IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Effect of Mating ratio on the Quails Performance A Review

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Abstract:

Mating ratio is the ratio of males to females in a population kept for breeding purpose. It is also called sex ratio and one of the major factors for the productive and reproductive performance of each and every species of animals but also an important determining factor for cost economics for rearing. Quails *(Coturnix sp.*) are generally kept for egg production in Far East and Asian Countries, while they are reared primarily for meat production in European and American Countries. Quails are also used as laboratory birds because of their short life span and small size. Mating ratio affects lots of traits like productive traits, reproductive traits and some other parameters also either directly or indirectly, alone or in combination with other factors in quails as well as other avian species and animals. Besides the other effects the major and important one are observed in fertility and hatchability of eggs. Number of results found by different scientists but most of the studies observed that higher mating ratio (1:1 to 1:3) performed better than lower mating ratio (1:4 to 1:7) in terms of egg production. Similar results were recorded from most of the researchers for the hatched chick weight and fertility while the others found just opposite results for fertility. But for hatchability trait

and embryonic mortality the results have so many variations with majority of non significant difference among the different mating ratios. There are very less literature were found on the effect of mating ratio on carcass traits and behavioral traits while the not a single literature was recorded for the effect of mating ratio on feed intake, feed conversion ratio and cost economics for rearing for extra males in breeding group/population. This review summarizes how mating ratio affect the number of economic traits of quail. The aim is to emphasize the role of mating ratio in quail farming and lots of future needs and scopes for the research works in that field.

Fertility, Hatchability, Japanese quail, Mating ratio

Introduction:

The quail called **bater** in Hindi are the group of small sized birds belongs to the family Phasianidae (Crawford, 1990; Minvielle, 1998) which generally crouch or run rather than fly to escape from danger. The term (quail) meaning "to sink, shivering from fear". They were first domesticated in Japan in 1595 and there are 2 species of quail in India; the black-breasted quail found in jungle (*Coturnix coromandelica)* and brown-coloured Japanese quail *(Coturnix coturnix japonica*) which is generally kept for egg production in Far East and Asian Countries, while they are reared primarily for meat production in European and American Countries (Minvielle, 2004). In Turkey, quails are kept as a dual purpose breed for meat and egg production. Quails are also important laboratory birds because of their small size and short life span so, cost of conducting experiments can be greatly reduced because they eat less, need less space, easy to handle and prolific breeders also reproduce faster than chicken as it can produce 4 generations in a year. Moreover, quails are immunologically more potent than chicken as they need no vaccination, little or no medication and are more resistant to environmental constraints due to inherent ability to grow under natural conditions.

There are 45 species of quail. Japanese quail is the smallest species; it is much smaller than pigeon. While the Indian quails weigh up to 100 g and lays 100 eggs a year, the Japanese quail weighs up to 250 g and lays 250 eggs a year.

Quails have certain distinct characteristics that made them suitable for both eggs as well as meat production. Those are:

- Early marketing age (Five weeks for meat purposes, which is less than broiler chicken (6 weeks)
- Early sexual maturity (6-7 weeks to start egg laying)
- High rate of lay (280 eggs per year)
- Minimum floor space requirement (8-10 quails can be housed in space required by single chicken)

Sexing of quails can be done at 3 week of age as adult male is identified by cinnamon-colored feathers, blunt and smaller feathers on the upper throat and lower breast region. The females in the same region will have black stippled feathers on lighter cinnamon color and the feathers are pointed in shape. The male male voice is louder and usually sounds like "ko-turro-neex". Quail matures at in about 6weeks of age and usually in full egg production at the age of 50 days. With proper care, Hens lays about 200-300 eggs in their first-year production which declines further. Life expectancy is only 24 to 30 months. Female quails are heavier than males with adult weight of 120 to 160g and 110 to 140g respectively. Quail eggs are mottled brown with light blue chalky material. The average egg weight is about 10 g. Incubation periodof quail egg is 17 to 18 days; weight of young chicks is about 6 to 7 g when hatched and is brownish with yellow stripes. Quail lays 75 percent of their eggs between 3 to 6 p.m. and 25 percent at night. 14 to 18 hours of light in a day is sufficient to maintain optimum egg production and fertility in quails. Quail eggs have occupied a unique place in poultry because of size, delicacy and several other nutritional facts like their meat and eggs contain less fat and cholesterol than chicken egg and thus are healthier. Quail broilers gain body weight of about 180-240 g at 35 days. The growth rate is maximum during the first three weeks of age and decreases thereafter.

There is wide variation in mating ratio among different bird species that is generally used in their respective farming and it is as following –

- For quail – 1:2 or 1:3
- For chicken – 1:10 (in meat type breeds), 1:15 (in egg type breeds) and 1:8 (in native breeds)
- For ducks – 1:6 (in meat type breeds), 1:8 (in egg type breeds)
- For turkey – 1:5
- For guinea fowl – 1:3
- For emu, ostrich and pigeon – 1:1

Different traits of quails are affected by number of factors like genetic and environmental factors such as genetic structure, mating ratio, parental age, rate of egg laying and climatic conditions (Kulenkamp *et al*., 1973; Harris *et al.,* 1984; Mayes and Takeballi, 1984).

Mating ratio is the ratio of males to females in a population kept for breeding purpose. It is also called sex ratio and one of the major factors for the productive and reproductive performance of each and every species of animals but also an important determining factor for cost economics for rearing.

The main purpose of breeder farms of quail is to produce an optimum number of quality eggs and meat. Therefore the small-scale enterprises are primarily interested for remedial actions for the environmental effects.

With growing consumer awareness and interest for the quality quail meat, the commercial quail production industry has gradually captured a sizeable section of the poultry meat market because of its small size with fast growth, early sexual maturity and high rate of egg production.

Effects of mating ratio

Mating ratio affects lots of traits like- productive traits, reproductive traits and some other parameters also either directly or indirectly, alone or in combination with other factors in quails as well as other avian species and animals.

Effects on Productive traits

1. Egg production:

a) Laying rate

Effect of sex ratio on egg production traits was studied by Khalil *et al*. (2011) in Japanese quail and showed that irrespective of photoperiods, there was decreasing sex ratio (1:6 or 1:8) leads to decreasing laying rate compared to higher sex ratio (1:2 or 1:4). These results are in agreement with other findings by Çetin (2002) who found that sex ratio (1:4) lead to increase in laying rate/hen compared to sex ratio 1:5.

Regarding the effect of sex ratio on Japanese quail, the total egg production percent was 53.21and57.01for sex ratio 1:2 and 1:3(male: female), respectively (Karousa *et al*., 2015). The obtained results revealed that there were non significant (P>0.05) differences in the total egg production due to sex ratio. These results agreed with Al-Rawi (1980) and similar result was obtained by Haghighi *et al*. (2016) on broiler breeder flock found that presence of male had no significant (P>0.05) effect on egg production.

Moreover, some studies was also done in pheasant like Ugurlu *et al*., 2017 recorded the 430 and 447 eggs production for 1:5 and 1:7 male and female ratios respectively and concluded that egg production increased with increasing sex ratio. Similarly conclusion was also made by Deeming and Wadland (2002) with the result of significantly (P<0.05) higher egg production under sex ratio 1:8 as compared to 1:12 and their report also showed that the protein levels of diet and sex ratio had a synergistic effect on egg production.

Conversely, Bates *et al*. (1987) reported that when the sex ratio decreased from 1:12 to 1:18 egg production of Pheasants were increased.

b) Egg weight

The egg weight was obtained higher from birds kept under 14hr L/d at mating ratio 1:4, but the lighter egg weight was obtained from birds kept under 12hr L/d at mating ratio 1:6 (Khalil *et al*., 2011). Egg weight in pheasant was observed lower (1.28 %) value for 1:5 than 1:7 and found there was no effect of mating ratio in egg weight recorded (Ugurlu *et al*., 2017). Likewise, a study with silver pheasant (*Lophura*

nychemera) reported by Kaleem *et al*. (2015) that an increase in male-female ratio from 1:2 to 1:5 mating ratio showed a positive effect on egg weight. However, these results are lacking explanation for this effect.

2. Body Weight:

There was a significant difference in body weight in relation to mating ratio recorded by Khalil *et al*. (2011) in Japanese quail that the females of 1:8 mating ratio group achieved higher body weight than rest of the group.

3. Mortality rate:

In the research work of Khalil *et al*. (2011) lowest mortality rate was recorded in 1:6 sex ratio while highest value found in 1:8 so that they concluded that 1:4 sex ratio with 16 hr L/D (light/dark) gave good result in Japanese quail.

4. Hatched chick weight:

A significant effect of mating ratio on hatched chick weight was observed in breeder quails by Ali *et al*. (2013) with highest chick weight (8.16 g) in 1:3 followed by 1:1 (7.65 g), 1:4 (7.53 g) and 1:2 (7.41 g). Their result was similar to observation of Seker *et al*. (2004) that mating ratio had a significant effect on the hatched chick weight indirectly through egg weight. In contrast to above studies Ugurlu *et al*. (2017) recorded that difference in hatched chick weight was not significant for mating ratio in pheasant in respect to effect of protein in diet and mating ratio while the highest hatching chick weight was 5:1 in 18% CP. In this result, it was determined that protein levels were effective on egg and hatching chick weight but, mating ratio was not effective on them.

Effects on Reproductive Traits

1. Fertility:

The research work at coastal climate of Odisha was done in Japanese quail by Majhi and Panigrahi (2016), the fertility values were 87.22, 88.22, 91.20 and 86.35 percent for mating ratios 1:1, 1:3, 1:5 and 1:7, respectively. The ratio 1:5 showed significantly ($P<0.05$) higher fertility (91.20%) than other ratios. There was no significant difference ($P>0.05$) between ratios 1:1, 1:3 and 1:7. The fertility values recorded in the study of Ipek *et al*. (2004) was well within the range of 86.72 - 94.77 percent for mating ratios 1:1 to 1:5

These finding corroborate those of Woodward and Abplanlap (1967) who obtained highest fertility with the ratio 1:1 and 1:2 compared to ratios 1:3, 1:4 or1:5. Same findings were recorded with the highest percentages of fertility in 1:1 and1:2 sex groups while the lowest one in 1:5 sex ratio. There were no significant ($P>0.05$) differences in sex ratio between 1:1 and 1:2. Also, no significant ($P>0.05$) differences were found in sex ratio between 1:3 and 1:4 in Narinc *et al*. (2013) research. Gulati *et al*. (1980) also

reported higher fertility with ratios 1:1 to 1:3 than those for ratio 1:4 or 1:5.Shreenivasaiah and Rumappa (1985) again observed higher fertility with ratio 1:1 than with ratio 1:2, 1:3 or 1:4.

Similar findings by Baumgartner *et al*. (1979) reported that the highest fertility was shown by 1:1 mating ratio while the lowest by 1:8 male-female ratio. In the study of Narahari *et al*. (1988) the highest fertility was set to 1:2 male and female ratio. Wilson and Holland (1974) reported that 1:1 male-female mating ratio of the quails reared in the cage yields better results than the other mating ratios. In another study in Japanese quails, Seker *et al*. (2004) found that optimum male to female ratio were 1:1 and 1:2 with the highest percentage of fertility (93.32%) for the quails kept in colony cages while the highest percentage of fertility was obtained with 1:2 male-female mating ratio for individually housed quails. Among the groups, the lowest percentages of fertility were observed 74.16% with 1:5 male-female ratio for the quails kept in colony cages. Gebreil (2002), have emphasized that for the optimum fertility ratio of Japanese quails, required male-female ratio must be between 1:1 and 1:3. In the study carried out on the effect of the male-female mating ratio on the fertility was examined by Yurdakul (2006) and similar findings were reported was that, the fertility percentage for 1:1 and 1:2 mating ratios were found to be 90% and 93%, respectively. On the other hand fertility was decreased below 80% for 1:4 and 1:5 mating ratios.

Regarding the effect of sex ratio, Karousa *et al.*, 2015 the fertility percentage was (79.17%) and (75.17%) for sex ratio 1: 2 and 1: 3(male: females), respectively. From the obtained data, it was observed that the fertility percentage was higher in sex ratio 1:2 than 1:3; there was high significant ($P<0.05$) difference in fertility due to sex ratio. The higher average of fertility percentage in sex ratio 1:2 may be attributed to the female received more mounting than those in case of 1:3. The obtained results in the present study are in agreement with Narinc *et al*. (2013) who concluded that fertility percentage of sex ratio 1:2(91.18%) was higher than sex ratio1:3(86.41%). Also, Ali *et al*. (2013) found that fertility percentage of sex ratio 1:2 (74%) was higher than sex ratio1:3 (70%).

Above results similar findings of Mandour *et al.* (1993) who reported non significant ($P>0.05$) effect of mating ratio from 1M: 1F to 1M: 4F on fertility in quail breeder. However fertility was significantly ($P<0.05$) affected in the same mating ratio when ration was supplemented with vitamin E-Selenium. It might be due to the vitamin E and Selenium that affected the male's sperm quality maintenance for longer time. Contrast to there findings, Barreto *et al.* (1997) and Hossain *et al.* (1998), reported that fertility and hatchability were not significantly ($P>0.05$) affected by Vitamin E and Selenium supplementation in broiler breeder hens.

There are some research was conducted on Japanese quail for the effect of photoperiod and sex ratio and themaximum values of fertility percent were obtained from 14h L/d (light/dark) at sex ratio 1:2 followed by 16h L/d at sex ratio 1:4 and the minimum value was at 18hr L/d at sex ratio 1:8 (Khalil *et al*., 2011).

Amrutkar *et al*. (2013) did not notice any significant (P>0.05) difference in fertility between mating ratios 1:3, 1:4, 1:5 and 1:6. The obtained results agreed with Ipek *et al*. (2004) who found that there were non significant (P>0.05) differences in fertility percentage between sex ratio 1:2 (94.44%) and 1:3(94.77%).

Ugurlu *et al*. studied in pheasants and found that the fertility rate for 5:1group was determined higher than those of 7:1 group but the difference was not significant (P>0.05).

The research work at coastal climate of Odisha was done in Japanese quail by Majhi and Panigrahi, 2016, the fertility values were 87.22±1.07, 88.22±1.06, 91.20±0.61 and 86.35±0.28 percent for mating ratios 1:1, 1:3, 1:5 and 1:7, respectively. The ratio 1:5 showed significantly higher fertility (91.20±0.61%) than other ratios. There was no significant difference between ratios 1:1, 1:3 and 1:7. The fertility values recorded in the study of Ipek *et al*., 2004 was well within the range of 86.72 - 94.77 percent for mating ratios 1:1 - 1:5

These finding corroborate those of Woodward and Abplanlap (1996) who obtained highest fertility with the ratio 1:1 and 1:2 compared to ratios 1:3, 1:4 or 1:5. Same findings were recorded with the highest percentages of fertility in 1:1 and 1:2 sex groups while the lowest one in 1:5 mating ratio. There was a non significant difference in between 1:1 and 1:2 mating ratio. Also, no significant differences were found in mating ratio between 1:3 and 1:4 in Narinc *et al*. (2013) research. Gulati *et al*. (1980) also reported higher fertility with ratios 1:1 - 1:3 than those for ratio 1:4 or 1:5. Shreenivasaiah and Rumappa (1985) again observed higher fertility with ratio 1:1 than with ratio 1:2, 1:3 or 1:4. These results was in good agreement with the findings of Kaymak (1991), where the effects of the male-female ratio and mating period on the fertility were examined and reported no significant difference in the percentage of fertility between 1:1 and 1:2 male-female ratios, while the percentage of fertility for 1:3 mating ratio was significantly the lowest among these groups.

Similar findings by Baumgartner *et al*. (1979) have been reported that the highest fertility was shown by 1:1 mating ratio while the lowest by 1:8 male-female ratio. In the study of Narahari *et al*. (1988) the highest fertility was set to 1:2 male-female. Wilson and Holland (1974) have reported that 1:1 male-female mating ratio of the quails reared in the cage yields better results than the other mating ratios. In another study by Seker *et al*. (2004) found that optimum male-female mating ratio were 1:1 and 1:2 with the highest percentage of fertility (93.32 %) for the quails kept in colony cages while the highest percentage of fertility was obtained with 1:2 male-female mating ratio for individually housed quails. Among the groups, the lowest percentages of fertility were observed to be 74.16% with 1:5 male-female ratio for the quails kept in colony cages. In a study carried out on quails, Kocak and Ozkan (1999) reported that the number of females per sire was inversely proportional to fertility. Gebreil (2002), have emphasized that for the optimum fertility ratio of Japanese quails, required male-female ratio must be between 1:1 and 1:3. In the study carried out on the effect of the male-female mating ratio on the fertility was examined by Yurdakul

(2006) and similar findings were reported was that, the fertility percentage for 1:1 and 1:2 mating ratios were found to be 90% and 93%, respectively. On the other hand fertility was decreased below 80% for 1:4 and 1:5 mating ratios.

Regarding the effect of mating ratio, Karousa *et al.*, 2015 the fertility percentage was (79.17±0.75%) and (75.17±0.75%) for mating ratio 1: 2 and 1: 3 (male: females), respectively. From the obtained data, it was observed that the fertility percentage was higher in mating ratio1:2 than 1:3, there was high significant difference in fertility due to mating ratio. The higher average of fertility percentage in mating ratio 1:2 may be attributed to the female received more mounting than those in case of 1:3. The obtained results in the present study are in agreement with Narinc *et al*., (2013) who concluded that fertility percentage of mating ratio 1:2 (91.18%) was higher than mating ratio 1:3 (86.41%). Also, Ali *et al*., (2013) found that fertility percentage of mating ratio 1:2 (74%) was higher than mating ratio1:3 (70%).

Above results were in contrast to Uluocak and Okan (1993), who reported lowest fertility rates from the mating ratio groups of 1M:1F. However, this result disagree the findings of Mandour *et al.* (1993) who reported non significant effect of mating ratio from 1M:1F to 1M:4F on fertility in quail breeder. However fertility was significantly affected in the same mating ratio when ration was supplemented with vitamin E- Selenium. It might be due to the vitamin E –Selenium that affects the males sperm quality maintenance for longer time.

There are some research was conducted on Japanese quail for the effect of photoperiod and mating ratio and the maximum values of fertility percent were obtained from 14hr L/d (light/dark) at mating ratio 1:2 followed by 16hr L/d at mating ratio 1:4 and the minimum value was at 18hr L/d at mating ratio 1:8 (Khalil *et al*., 2011).

Amrutkar *et al.* (2013) did not notice any significant difference in fertility between mating ratios 1:3, 1:4, 1:5 and 1:6. the obtained results agreed with Ipek *et al*., (2004) who found that there were non significant differences in fertility percentage between mating ratio 1:2 (94.44%) and 1:3(94.77%).

Ugurlu *et al*. studied in pheasants and found The fertility rate for 5:1 group were determined higher than those of 7:1 group but the difference was not significant.

2. Hatchability:

In the study of Majhi *et al*. (2016) hatchability on total eggs (H_{TES}) was also found to be the highest in sex ratio of 1:5 (77.43%) and lowest in 1:1 (69.81%). While the ratios 1:3 and 1:7 had significantly ($P<0.05$) higher values than ratio 1:1. Various researchers have reported 57.6-85.2% hatchability (Sreenivasian and Rumappa, 1985; Seet *et al*., 1992 and Seker *et al*., 2004) in different mating ratios. These findings disagree with those of Razuki *et al*. (2009) and Amrutkar *et al*. (2013). Razuki *et al*. (2009) obtained that H_{TES} was not affected by sex ratios1:2, 1:3, 1:4 and 1:6 and 1:12. Amrutkar *et al*. (2013) also reported that this trait was unaffected by mating ratios1:3, 1:4, 1:5 and 1:6.Hatchability on fertile eggs (H_{FES}) was again found to be the highest in ratio 1:5 (84.93%) and lowest in ratio 1:1 (80.12%).

The ratios 1:5 and 1:7 shows higher values compared to other ratios but did not showed any significant (P>0.05) difference. Ratio of 1:3 showed significantly (P<0.05) higher hatchability compared to 1:1 ratio. Amrutkar *et al*. (2013) also observed that mating ratios1:3, 1:4, 1: 5 and 1:6 not significance (P>0.05) influence HFES.

Regarding the effect of sex ratio Karousa *et al.* (2015) the H_{TES} was 49% and 52.50% for sex ratio1: 2 and 1: 3 (male: females), respectively. These data showed that H_{TES} was higher in sex ratio1:3 than 1:2, but it was non significant (P>0.05). These results agreed with the reports of Ipek *et al*. (2004); Raji *et al*. (2014) who found that H_{TES} higher in mating ratio (male:female) 1:3 (65.87%)than 1:2 (20.83%). Similar result was obtained by Baser *et al*. (2002), Seker *et al*. (2005) and Raji *et al*. (2014) those found statistically higher effect of mating ratio in hatchability of quail's egg. The average of H_{FES} was 64.75% and 70.12% of sex ratio 1: 2 and 1: 3 (male: females), respectively so that the average of H_{FES} was higher in sex ratio1:3 than 1:2, there was higher significant difference (P< 0.01) in H_{FES} due to sex ratio.

On the other hand, the obtained results were disagreed with Ipek *et al*. (2004) and Ali *et al*. (2013) Mating ratio and Vitamin E and Selenium supplementation significantly (P<0.05) affected hatchability. The mating ratio 1:1 had highest percent of hatchability than other groups. Quails supplemented with Vitamin E and Selenium had significantly (P<0.05) higher hatchability (71%) as compared to control group (68%). Generally, the observation was that hatchability is directly proportional to number of males. These results were similar to studies by Seker *et al*. (2005), who found statistically higher effect of sex ratio in hatchability. The results of Ali *et al*. (2013) were in agreement with that of the work of Mandour *et al.* (1993), who obtained the significant effect of Vitamin E and Selenium supplementation to the same mating ratio on hatchability. It might be due to the fact that vitamin E- Selenium supplementation affects the breeder performance which resulted in to higher number of viable chicks and lower mortality of embryos during incubation but also helps to males for maintaining sperm quality for longer time. Moreover, Deeming and Wadland (2002) found that hatchability percent increased in sex ratio 1:8 compared to 1:12 in pheasants (*Phasianus colchinus).* The fertility, hatchability and hatchability fertility efficiency (HFE) for 5:1group were determined higher than those of 7:1group but, there were no significant (P>0.05) differences for fertility, hatchability and hatchability fertility efficiency.

Ali *et al*. (2013) results were corroborate to the study performed by Barreto *et al.* (1997) and Hossain *et al.* (1998), who reported that fertility and hatchability were not significantly (P>0.05) affected by Vitamin E and Selenium supplementation in broiler breeder hens.

3. Embryonic mortality:

The research work in the effect of photoperiod and sex ratio on productive and reproductive performance of Japanese quail was done by Khalil *et al*. (2011) and recorded highest total dead embryonic percentage (29.11%)in 1:6 sex ratio group with the least one (24.08%) was in 1:4 group. Another experiment in Japanese quail at coastal climate of Odisha showed the higher embryonic mortality in terms of percentage of dead-in-shell (DIS), early embryonic mortality (EEM) and late embryonic mortality (LEM) with the value of (4.83%), (9.17%) and (3.42%) respectively in the sex ratio of 1:1 but the lower value of DIS (3.06%) in 1:5, EEM (6.60%) in 1:7 and LEM (2.40%) in 1:3 (Majhi *et al.*, 2016). In contrast to this observation Raji *et al*. (2014) study showed very high percentages of EEM as 18.15, 42.11, 7.59, 16.67 and 90.0 percent for mating ratios 1:1, 1:2, 1:3, 1:4 and 1:5, respectively in Japanese quail. The incidence of LEM was the highest (3.42%) in ratio 1:1 and the lowest (2.40%) in ratio 1:3 so that, they not found any significant ($P<0.05$) difference between ratios 1:1, 1:3, 1:5 and 1:7, while ratio 1:3 showed significantly LEM than other ratio and concluded that, in general, mating ratio did not influence LEM. But the high significance ($P>0.05$) difference in EEM in Japanese quail was found between 1:2 (9.44%) and 1:3 (3.05%) by Seker *et al*. (2004). Alsobayel and Albadry (2012) reported by changed sex ratio from 1:6 to 1:14 that EEM, LEM and total embryonic mortality decreasing for Baladi Chickens. The total embryonic mortality was determined as 13.28% and 13.88% for 5:1 and 7:1 respectively by Ugurlu *et al*. (2017) in pheasants, however, the early period embryonic mortality (EPEM) rates and late period embryonic mortality (LPEM) rates was low i.e. 3.20 % for 1:7 but middle period embryonic mortality (MPEM) rates was low (3.46 %) for the 1:5.

4. Area of cloacal gland (mm^2):

Sachs (1967) and Siopes and Wilson (1975) reported the area of cloacal gland as a good indicator of testicular function and size. Khalil *et al*. (2011) reported significant difference in cloacal gland area among different mating ratio in Japanese quail with higher value in 1:4 and lower value in 1:8 mating ratio.

Effects on Behavioral Traits

1. Plumage condition score:

There was significant difference found in different combination of mating ratio with photoperiod in Japanese quail and higher score was detected in combination of 1:2 and 16 hr L/D (light/dark) and lower score in 1:6 with 18 hr L/D (light/dark), so that here the conclusion was that the plumage condition score is directly proportional to mating ratio (Khalil *et al*., 2011).

2. Resting behavior:

The most commonly observed behavior in broiler chickens across all age and mating ratios was resting, which ranged from 75.3 to 85.3%, but this was not influenced by the mating ratio (SON *et al*., 2010).

3. Pecking behavior:

Ranges in the percentage of pecking behavioral frequency across al1 age and mating ratios were 7.4 to 20,2 and. The pecking behavioral frequency was affect by age but unaffected by mating ratio in broiler chickens (SON *et al*., 2010).

4. Moving behavior:

The effect of mating ratio on moving ability on broiler chickens did not show a clear pattern, bat the moving behavioral frequency was higher in 0:100 and 25:75 of male to female ratio than 100:0 and 75:25 ratios at 2 week of age. N 3 and 4 weeks of age, moving activities were seems high in the 25/75 ratio than other mating ratios. At 5 weeks of age, moving frequency was high in the 25:75 ratio compared to the 100:0 and 0:100 ratios, but was not different from other mating ratios (SON *et al*., 2010).

5. Tonic immobility (TI):

TI reaction was significantly shorter for females than males in the all of mating ratio in broiler chicken. TI reaction was significantly affected by mating ratio. TI reaction was significantly interaction among age, sex and mating ratio at both ages. TI reaction was shorter in 25/75 ratio than in other mating ratios at 19 days age than 100:0 and 0:100 at 33 days age) so that, It appears that mixed rearing of males and females may be appropriate to stimulate locomotors abilities and this was particularly evident in the 25/75 ratio of male to female .In that study, birds reared in this mating ratio had better moving ability and exercised more than rearing single sex (SON *et al*., 2010).

Effects on Blood parameters

There was significant effect of mating ratio on calcium and iron content of blood observed in Japanese quail by Khalil *et al*. (2011) and they were found that group of 1:8 mating ratio are having higher blood calcium level than 1:6 group and the data for iron level in blood is just opposite to that, besides that females generally having higher calcium and inorganic phosphorus than male but male having higher iron content in blood than female.

Work done in Chhattisgarh: No literature is traceable in Chhattisgarh.

Conclusion

Mating ratio affects lots of traits like productive traits, reproductive traits and some other parameters also either directly or indirectly, alone or in combination with other factors in quails. Besides the other effects the major and important one are observed in fertility and hatchability of eggs. Number of results found by different scientists but most of the studies observed that higher mating ratio (1:1 to 1:3) performed better than lower mating ratio (1:4 to 1:7) in terms of egg production. Similar results were recorded from most of the researchers for the hatched chick weight and fertility while the others found just opposite results for fertility. But for hatchability trait and embryonic mortality the results have so many variations with majority of non significant difference among the different mating ratios. The aim is to emphasize the role of mating ratio in quail farming and its effects.

Future Scope

There are very less literature were found on the effect of mating ratio on carcass traits and behavioral traits while the not a single literature was recorded for the effect of mating ratio on feed intake, feed conversion ratio and cost economics for rearing for extra males in breeding group/population. There are lots of future needs and scopes for the research works in that field.

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