 283.83 for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were significant ($p<0.05$). Response of best cocoon number against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation increase amount of best cocoon number from 184.17 for random population to 213.63 for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were significant ($p<0.05$).

Response of middle cocoon number against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation increase amount of middle cocoon number from 48.792 for random population to 57.875 for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant ($p>0.05$). Response of low cocoon number against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation increase amount of low cocoon number from 5.333 for random population to 6.000 for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant ($p>0.05$).

Response of double cocoon number against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation decrease amount of double cocoon number from 9.667 for random population to 6.333 for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were significant ($p<0.05$). Response of best cocoon percentage against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation increase amount of best cocoon percentage from 62.101% for random population to 74.130% for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were significant ($p<0.05$).

Response of middle cocoon percentage against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation increase amount of middle cocoon percentage from 12.268% for random population to 19.685% for selected population. Meanwhile, statistical differences of response to selection

in this character between two selected and random populations were significant ($p<0.05$). Response of low cocoon percentage against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation decrease amount of low cocoon percentage from 2.4533% for random population to 2.1138% for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant ($p>0.05$).

Response of double cocoon percentage against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation decrease amount of double cocoon percentage from 3.8771% for random population to 2/2163% for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were significant ($p<0.05$). Response of total best cocoon weight against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation increase amount of total best cocoon weight from 308.00 g for random population to 372.77 g for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were significant ($p<0.05$).

Response of double cocoon weight against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation increase amount of double cocoon weight from 3.29435 g for random population to 3.39658 g for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant ($p>0.05$). Response of single best cocoon weight against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation decrease amount of single best cocoon weight from 2.9439 g for random population to 1.8909 g for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were significant ($p<0.05$). Response of 10000 larvae cocoon weight against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation increase amount of 10000 larvae cocoon weight from 17568.8 g for random population to 17981.4 g for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant ($p>0.05$).

Response of larval duration against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation increase amount of larval duration from 609.9583 h for random population to 610.4583 h for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant ($p>0.05$). Response of hatched larvae number against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation increase amount of hatched larvae number from 520.25 for random population to 588.29 for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were significant ($p<0.05$).

Response of un-hatched eggs number against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation increase amount of un-hatched eggs number from 11.958 for random population to 18.958 for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were significant ($p<0.05$). Response of unfertilized eggs number against individual selection for cocoon weight in base generation.

From obtained results, it is showed that individual selection for cocoon weight in base generation decrease amount of un-fertilized eggs number from 19.250 for random population to 9.917 for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant ($p>0.05$). Response of hatched eggs percentage against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation increase amount of hatched eggs percentage from 2.1725% for random population to 95.4496% for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant ($p>0.05$). Response of un-hatched eggs percentage against individual selection for cocoon weight in base generation.

From obtained results, it is showed that individual selection for cocoon weight in base generation increase amount of un-hatched eggs percentage from 2.1725% for random population to 2.9321% for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant ($p>0.05$). Response of unfertilized eggs percentage against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation decrease amount of unfertilized eggs percentage from 3.4221% for random population to 1.6179% for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant ($p>0.05$). Response of hatchability percentage against individual selection for cocoon weight in base generation.

From obtained results, it is showed that individual selection for cocoon weight in base generation decrease amount of hatchability percentage from 97.7408% for random population to 97.0254% for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant ($p>0.05$). Response of total produced eggs number against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation increase amount of total produced eggs number from 551.46 for random population to 617.17 for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were significant ($p<0.05$).

Response of alive larvae number against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation increase amount of alive larvae number from 247.96 for random population to 271.04 for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant ($p>0.05$). Response of alive pupae number against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation increase amount of alive pupae number from 224.88 for random population to 248.54 for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant ($p>0.05$).

Response of pupae vitality percentage (total cocoon) against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation increase amount of pupae vitality percentage (total cocoon) from 90.792% for random population to 91.616% for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant ($p>0.05$). Response of pupae vitality percentage (best cocoon) against individual selection for cocoon weight in base generation.

From obtained results, it is showed that individual selection for cocoon weight in base generation increase amount of pupae vitality percentage (best cocoon) from 95.242% for random population to 95.875% for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant ($p>0.05$). Response of pupae vitality percentage (middle cocoon) against individual selection for cocoon weight in base generation.

From obtained results, it is showed that individual selection for cocoon weight in base generation increase amount of pupae vitality percentage (middle cocoon) from 82.450% for random population to 91/001% for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were significant ($p<0.05$). Response of produced cocoon number against individual selection for cocoon weight in base generation.

From obtained results, it is showed that individual selection for cocoon weight in base generation increase amount of produced cocoon number from 240.46 for random population to 263.42 for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant ($p>0.05$). Response of best cocoon number against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation increase amount of best cocoon number from 179.17 for random population to 190.38 for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant ($p>0.05$). Response of middle cocoon number against individual selection for cocoon weight in base generation.

From obtained results, it is showed that individual selection for cocoon weight in base generation increase

amount of middle cocoon number from 47.677 for random population to 58/833 for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant ($p>0.05$). Response of low cocoon number against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation decrease amount of low cocoon number from 6.333 for random population to 6.617 for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant ($p>0.05$). Response of double cocoon number against individual selection for cocoon weight in base generation.

From obtained results, it is showed that individual selection for cocoon weight in base generation increase amount of double cocoon number from 7.292 for random population to 8.042 for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant ($p>0.05$).

Response of best cocoon percentage against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation decrease amount of best cocoon percentage from 74.400% for random population to 71.570% for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant ($p>0.05$). Response of middle cocoon percentage against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation decrease amount of middle cocoon percentage from 23.341% for random population to 19.743% for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant ($p>0.05$).

Response of low cocoon percentage against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation decrease amount of low cocoon percentage from 2.5983% for random population to 2.2825% for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant ($p>0.05$). Response of double cocoon percentage against individual selection for cocoon weight in base generation.

From obtained results, it is showed that individual selection for cocoon weight in base generation decrease amount of double cocoon percentage from 2.9550% for random population to 2.8063% for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant ($p>0.05$). Response of total best cocoon weight against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation increase amount of total best cocoon weight from 298.51 g for random population to 324.80 g for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant ($p>0.05$).

Response of double cocoon weight against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation increase amount of double cocoon weight from 3.08264 g for random population to 3.41590 g for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were significant ($p<0.05$). Response of single best cocoon weight against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation increase amount of single best cocoon weight from 1.68842 g for random population to 1.69379 g for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant ($p>0.05$).

Response of 10000 larvae cocoon weight against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation decrease amount of 10000 larvae cocoon weight from 17000.4 g for random population to 16846.6 g for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant ($p>0.05$). Response of larval duration against individual selection for cocoon weight in base generation.

From obtained results, it is showed that individual selection for cocoon weight in base generation decrease amount of larval duration from 612.083 h for random population to 611.167 h for selected population. Meanwhile, statistical differences of response to selection

in this character between two selected and random populations were not significant (p>0.05). Response of hatched larvae number against individual selection for cocoon weight in base generation.

From obtained results, it is showed that individual selection for cocoon weight in base generation decrease amount of hatched larvae number from 503.54 for random population to 500.33 for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant (p>0.05). Response of un-hatched eggs number against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation decrease amount of un-hatched eggs number from 25.083 for random population to 20.750 for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant (p>0.05).

Response of un-fertilized eggs number against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation decrease amount of un-fertilized eggs number from 12.750 for random population to 11.417 for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant (p>0.05). Response of hatched eggs percentage against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation increase amount of hatched eggs percentage from 92.972% for random population to 93.684% for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant (p>0.05).

Response of un-hatched eggs percentage against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation decrease amount of un-hatched eggs percentage from 4.752% for random population to 3.813% for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant (p>0.05). Response of un-fertilized eggs percentage against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation increase amount of un-fertilized eggs percentage from 2.2758% for random population to 2.5008% for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant (p>0.05).

Response of hatchability percentage against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation increase amount of hatchability percentage from 95.130% for random population to 96.070% for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant (p>0.05).

Response of total produced eggs number against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation decrease amount of total produced eggs number from 541.38 for random population to 532.50 for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant (p>0.05).

Response of alive larvae number against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation increase amount of alive larvae number from 260.43 for random population to 297.54 for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant (p>0.05). Response of alive pupae number against individual selection for cocoon weight in base generation.

From obtained results, it is showed that individual selection for cocoon weight in base generation increase amount of alive pupae number from 238.43 for random population to 270.92 for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant (p>0.05). Response of pupae vitality percentage (total cocoon) against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation decrease amount of pupae vitality percentage (total cocoon) from 90.563% for random population to 89.019% for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant (p>0.05).

Response of pupae vitality percentage (best cocoon) against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation decrease amount of pupae vitality percentage (best cocoon) from 94.302% for random population to 93.392% for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant ($p>0.05$).

Response of pupae vitality percentage (middle cocoon) against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation decrease amount of pupae vitality percentage (middle cocoon) from 88.107% for random population to 88.012% for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant ($p>0.05$).

Response of produced cocoon number against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation increase amount of produced cocoon number from 243.91 for random population to 282.42 for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were significant ($p<0.05$). Response of best cocoon number against individual selection for cocoon weight in base generation.

From obtained results, it is showed that individual selection for cocoon weight in base generation increase amount of best cocoon number from 156.48 for random population to 181.21 for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant ($p>0.05$). Response of middle cocoon number against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation increase amount of middle cocoon number from 65.652 for random population to 76.792 for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant ($p>0.05$).

Response of low cocoon number against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation increase amount of low cocoon number from 5.870 for random population to 8.500 for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant ($p>0.05$).

Response of double cocoon number against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation increase amount of double cocoon number from 15.913 for random population to 15.917 for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant ($p>0.05$). Response of best cocoon percentage against individual selection for cocoon weight in base generation.

From obtained results, it is showed that individual selection for cocoon weight in base generation decrease amount of best cocoon percentage from 63.087% for random population to 62.473% for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant ($p>0.05$). Response of middle cocoon percentage against individual selection for cocoon weight in base generation.

From obtained results, it is showed that individual selection for cocoon weight in base generation increase amount of middle cocoon percentage from 27.388% for random population to 27.755% for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant ($p>0.05$). Response of low cocoon percentage against individual selection for cocoon weight in base generation.

From obtained results, it is showed that individual selection for cocoon weight in base generation increase amount of low cocoon percentage from 2.950% for random population to 3.763% for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant ($p>0.05$). Response of double cocoon percentage against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation decrease amount of double cocoon percentage from 6.574% for random population to 6.011% for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant ($p>0.05$).

Response of total best cocoon weight against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation increase amount of total best cocoon weight from 236.96 g for random population to 295.86 g for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were significant ($p<0.05$).

Response of double cocoon weight against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation decrease amount of double cocoon weight from 16.25 g for random population to 3.10 g for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant ($p>0.05$). Response of single best cocoon weight against individual selection for cocoon weight in base generation.

From obtained results, it is showed that individual selection for cocoon weight in base generation increase amount of single best cocoon weight from 1.5410 g for random population to 2.0498 g for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant ($p>0.05$). Response of 10000 larvae cocoon weight against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation decrease amount of 10000 larvae cocoon weight from 17174.3 g for random population to 16770.2 g for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant ($p>0.05$).

Response of larval duration against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation increase amount of larval duration from 598.9783 h for random population to 599.5000 h for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were significant ($p<0.05$). Response of hatched larvae number against individual selection for cocoon weight in base generation.

From obtained results, it is showed that individual selection for cocoon weight in base generation increase amount of hatched larvae number from 489.74 for random population to 561.83 for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were significant ($p<0.05$). Response of un-hatched eggs number against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation decrease amount of un-hatched eggs number from 13.826 for random population to 7.458 for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were significant ($p<0.05$).

Response of un-fertilized eggs number against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation decrease amount of un-fertilized eggs number from 18.652 for random population to 13.167 for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were not significant ($p>0.05$). Response of hatched eggs percentage against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation increase amount of hatched eggs percentage from 93.8226% for random population to 96.5850% for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were significant ($p<0.05$).

Response of un-hatched eggs percentage against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation decrease amount of un-hatched eggs percentage from 2.6022% for random population to 1.2592% for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were significant ($p<0.05$). Response of un-fertilized eggs percentage against individual selection for cocoon weight in base generation.

From obtained results, it is showed that individual selection for cocoon weight in base generation decrease amount of un-fertilized eggs percentage from 3.5752% for random population to 2.1558% for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were significant ($p<0.05$). Response of hatchability percentage against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation increase amount of hatchability percentage from 97.2887% for random population to 98.7167% for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were significant ($p<0.05$).

Response of total produced eggs number against individual selection for cocoon weight in base generation. From obtained results, it is showed that individual selection for cocoon weight in base generation increase amount of total produced eggs number from 522.22 for random population to 582.46 for selected population. Meanwhile, statistical differences of response to selection in this character between two selected and random populations were significant ($p<0.05$).

Being significant the effect of confluence kind, variety, genus, month, generation and repetition for individual characteristics (cocoon weight, cocoon shell weight and cocoon shell percentage) and also variety effect for family characteristics (best cocoon percentage, cocoon number and larval duration) is indicate varieties function imitation of genotype specification and being of phenotype variation produced of different confluences of these varieties (Chattopadhyay *et al*., 1994; Shon and Ramires, 1999).

Pashaki (2010) has reported the difference of heritability between 32, 104 and 110 lines. Also Esfandarani *et al*. (2000) showed the records about heritability difference among of breeds. Seidavi (2010) reported low and positive correlation percentage of cocoon weight and cocoon shell percentage in 104 and 110 lines and negative for 32 line. In other research report negative genius correlation of cocoon weight and cocoon shell percentage (Ghanipoor *et al*., 2006).

The most importance and the first process in project of reformative program is definition and determination of aim selection. This process takes into consideration in often plans of breed improvement but is necessary to do a long-term selection program. In fact, the aims of breed improvement define the exposed direction for genius change in flock and exactly must be on basis of economical facts of breeding system. Determination of breed improvement aim is trying to response to this question that where will we go in this breed improvement plan? (Ponzoni, 1993).

When selection aims select that income, maximize in exchange for each head of domesticated animal. In fact, any of important economical characteristic has economical coefficient. Economical coefficient is relative because this is concern of price. Another aim minimizes the cost in exchange for every production unit. The aims of improvement can determine in this case are characteristics that farmers wants improve them and will emphasize by farmers to those of characters. For example farmers wants increase wool weight. He considers this as a prior aim himself then decreases fiber diagonal and increases this as a second aim and as a third aim of domesticated animal weight (Simm, 1998).

In aim of selection, we consider the characteristics so that include under following specification: the character is heritabilatable, characteristics is definable, this definable can be via measurement or via looking and coding and characteristics may have economical value. In order to determination of selection aim in necessary to specify a breed have highest competence either in characteristic or compound rate of characteristics and then with attention to that characteristic or characteristics determined suitable reformative strategic. Also must exist variety in this characteristic and or compound of characteristics. As long as can achieved to development in this characteristic. On the other hands is necessary that can exist differences between animals for every characteristics and is necessary to be inheritance at least part of these differences (Simm, 1998).

Most importance function of heritability in genius studies is its anticipation function that is confidence rate of phenotype individuals value and individuals characteristics to achieved breeding value. When on the one hands phenotype individuals value is solely measurable directly and on the other hand breeding value is also only factors that can determine the effect of phenotype individual value in future generation. There for, if reformer have an intention to select basis individuals only on the basis of phenotype value, his success is forecast only when that is obvious rate of conformity between phenotype and breeding value namely heritability (Falconer, 1990; Zade and Moghadam, 1997).

Correctness of selection is as a criterion of relation intensity between actual reformative values and their anticipated amount and depends on numerous factors such as heritability of characteristic and assessment method. Kind of assessment depending on that is used itself individual records or in addition to itself individual records is used also relative record, effect on assessment correctness (Shoja and Pirani, 2003; Pashmi, 2009). Being of error in genius parameters estimate and phenotype and difference between actual genius and phenotype parameters of society with estimated amounts effect on genius development. In this case, genius produced development is less expected amount (Kashan, 2000).

If selection intensity is high, it means that we select only best individuals on the basis of selection criterion. If selection criterion is correct criterion, selective individuals will be more better than average for purposes of genius as a parents of future generation. In this case is quick speed of genius development. On the other hands, if selection intensity is few, selective individuals wont be more better than average of society for purposes of genius and is slow speed of genius development, consequently (Shoja and Pirani, 2003; Pashmi, 2009). Selection difference is another explanation of selection intensity, it means that as ever selection difference is more, selection intensity is fewer (Shoja and Pirani, 2003).

Seidavi (2010) in estimate of genius parameters of silkworm commercial pure lines estimated the heritability 0.496, 0.499 and 313 for cocoon weight characteristics, cocoon shell weight and cocoon shell percentage,

respectively. This reality is explainable simply that why cocoon shell weight is part of cocoon weight. In this research, estimated genius correlation of two characteristics was 0.831. In research of Ghanipoor *et al.* (2006) was estimated heritability 0.400-0.468, 0.292-0.503 and 0.172-0.295 for cocoon weight characteristics, cocoon shell weight and cocoon shell percentage, respectively.

Ghanipoor *et al.* (2006) in study about Japanese silkworm three lines obtained genius increasing correlation for cocoon weight characteristics between 0.919-0.921, cocoon shell weight and cocoon shell percentage 0.699-0.830 and for cocoon weight characteristics and cocoon shell percentage 0.119-0.208. Also in this research, environmental correlation estimated between above characteristics 0.487-0.676, 0.375-0.517 and 0.119-0.208, respectively. Also obtained phenotype correlation in these characteristics 0.729-0.753, 0.592-0.610 and 0.067-0.205.

## CONCLUSION

In this research have been studied various characteristics in three variety and based on this research was shown that selection caused to create response to selection that this response to selection was positive. Response to selection was different about various characteristics and some of characteristics is more significant and other some is fewer but totally response to selection has been positive and satisfactory. In 32 lines characteristics such as pupae vitality percentage in middle cocoon, produced cocoons number, best cocoons number, double cocoons number, best cocoons percentage, middle cocoons percentage, double cocoons percentage, total best cocoon weight, single best cocoon weight, hatched larvae number, un-hatched egg number, total produced eggs number were more significant than another characteristics. In 104 line characteristics of pupae vitality percentage in middle cocoon and double cocoons weight were more significant. Also in 110 line characteristics of produced cocoons number, total best cocoon weight, larval duration, hatched larvae number, un-hatched larvae number, hatched eggs percentage, un-fertilized eggs percentage and total produced eggs number were more significant and higher heritability than other characteristics.

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