Results
5. RESULTS

5.1 Baseline susceptibility

Baseline susceptibility study was carried out for the natural population of GRP strain and LC99 value was found to be 1.49, 0.99, 0.249 and 0.0024 for DDT, Chloropyrifos, Carbofuran and Cyfluthrin insecticides respectively.

5.2 Genetic basis of Insecticide Resistance

a. DDT

The establishment of homozygous resistant and susceptible strains of *An. stephensi* for DDT to a diagnostic dose of 3.0 ppm is represented in Table 1. As indicated earlier, homozygous resistant and susceptible strains were synthesized by selective inbreeding for 19 and 5 generations respectively. The data on various genetic crosses for resistance and susceptibility has been represented in Table 2. The crosses between the susceptible male to susceptible female (cross 1) and resistant male to resistant female (cross 2) were shown to be pure line for susceptibility and resistance (Table 2). In the crosses 3 and 4 (Table 2), the F₁ hybrids showed 49.69% and 51.91% resistance and 50.31% and 48.09% susceptibility respectively. The dosage mortality (d-m) line was found in the mid of resistant and susceptible strain (Fig.1). The results of the backcrosses to homozygous susceptible parents showed 39.55%, 40.05%, 37.82% and 48.98% resistance and 60.45%, 59.94%, 62.18% and 51.02% susceptibility respectively (Table 2). The d-m line for back crosses were found between susceptible and F₁ hybrid (Fig.1). The resistant and susceptible ratio for F₁ hybrid was almost 1:1.
The crosses 9 and 10 of F₂ progeny showed 51.40% and 51.14% resistance and 48.60% and 48.86% susceptibility respectively.

The Log-dosage-probit (LD-P) lines (Fig.1) were constructed for resistant, susceptible, F₁ hybrid, back crosses and F₂ progeny (Finney 1971, Georghiou 1965). The LD-P line for F₁ was found in the mid of resistant and susceptible strain (Fig.1) clearly indicating that the gene ddr is intermediate. As the response of F₁ hybrids to the diagnostic concentration was similar in both the crosses, which indicated that only a single gene was operational in conferring the resistance to DDT.

The LC₅₀ values of susceptible, resistant and F₁ hybrids were analyzed for the degree of dominance “D” (Stone 1968). The value of D is found near zero indicating intermediate, since resistance was shown in both the sexes, it was identified as autosomal.

b. Chloropyrifos

As indicated earlier the homozygous resistant and susceptible strain were established by selective inbreeding after 23 and 5 generation respectively, using the diagnostic concentration of 0.2 ppm Chloropyrifos (Table 3). The data for various genetic crosses for resistance and susceptibility has been given in Table 4. The crosses between the susceptible male to susceptible female (cross 1) and resistant male to resistant female (cross 2) were shown to be pure line for susceptibility and resistance (Table 4). In the crosses 3 and 4 (Table 4), the F₁ hybrids showed 65.82% and 61.32% resistance and 34.18% and 38.68%
susceptibility respectively. The dosage mortality (d-m) line was found towards resistant strain (Fig. 2). The results of the backcrosses to homozygous susceptible parent showed 41.85%, 44.88%, 45.78% and 44.9% resistance and 58.15%, 55.12%, 54.2% and 55.1% susceptibility respectively (Table 4). The d-m line for back crosses were found between susceptible and F1 hybrid (Fig. 2). The crosses 9 and 10 of F2 progeny showed 51.44% and 53.21% resistance and 48.56% and 46.79% susceptibility respectively.

The Log-dosage-probit (LD-P) lines (Fig. 2) were constructed for resistant, susceptible, F1 hybrid, back crosses and F2 progeny (Finney 1971, Georgiou 1965). The LD-P line for F1 was found towards the resistant strain (Fig. 2) clearly indicating that the gene cpr is incompletely dominant. As the response of F1 hybrids to the diagnostic concentration was similar in both the crosses, which indicated that only a single gene was operational in conferring the resistance to Chloropyrifos.

The LC50 values of susceptible, resistant and F1 hybrids were analyzed for the degree of dominance “D” (Stone 1968). The value of D is found less than one indicating the gene cpr is incompletely dominant, since resistance was shown in both the sexes, it was identified as autosomal.

c. Carbofuran

The Table 5 represents the establishment of homozygous resistant and susceptible strains of An. stephensi for Carbofuran to a diagnostic dose of 0.5 ppm by selective inbreeding for 17 and 4 generations respectively. Table 6 represents
the data for various genetic crosses for resistance and susceptibility. The crosses between the susceptible male to susceptible female (cross 1) and resistant male to resistant female (cross 2) were shown to be pure line for susceptibility and resistance. In the crosses 3 and 4, the F₁ hybrids showed 82.01% and 76.05% resistance and 17.99% and 23.95% susceptibility respectively. The dosage mortality (d-m) line was found closer to the resistant strain (Fig. 3). The results of the backcrosses to homozygous susceptible parents showed 56.26%, 53.99%, 53.56% and 53.92% resistance and 43.74%, 46.01%, 46.44% and 46.08% susceptibility respectively (Table 6). The d-m line for back crosses were found between susceptible and F₁ hybrid (Fig. 3). The crosses 9 and 10 of F₂ progeny showed 63.32% and 65.41% resistance and 36.68% and 34.59% susceptibility respectively.

The Log-dosage-probit (LD-P) lines (Fig. 3) were constructed for resistant, susceptible, F₁ hybrid, back crosses and F₂ progeny (Finney 1971, Georghiou 1965). The LD-P line for F₁ was found closer to the resistant strain (Fig. 3) clearly indicating that the gene cbr is incompletely dominant. As the response of F₁ hybrids to the diagnostic concentration was similar in both the crosses, which indicated that only a single gene was operational in conferring the resistance to Carbofuran.

The LC₅₀ values of susceptible, resistant and F₁ hybrids were analyzed for the degree of dominance “D”(Stone 1968). The value of D is found less than one indicating the gene cbr is incompletely dominant, since resistance was shown in both the sexes, it was identified as autosomal.
d. Cyfluthrin

A diagnostic dose of 0.005 was selected to establish homozygous resistant and susceptible strains by selective inbreeding for 26 and 9 generations respectively and the data has been represented in Table 7. The data on various genetic crosses for resistance and susceptibility has been represented in Table 8. The crosses between the susceptible male to susceptible female (cross 1) and resistant male to resistant female (cross 2) were shown to be pure line for susceptibility and resistance. In the crosses 3 and 4, the F₁ hybrids showed 53.86% and 50.9% resistance and 46.14% and 49.1% susceptibility respectively. The dosage mortality (d-m) lines were found closer to resistant strain (Fig. 4). The results of the backcrosses to homozygous susceptible parent showed 47.83%, 48.28%, 51.52% and 48.89% resistance and 52.17%, 51.72%, 48.48% and 51.11% susceptibility respectively (Table 8). The d-m line for back crosses were found between susceptible and F₁ hybrid (Fig. 4). The resistant and susceptible ratio for F₁ hybrid was almost 1:1. The crosses 9 and 10 of F₂ progeny showed 53.98% and 55.84% resistance and 46.02% and 44.16% susceptibility respectively.

The Log-dosage-probit (LD-P) lines (Fig. 4) were constructed for each of the crosses (Finney 1971, Georghiou, 1965). The LD-P line for resistant, susceptible, F₁ hybrid and F₂ progeny clearly showed that the gene for cyfluthrin resistance (cfₐ) is incompletely dominant. As the response of F₁ hybrids to the diagnostic concentration was similar in both the crosses, it was assumed that only a single gene was operational in conferring the resistance to cyfluthrin.
The LC_{50} values of susceptible, resistant and F₁ hybrids were analyzed for the degree of dominance "D" (Stone 1968). The value of D is found less than 1 indicating incomplete dominance, since resistance was shown in both the sexes, it was identified as autosomal.

5.3. Biochemical studies of insecticide resistant / susceptible strains

A. Quantitative analysis

a. Total Protein (Tp):

The results of Tp content of the resistant and the susceptible strains during their developmental stages are given in Table 9 and the histogram is represented in Fig. 5. The protein content in resistant strains was found to be higher when compared to susceptible strain. The Tp content in the susceptible (S) strain was 40.9±1.5, 80.7±1.0, 68.0±2.0, 101.1±0.7, 81.5±0.9, 75.0±4.0 and 103.1±2.4 μg/mg of body weight in the eggs, male larva, male pupa, adult male, female larva, female pupa and adult female respectively. Similarly for the above stages, the DDT resistant (DDR) strain showed 43.8±0.3, 92.9±0.4, 81.7±2.0, 117.6±2.0, 94.7±1.2, 86.8±0.4 and 124.0±2.9 μg/mg respectively; the Chloropyrifos resistant (CPR) strain showed 46.3±0.7, 96.3±1.2, 87.9±2.0, 115.8±2.7, 97.8±1.8, 90.2±2.0 and 120.6±1.4 μg/mg; the Tp content in the Carbofuran resistant (CFR) strain was 45.9±1.1, 105.6±1.9, 91.1±4.0, 120.9±0.8, 105.8±4.9, 93.3±1.9 and 124.8±1.0 μg/mg respectively; in the Cyfluthrin resistant (CYR) strain it was found to be 45.5±0.9, 102.7±1.5, 93.1±0.7, 123.2±1.2, 103.9±2.9, 95.7±0.5 and 124.8±2.9 μg/mg respectively.
b. Soluble Protein (Sop):

The Sop content of the resistant and the susceptible strains are represented in Table 10. The amount of Sop content in the S strain was 36.2±1.1, 68.2±1.6, 58.8±4.9, 63.2±2.2, 76.7±0.0, 69.9±3.4 and 71.7±2.7; for DDR strain 41.4±0.6, 84.3±1.4, 74.1±3.8, 77.6±3.3, 88.9±1.4, 80.8±4.5 and 83.5±3.0; for CPR strain 42.5±1.2, 83.6±0.2, 73.2±1.2, 83.1±1.1, 96.4±4.6, 81.7±0.0 and 86.8±1.1; for CFR strain 41.9±0.7, 82.7±2.1, 75.9±5.5, 81.7±2.3, 96.9±0.5, 80.1±4.7 and 85.1±5.0; for CYR strain 41.1±1.0, 85.5±2.1, 78.3±0.8, 82.8±1.2, 95.6±0.9, 81.5±5.1 and 87.4±1.9 µg/mg of body weight in the eggs, male larva, male pupa, adult male, female larva, female pupa and adult female respectively. The histogram for the same has been represented in Fig. 6. The variations in Sop for resistant strain were significant when compared to susceptible.

c. α esterase:

The α esterase activity of the resistant and the susceptible strains during the developmental stages are represented in Table 11 and histogram for the same in Fig. 7. The α esterase activity in the S strain was 155±5, 645±10, 619±9, 900±5, 701±2, 640±1 and 930±10; for DDR strain 191±4, 878±5, 781±10, 1160±10, 896±7, 801±2 and 1190±3; for CPR strain 199±10, 949±2, 797±1, 1172±10, 1003±2, 878±2 and 1205±5; for CFR strain 202±5, 956±3, 799±5, 1192±5, 1034±7, 817±10 and 1188±5; for CYR strain 201±6, 975±1, 796±5, 1165±10, 1009±1, 815±20 and 1172±10 moles of α naphthyl acetate hydrolyzed/µg protein/min in the eggs, male larva, male pupa, adult male, female
larva, female pupa and adult female respectively. A significant increase in the α esterase activity was observed among the resistant strains.

d. β esterase:

The data containing the β esterase activity of the resistant and the susceptible strains are represented in Table 12 and histogram for the same is represented in Fig. 8. The β esterase activity in resistant strains was found to be significantly more when compared to susceptible strain. The β esterase activity in the S strain was 102±15, 483±4, 490±5, 555±3, 489±1, 491±15 and 597±15; in DDR strain it was found to be 125±3, 587±2, 589±6, 671±4, 611±1, 608±4 and 730±14; for CPR strain 122±6, 596±3, 598±9, 672±10, 603±3, 600±3 and 737±6; for CFR 126±5, 605±3, 595±8, 673±6, 637±7, 609±7 and 739±15; for CYR strain 125±9, 599±2, 593±7, 665±11, 615±2, 601±9 and 722±8 moles of β naphthyl acetate hydrolyzed/µg protein/min in the eggs, male larva, male pupa, adult male, female larva, female pupa and adult female respectively.

e. Acid phosphatase (Acph):

The activity of Acph in the resistant and the susceptible strains are represented in Table 13. The activity of Acph during the developmental stages of S strain was found to be 80±5, 193±2, 202±2, 200±5, 207±6, 211±4 and 210±3 moles of α naphthol released/µg protein/min in the eggs, male larva, male pupa, adult male, female larva, female pupa and adult female respectively. Similarly for the insecticide resistant strains, DDR strain showed 93±6, 229±5, 239±3, 234±1, 246±3, 250±7 and 250±7; in CPR strain 93±8, 232±7, 253±7, 232±3, 250±4,
269±6 and 257±5; for CFR strain 97±4, 246±5, 249±5, 237±6, 261±5, 259±1 and 265±9; for CYR strain 95±10, 236±3, 253±6, 240±4, 252±1, 259±6 and 249±1 moles of α naphthol released/μg protein/min for the above mentioned stages respectively. The histogram for acid phosphatase activity for the insecticide resistant and susceptible strain is presented in Fig. 9.

f. Alkaline phosphatase (Aph):

The activity of Aph in the resistant and the susceptible strains are represented in Table 14 and histogram in Fig. 10. The alkaline phosphatase activity in resistant strains was found to be higher when compared to susceptible strain. The activity of Aph during the developmental stages of S strain was found to be 85±9, 234±3, 220±7, 232±10, 244±8, 236±4 and 242±9 moles of α naphthol released/μg protein/min in the eggs, male larva, male pupa, adult male, female larva, female pupa and adult female respectively. Similarly for the insecticide resistant DDR strain it was found to be 96±8, 281±4, 249±5, 281±1, 297±5, 285±10 and 300±4; in CPR strain 101±4, 290±9, 267±9, 281±5, 303±8, 284±5 and 308±9; for CFR strain 100±5, 290±8, 262±10, 283±5, 305±6, 293±4 and 306±4; for CYR strain 104±2, 289±7, 261±11, 284±6, 297±5, 284±6 and 299±10 moles of α naphthol released/μg protein/min for the above mentioned stages respectively.

g. Acetylcholinesterase (AChE):

The activity of AChE in the resistant and the susceptible strains are represented in Table 15. The AChE activity in the S strain was 10.3±0.9,
20.2±0.8, 21.6±0.5, 23.6±0.4, 21.4±0.1, 22.0±0.9 and 23.9±0.8; for DDR strain
7.9±0.3, 15.1±0.4, 15.9±0.3, 16.1±0.3, 15.9±0.4, 16.1±0.5 and 17.5±0.3; for CPR
strain 8.0±0.7, 15.0±0.2, 16.3±0.9, 16.4±0.1, 16.5±0.5, 16.7±0.4 and 16.9±0.1; for
CFR strain 7.9±0.2, 15.3±0.2, 16.0±0.5, 16.5±0.2, 16.1±0.5, 16.7±0.7 and
17.7±0.7; for CYR strain 7.9±0.9, 15.2±0.2, 16.1±0.8, 16.7±0.5, 16.1±0.3,
16.5±0.1 and 16.8±0.6 moles acetylthiocholine hydrolyzed /mg protein/min in the
eggs, male larva, male pupa, adult male, female larva, female pupa and adult
female respectively. The histogram for the same has been represented in Fig. 11.
There was significant decrease in the activity of AChE among the resistant strains
compared to the susceptible.

h. Lactate dehydrogenase (LDH):

The activity of LDH in the resistant and the susceptible strains are
represented in Table 16 and the histogram for the is given in Fig. 12. The LDH
activity in resistant strains was found to be significantly less when compared to
susceptible strain. The S strain showed 0.23±0.01, 0.46±0.01, 0.47±0.02,
0.53±0.01, 0.48±0.03, 0.48±0.01 and 0.66±0.01; for DDR strain 0.20±0.02,
0.39±0.02, 0.40±0.03, 0.43±0.04, 0.40±0.02, 0.40±0.05 and 0.52±0.03; for CPR
strain 0.19±0.02, 0.38±0.01, 0.40±0.01, 0.43±0.01, 0.40±0.02, 0.39±0.01 and
0.53±0.03; for CFR strain 0.19±0.01, 0.38±0.03, 0.39±0.05, 0.42±0.01, 0.39±0.03,
0.40±0.04 and 0.51±0.01; for CYR strain 0.19±0.01, 0.37±0.01, 0.39±0.04,
0.43±0.01, 0.39±0.09, 0.39±0.05 and 0.51±0.04 µg pyruvate converted /µg
protein/min in the eggs, male larva, male pupa, adult male, female larva, female
pupa and adult female respectively.
B. Qualitative analysis

a. Protein:

Eggs: The protein profile for DDT, Chloropyrifos, Carbofuran and Cyfluthrin resistant and susceptible strains is presented in Plate 2a, the zymogram for the same has been represented in Fig. 13 and the Relative mobility is given in Table 17. The S strain showed 9 bands (1, 2, 3, 5, 7, 9, 10, 11 and 12); DDR strain showed 9 bands (1, 2, 3, 5, 8, 9, 10, 11 and 12); CPR strain showed 9 bands (2, 3, 4, 6, 8, 9, 10, 11 and 12); CFR strain showed 9 bands (2, 3, 4, 6, 8, 9, 10, 11 and 12) and CYR strain showed 10 bands (1, 2, 3, 5, 8, 9, 10, 11, 12 and 13).

Larvae: The protein profile for DDT, Chloropyrifos, Carbofuran and Cyfluthrin resistant and susceptible strains is presented in Plate 2b, the zymogram for the same has been represented in Fig. 14 and the Relative mobility is given in Table 18. The S strain showed 17 bands (2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 14, 15, 16, 17, 18, 19 and 22); DDR strain showed 17 bands (2, 3, 4, 5, 6, 8, 9, 10, 12, 13, 15, 16, 17, 18, 19, 21 and 22); CPR strain showed 17 bands (2, 3, 4, 5, 6, 8, 9, 10, 12, 13, 15, 16, 17, 18, 19, 20 and 22); CFR strain showed 19 bands (2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 18, 19, 20 and 22) and CYR strain showed 18 bands (1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14, 15, 16, 17, 18, 19 and 22).

Pupae: The protein profile for DDT, Chloropyrifos, Carbofuran and Cyfluthrin resistant and susceptible strains is presented in Plate 2c, the zymogram for the same has been represented in Fig. 15 and the Relative mobility is given in Table 19. The S strain showed 16 bands (2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17 and 20); DDR strain showed 16 bands (2, 3, 4, 5, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19 and 22).
17, 19 and 20); CPR strain showed 16 bands (2, 3, 4, 5, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 19 and 20); CFR strain showed 17 bands (2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18 and 20) and CYR strain showed 17 bands (1, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18 and 20).

Adults: The protein profile for DDT, Chloropyrifos, Carbofuran and Cyfluthrin resistant and susceptible strains is presented in Plate 2d, the zymogram for the same has been represented in Fig. 16 and the Relative mobility is given in Table 20. The S strain showed 10 bands (5, 6, 7, 8, 10, 12, 13, 14, 15 and 16); DDR strain showed 13 bands (1, 2, 3, 4, 5, 6, 7, 8, 10, 13, 14, 15 and 16); CPR strain showed 14 bands (1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 13, 14, 15 and 16); CFR strain showed 14 bands (1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 13, 14, 15 and 16) and CYR strain showed 14 bands (1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 13, 14, 15 and 16).

b. α esterase:

Eggs: The α esterase isozyme for DDT, Chloropyrifos, Carbofuran and Cyfluthrin resistant and susceptible strains is presented in Plate 3a, the zymogram for the same is represented in Fig. 17 and the Rm values are given in Table 21. The S strain showed 5 bands (2, 5, 6, 9 and 12); DDR strain showed 6 bands (1, 3, 4, 6, 8 and 10); CPR strain showed 5 bands (2, 5, 6, 7 and 11); CFR strain showed 5 bands (1, 2, 5, 6, and 10) and CYR strain showed 5 bands (2, 4, 6, 8 and 11).

Larvae: The α esterase isozyme for DDT, Chloropyrifos, Carbofuran and Cyfluthrin resistant and susceptible strains is presented in Plate 3b, the zymogram for the same is represented in Fig. 18 and the Rm values are given in Table 22.
The S strain showed 9 bands (1, 2, 3, 4, 5, 8, 10, 14 and 16); DDR strain showed 12 bands (1, 2, 3, 4, 5, 6, 8, 10, 12, 13, 15 and 17); CPR strain showed 13 bands (1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 14 and 16); CFR strain showed 11 bands (1, 2, 3, 4, 5, 6, 7, 8, 9, 14 and 16) and CYR strain showed 10 bands (1, 2, 3, 4, 5, 6, 8, 11, 14 and 16).

Pupae: The α esterase isozyme for DDT, Chloropyrifos, Carbofuran and Cyfluthrin resistant and susceptible strains is presented in Plate 3c, the zymogram for the same is represented in Fig. 19 and the Rm values are given in Table 23. The S strain showed 5 bands (1, 2, 6, 12 and 14); DDR strain showed 8 bands (1, 3, 6, 8, 10, 11, 12 and 14); CPR strain showed 8 bands (1, 5, 6, 7, 8, 10, 11 and 15); CFR strain showed 7 bands (1, 5, 6, 8, 9, 11 and 13) and CYR strain showed 8 bands (1, 4, 6, 7, 8, 10, 11 and 13).

Adults: The α esterase isozyme for DDT, Chloropyrifos, Carbofuran and Cyfluthrin resistant and susceptible strains is presented in Plate 3d, the zymogram for the same is represented in Fig. 20 and the Rm values are given in Table 24. The S strain showed 7 bands (3, 5, 7, 8, 13, 15 and 16); DDR strain showed 10 bands (1, 2, 3, 5, 7, 9, 11, 13, 15 and 16); CPR strain showed 9 bands (1, 2, 4, 6, 7, 11, 12, 14 and 16); CFR strain showed 10 bands (1, 2, 4, 6, 7, 10, 11, 12, 14 and 16) and CYR strain showed 10 bands (1, 2, 4, 6, 7, 10, 11, 12, 14 and 16).

c. β

Eggs: The β esterase isozyme for DDT, Chloropyrifos, Carbofuran and Cyfluthrin resistant and susceptible strains is given in Plate 4a, the zymogram is
represented in Fig. 21 and the Rm values are given in Table 25. The number of bands in S strain was found to be 3 (2, 5 and 6); DDR strain showed 5 bands (1, 3, 5, 6, and 7); CPR strain showed 3 bands (2, 5 and 6); CFR strain showed 6 bands (1, 2, 4, 5, 6 and 8) and CYR strain showed 3 bands (2, 5, and 6).

Larvae: The β esterase isozyme for DDT, Chloropyrifos, Carbofuran and Cyfluthrin resistant and susceptible strains is given in Plate 4b, the zymogram is represented in Fig. 22 and the Rm values are given in Table 26. The number of bands in S strain was found to be 6 (1, 3, 4, 7, 10 and 13); DDR strain showed 9 bands (1, 3, 4, 6, 7, 9, 10, 11 and 12); CPR strain showed 7 bands (1, 3, 4, 6, 7, 10 and 13); CFR strain showed 10 bands (1, 2, 3, 4, 6, 7, 8, 9, 10 and 13) and CYR strain showed 11 bands (1, 2, 3, 4, 5, 6, 7, 8, 9, 10 and 13).

Pupae: The β esterase isozyme for DDT, Chloropyrifos, Carbofuran and Cyfluthrin resistant and susceptible strains is given in Plate 4c, the zymogram is represented in Fig. 23 and the Rm values are given in Table 27. The number of bands in S strain was found to be 6 (1, 2, 3, 4, 13 and 15); DDR strain showed 8 bands (1, 2, 3, 4, 5, 6, 9 and 14); CPR strain showed 8 bands (1, 2, 3, 4, 5, 7, 10 and 14); CFR strain showed 8 bands (1, 2, 3, 4, 5, 8, 11 and 14) and CYR strain showed 7 bands (1, 2, 3, 4, 5, 12 and 14).

Adults: The β esterase isozyme for DDT, Chloropyrifos, Carbofuran and Cyfluthrin resistant and susceptible strains is given in Plate 4d, the zymogram is represented in Fig. 24 and the Rm values are given in Table 28. The number of bands in S strain was found to be 4 (2, 3, 4, and 9); DDR strain showed 5 bands
(1, 2, 3, 5 and 9); CPR strain showed 7 bands (1, 2, 3, 6, 7, 8 and 9); CFR strain showed 7 bands (1, 2, 3, 6, 7, 8 and 9); and CYR strain showed 7 bands (1, 2, 3, 6, 7, 8 and 9).

d. Acid Phosphatase (Acph):

Eggs: The Acph isozyme for DDT, Chloropyrifos, Carbofuran and Cyfluthrin resistant and susceptible strains is given in Plate 5a, the zymogram is represented in Fig. 25 and the Rm values are given in Table 29. The S strain showed four bands (1, 2, 5 and 6); the DDR strain showed four bands (1, 2, 3 and 7); CPR strain showed three bands (1, 2 and 3); CFR strain showed four bands (1, 2, 4 and 8) and CYR strain showed four bands (1, 2, 5 and 8).

Larvae: The Acph isozyme for DDT, Chloropyrifos, Carbofuran and Cyfluthrin resistant and susceptible strains is given in Plate 5b, the zymogram is represented in Fig. 26 and the Rm values are given in Table 30. The number of bands in S DDR and CPR strains was found to be three (1, 2 and 4); in CFR it was found to be three (1, 2 and 5); in CYR strain also showed 3 bands (1, 2 and 3).

Pupae: The Acph isozyme for DDT, Chloropyrifos, Carbofuran and Cyfluthrin resistant and susceptible strains is given in Plate 5c, the zymogram is represented in Fig. 27 and the Rm values are given in Table 31. The S strain showed two bands (2 and 4); the DDR and CPR strains showed two bands (3 and 4); CFR and CYR strains showed three bands (1, 2 and 4).
Adults: The Acph isozyme for DDT, Chloropyrifos, Carbofuran and Cyfluthrin and susceptible strains is given in Plate 5d, the zymogram is represented in Fig. 28 and the Rm values are given in Table 32. The S strain showed three bands (1, 2 and 3); the DDR strain showed four bands (1, 2, 3 and 5); CPR, CFR and CYR strains showed four bands (1, 2, 3 and 4).

e. Alkaline phosphatase (Aph):

Eggs: The Aph isozyme for DDT, Chloropyrifos, Carbofuran and Cyfluthrin resistant and susceptible strains is given in Plate 6a, the zymogram is represented in Fig. 29 and the Rm values are given in Table 33. The S strain showed three bands (2, 4 and 5); the DDR strain showed three bands (1, 3 and 5); CPR CFR and CYR strains showed three common bands (2, 4 and 6).

Larvae: The Aph isozyme for DDT, Chloropyrifos, Carbofuran and Cyfluthrin resistant and susceptible strains is given in Plate 6b, the zymogram is represented in Fig. 30 and the Rm values are given in Table 34. The number of bands in S strain was found to be three (2, 6 and 10); in DDR it was found to be five (2, 3, 4, 6 and 10); and CPR strain showed nine bands (2, 3, 4, 5, 6, 7, 8, 9 and 11); in CFR it was found seven bands (2, 3, 4, 5, 6, 9 and 11); CYR strain showed eight bands (1, 2, 5, 6, 7, 8, 9 and 11).

Pupae: The Aph isozyme for DDT, Chloropyrifos, Carbofuran and Cyfluthrin resistant and susceptible strains is given in Plate 6c, the zymogram is represented in Fig. 31 and the Rm values are given in Table 35. The number of bands in S strain was found to be three (1, 4 and 5); in DDR and CFR strains it was found to
be four common bands (1, 2, 4 and 6); and CPR and CYR strains showed five bands (1, 2, 3, 4 and 6).

Adults : The Aph isozyme for DDT, Chloropyrifos, Carbofuran and Cyfluthrin resistant and susceptible strains is given in Plate 6d, the zymogram is represented in Fig. 32 and the Rm values are given in Table 36. The susceptible strain showed five bands (1, 2, 3, 6 and 7); in DDR it was found to be six (1, 2, 3, 4, 6 and 7); and CPR and CFR strains showed common six bands (1, 2, 3, 5, 6 and 7) and CYR strain showed all the seven bands (1, 2, 3, 4, 5, 6 and 7).

f. Acetylcholinesterase (AChE) :

Eggs : The AChE enzyme pattern for DDT, Chloropyrifos, Carbofuran and Cyfluthrin resistant and susceptible strains is given in Plate 7a, the zymogram is represented in Fig. 33 and the Rm values are given in Table 37. A single band with relative mobility of 0.44 was observed in both resistant and susceptible strains. However, the expression of this enzyme was reduced among the resistant strain when compared to the susceptible strain.

Larvae : The AChE enzyme pattern for DDT, Chloropyrifos, Carbofuran and Cyfluthrin resistant and susceptible strains is given in Plate 7b, the zymogram is represented in Fig. 34 and the Rm values are given in Table 38. A single band with relative mobility of 0.39 was observed in both resistant and susceptible strains and the expression of this enzyme was reduced among the resistant strain when compared to the susceptible strain.
Papae: The AChE enzyme pattern for DDT, Chloropyrifos, Carbofuran and Cyfluthrin resistant and susceptible strains is given in Plate 7c, the zymogram is represented in Fig. 35 and the Rm values are given in Table 39. A single band with relative mobility of 0.407 was observed in both resistant and susceptible strains and the expression of this enzyme was reduced among the resistant strain when compared to the susceptible strain.

Adults: The AChE enzyme pattern for DDT, Chloropyrifos, Carbofuran and Cyfluthrin resistant and susceptible strains is given in Plate 7d, the zymogram is represented in Fig. 36 and the Rm values are given in Table 40. A single band with relative mobility of 0.358 was observed in both resistant and susceptible strains and the expression of this enzyme was reduced among the resistant strain when compared to the susceptible strain.

g. Lactate dehydrogenase (LDH):

Eggs: The LDH isozyme for DDT, Chloropyrifos, Carbofuran and Cyfluthrin resistant and susceptible strains is given in Plate 8a, the zymogram is represented in Fig. 37 and the Rm values are given in Table 41. Single band was observed in both susceptible and resistant strains with different relative mobility which could be due to an altered enzyme. The S strain showed band 3 with relative mobility (Rm) of 0.547; band 1 was observed in DDR and CPR strains, with Rm value 0.527; band 2 was observed in CFR and CYR strains with Rm value 0.541.

Larvae: The LDH isozyme for DDT, Chloropyrifos, Carbofuran and Cyfluthrin resistant and susceptible strains is given in Plate 8b, the zymogram is represented
in Fig. 38 and the Rm values are given in Table 42. The number of bands in S strain was found to be three (1, 2 and 5); in DDR, CPR and CFR it was found to be two bands (2 and 5); CYR strain showed two bands (3 and 4).

Pupae: The LDH isozyme for DDT, Chloropyrifos, Carbofuran and Cyfluthrin resistant and susceptible strains is given in Plate 8c, the zymogram is represented in Fig. 39 and the Rm values are given in Table 43. No difference was observed in the isozyme pattern in the pupal stage. All the experimental strains showed four zones of activity, bands (1, 2, 3 and 4) were found to be common for S, DDR, CPR, CFR and CYR strains.

Adults: The LDH isozyme for DDT, Chloropyrifos, Carbofuran and Cyfluthrin resistant and susceptible strains is given in Plate 8d, the zymogram is represented in Fig. 40 and the Rm values are given in Table 44. The S strain showed four bands (2, 3, 5 and 7); in DDR it was found to be three (3, 4, and 7); and CPR three bands were observed (3, 6 and 7); and CFR strain showed four bands (1, 3, 4 and 7) and CYR strain showed four bands (1, 3, 6 and 7).

h. Glucose–6-phosphate dehydrogenase (G6pdh):

Eggs: The G6pdh isozyme for DDT, Chloropyrifos, Carbofuran and Cyfluthrin resistant and susceptible strains is given in Plate 9a, the zymogram is represented in Fig. 41 and the Rm values are given in Table 45. The G6pdh showed single band for both the resistant and susceptible strain with different relative mobility. The band 1 was found in S strain, band 2 was found in DDR strain, band 3 was common for CPR, CFR and CYR strains.
Larvae: The G6pdh isozyme for DDT, Chloropyrifos, Carbofuran and Cyfluthrin resistant and susceptible strains is given in Plate 9b, the zymogram is represented in Fig. 42 and the Rm values are given in Table 46. The resistant and susceptible strain showed single band with different relative mobility, S strain showed band 1 with Rm Value 0.225; DDR strain showed band 2 with Rm value 0.23; CPR, CFR and CYR strains showed band 3 with Rm value 0.262.

Pupae: The G6pdh isozyme for DDT, Chloropyrifos, Carbofuran and Cyfluthrin resistant and susceptible strains is given in Plate 9c, the zymogram is represented in Fig. 43 and the Rm values are given in Table 47. Single band was found to be common for S, DDR, CPR, CFR and CYR strains.

Adults: The G6pdh isozyme for DDT, Chloropyrifos, Carbofuran and Cyfluthrin resistant and susceptible strains is given in Plate 9d, the zymogram is represented in Fig. 44 and the Rm values are given in Table 48. Band 1 was found to be common for susceptible and resistant strains. Variation in the intensity and thickness of the band was observed with maximum expression in resistant strains.

i. Xanthine dehydrogenase (Xdh):

Eggs: The Xdh isozyme for DDT, Chloropyrifos, Carbofuran and Cyfluthrin resistant and susceptible strains is given in Plate 10a, the zymogram is represented in Fig. 45 and the Rm values are given in Table 49. The S, DDR, CPR, CFR and CYR strains showed a common band with relative mobility of 0.209.
The Xdh isozyme for DDT, Chloropyrifos, Carbofuran and Cyfluthrin resistant and susceptible strains is given in Plate 10b, the zymogram is represented in Fig. 46 and the Rm values are given in Table 50. A single zone of activity with mobility of 0.24 was to be common for S, DDR, CPR, CFR and CYR strains.

Pupae: The Xdh isozyme for DDT, Chloropyrifos, Carbofuran and Cyfluthrin resistant and susceptible strains is given in Plate 10c, the zymogram is represented in Fig. 47 and the Rm values are given in Table 51. There was a common band for both susceptible and resistant strain with relative mobility of 0.26.

Adults: The Xdh isozyme for DDT, Chloropyrifos, Carbofuran and Cyfluthrin resistant and susceptible strains is given in Plate 10d, the zymogram is represented in Fig. 48 and the Rm values are given in Table 52. The band 1 (Rm-0.089) was observed in S strain and DDR strain; band 2 (Rm-0.115) was observed in CPR, CFR and CYR strains.

5.4 Effect of insecticides on fecundity, egg hatchability and sex-ratio.

Fecundity:

The data on egg production ratio, percent egg hatchability, sex ratio distortion in An. stephensi for three generations (parental, F₁ and F₂) using two sub lethal concentrations of DDT, Chloropyrifos, Carbofuran and Cyfluthrin is given in Tables 53, 54, 55 and 56 respectively. The present investigation revealed that the number of eggs/female for sub lethal concentration of 0.1 ppm of DDT
was found to be 76.44, 78.60 and 81.20; for 0.25 ppm it was found to be 69.28, 68.36 and 70.08; the control showed 98.68, 97.92 and 98.16 for parental, F1 and F2 generations respectively. The decrease in the egg production ratio was found to be 0.77, 0.80 and 0.82 for 0.1 ppm; 0.70, 0.69 and 0.71 for 0.25 ppm for the said generations respectively compared to the control value of 1.0.

Similarly for Chloropyrifos the number of eggs/female was 69.08, 68.48 and 71.96 to 0.001 ppm; 62.10, 62.48 and 64.24 for 0.0025 ppm; 90.10, 95.36 and 93.88 in control for the parental, F1 and F2 generations respectively. The decrease in the egg production ratio was found to be 0.76, 0.71 and 0.76 to 0.001 ppm; 0.68, 0.65 and 0.68 to 0.0025 ppm respectively for the above said generations when compared to the control value of 1.0. For Carbofuran it was found to be 89.08, 87.48 and 94.92 to 0.0025 ppm; 79.92, 78.24 and 79.60 to 0.005 ppm; for the control 92.84, 93.52 and 95.64 eggs/female in the parental, F1 and F2 generations respectively. The decrease in egg production ratio was found to be 0.95, 0.93 and 0.99 to 0.0025 ppm; 0.86, 0.83 and 0.83 to 0.005 ppm respectively for the above said generations in comparison to the control value of 1.0. Cyfluthrin showed 68.76, 66.96 and 69.36 to 0.0001 ppm; 59.64, 58.88 and 59.32 to 0.00025 ppm; 100.64, 99.16 and 102.12 to control respectively in the parental, F1 and F2 generations. The reduced fecundity ratio was found to be 0.68, 0.67 and 0.67 to 0.0001 ppm; 0.59, 0.59 and 0.58 to 0.00025 ppm in comparison with the control value of 1.0 in the above mentioned generations.

The insecticide resistant strains showed reduced fecundity of 76.20 to 3.0 ppm DDT, 66.12 to 0.2 ppm Chloropyrifos, 94.92 to 0.5 ppm Carbofuran and
57.68 to 0.005 ppm Cyfluthrin. The reduced fecundity ratio was found to be 0.74, 0.69, 0.99 and 0.58 respectively for the said insecticide resistant strains with respect to control value of 1.0 (Table 57).

The percent egg hatchability for DDT was found to be 88.12, 85.13 and 87.78 to 0.1 ppm; 81.81, 83.85 and 82.13 to 0.25 ppm; 96.67, 95.95 and 97.84 for control: for Chloropyrifos 84.71, 82.12 and 87.43 to 0.001 ppm; 78.17, 82.45 and 79.45 to 0.0025 ppm; 96.18, 93.91 and 97.86 for control: for Carbofuran 95.50, 91.63 and 92.28 to 0.0025 ppm; 93.94, 92.60 and 94.32 to 0.005 ppm; 96.89, 93.62 and 95.69 for control; for Cyfluthrin 76.26, 76.64 and 79.97 to 0.0001 ppm; 72.16, 71.46 and 72.01 to 0.00025 ppm; 96.10, 95.48 and 94.32 for control respectively in Parental, F₁ and F₂ generations.

The reduced hatchability ratio for DDT was found to be 0.91, 0.88 and 0.89 to 0.1 ppm; 0.84, 0.87 and 0.83 to 0.25 ppm: for Chloropyrifos 0.88, 0.87 and 0.89 to 0.001 ppm; 0.81, 0.87 and 0.81 to 0.0025 ppm: for Carbofuran 0.94, 0.91 and 0.95 to 0.0025 ppm; 0.83, 0.82 and 0.82 to 0.005 ppm: for Cyfluthrin 0.79, 0.80 and 0.84 to 0.0001 ppm; 0.75, 0.74 and 0.76 to 0.00025 with respect to control value of 1.0 in Parental, F₁ and F₂ generations.

The percent hatchability for insecticide resistant strains was 85.93 to 3.0 ppm DDT, 78.16 to 0.2 ppm Chloropyrifos, 92.28 to 0.5 ppm Carbofuran and 77.46 to 0.005 ppm Cyfluthrin. The reduced hatchability ratio was found to be
0.88, 0.81, 0.96 and 0.79 respectively for the said insecticide resistant strains with respect to control value of 1.0 (Table 57).

Sex ratio:

The sex ratio for sub lethal concentrations of DDT was found to be 0.84:1 and 0.90:1; 0.83:1 and 1.07:1; 0.97:1 and 0.85:1 to 0.1 and 0.25 ppm: Chloropyrifos showed 1.13:1 and 0.87:1; 0.87:1 and 0.73:1 ; 1:1 and 0.75:1 to 0.001 and 0.0025 ppm: Carbofuran was 0.91:1 and 0.88:1; 1:1 and 0.91:1; 0.94:1 and 0.94:1 0.0025 and 0.005 ppm: for Cyfluthrin it was observed that 0.93:1 and 1.17:1; 0.73:1 and 1.2:1; 0.89:1 and 1.09:1 to 0.0001 and 0.00025 ppm respectively for males to females in parental, F1 and F2 generations. The sex ratio for DDT resistant strain was 0.94:1, 0.84:1 for Chloropyrifos resistant strain, 0.94:1 for Carbofuran resistant strain and 0.85:1 in case of cyfluthrin resistant strain for males: females respectively (Table 57).
Table 1: Development of DDT Resistance in *An. stephensi*

<table>
<thead>
<tr>
<th>Generation</th>
<th>Concentration (ppm)</th>
<th>Resistant strain Resistance (%)</th>
<th>Susceptible strain Susceptibility (%)</th>
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</thead>
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<td>No. of Larvae tested*</td>
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<td>♂ ♂ ♀ ♀ Total %</td>
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R- Resistant  S- Susceptible

* Third instar larvae exposed to 3.0 ppm for 24 h.
Fig. 1: Dosage - mortality relationships of DDT - resistant and susceptible strains of *An. stephensi*.
Table 3: Development of Chloropyrifos Resistance in *An. stephensi*

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<tr>
<th>Generation</th>
<th>Concentration (ppm)</th>
<th>Resistant strain Resistance (%)</th>
<th>Susceptible strain Susceptibility (%)</th>
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R - Resistant
S - Susceptible
* Third instar larvae exposed to 0.2 ppm for 24 h.
Concentration of Chlomphyrifos (ppm)

Fig. 2: Dosage - mortality relationships of Chlorophyrifos - resistant and susceptible strains of An. stephensi.

S - Susceptible, R - Resistant
5: Development of Carbofuran Resistance in *An. stephensi*

<table>
<thead>
<tr>
<th>Generation</th>
<th>Concentration (ppm)</th>
<th>Resistant strain Resistance (%)</th>
<th>Susceptible strain Susceptibility (%)</th>
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<td>F18</td>
<td>0.5</td>
<td>100.00</td>
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<td>100.00</td>
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Table 6: Inheritance pattern of Carbofuran Resistance in *An. stephensi*

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<th>Sl No</th>
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<th>No. of *♀’s tested</th>
<th>No. of Larvae tested*</th>
<th>Resistant</th>
<th>Susceptible</th>
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</table>

R- Resistant   S- Susceptible
* Third instar larvae exposed to 0.5 ppm for 24 h.
Concentration of Carbofuran (ppm)

S - Susceptible, R - Resistant

Fig. 3: Dosage-mortality relationships of Carbofuran-resistant and susceptible strains of An. stephensi.
Table 7: Development of Cyfluthrin resistance in *An. stephensi*

<table>
<thead>
<tr>
<th>Iteration</th>
<th>Concentration (ppm)</th>
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<td>Resistance (%)</td>
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Table 8: Inheritance pattern of Cyfluthrin resistance in *An. stephensi*

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<th>No. of Larvae tested*</th>
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<tr>
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<td>F1♂ X F1♀ (cross 3)</td>
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<td>263</td>
<td>259</td>
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<td>53.98</td>
<td>213</td>
<td>232</td>
<td>445</td>
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</table>

R- Resistant  S- Susceptible
* Third instar larvae exposed to 0.005 ppm for 24 h.*
Fig. 4: Dosage-mortality relationships of cyfluthrin - resistant and susceptible strains of *An. stephensi*. 

S - Susceptible, R - Resistant
Table 9: Total protein (Tp) profile (in μg/mg of body weight) in the developmental stages of the Susceptible, DDT, Chlorpyrifos, Carbofuran and Cyfluthrin resistant strains of An. stephensi

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Stage</th>
<th>S</th>
<th>DDR</th>
<th>CPR</th>
<th>CFR</th>
<th>CYR</th>
<th>Percent increase over susceptible</th>
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<td></td>
<td></td>
<td>DDR♂</td>
<td>CPR♂</td>
<td>CFR♂</td>
<td>CYR♂</td>
<td>DDR♂</td>
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<td><strong>43.8±0.3</strong></td>
<td><strong>46.3±0.7</strong></td>
<td><strong>45.9±1.1</strong></td>
<td><strong>45.5±0.9</strong></td>
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<td>DDR♂</td>
<td>CPR♂</td>
<td>CFR♂</td>
<td>CYR♂</td>
<td>DDR♂</td>
</tr>
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<td><strong>102.7±1.5</strong></td>
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<td><strong>81.7±2.0</strong></td>
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<td><strong>93.1±0.7</strong></td>
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<td>DDR♀</td>
<td>CPR♀</td>
<td>CFR♀</td>
<td>CYR♀</td>
<td>DDR♀</td>
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<td><strong>94.7±1.2</strong></td>
<td><strong>97.8±1.8</strong></td>
<td><strong>105.8±4.9</strong></td>
<td><strong>103.9±2.9</strong></td>
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<td><strong>86.8±0.4</strong></td>
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<td><strong>93.3±1.9</strong></td>
<td><strong>95.7±0.5</strong></td>
<td><strong>15.73</strong></td>
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<td><strong>120.6±1.4</strong></td>
<td><strong>124.8±1.0</strong></td>
<td><strong>124.8±2.9</strong></td>
<td><strong>20.27</strong></td>
</tr>
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</table>

S: Susceptible; DDR: DDT resistant; CPR: Chlorpyrifos resistant; CFR: Carbofuran resistant; CYR: Cyfluthrin resistant strains

Values are mean ± SD based on six observations

* Significant (P<0.05)
Figure 5: Histogram showing the Total Protein (Top) (μg/mg of body weight) in the developmental stages of Susceptible (S), DDT (DDR), Chloropyrifos (CPR), Carbofuran (CFR) and Cyfluthrin (CYR) resistant strains of *An. stephensi*.
Table 10: Soluble protein (Sop) profile (in μg/mg body weight) in the developmental stages of the Susceptible, DDT, Chloropyrifos, Carbofuran and Cyfluthrin resistant strains of An. stephensi

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Stage</th>
<th>S</th>
<th>DDR</th>
<th>CPR</th>
<th>CFR</th>
<th>CYR</th>
<th>Percent increase over susceptible</th>
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</thead>
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<td></td>
<td></td>
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<td>DDR♂</td>
<td>CPR♂</td>
<td>CFR♂</td>
<td>CYR♂</td>
<td>DDR♂</td>
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<td>42.5±1.2*</td>
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<td>82.7±2.1*</td>
<td>85.5±2.1*</td>
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<td>Pupae</td>
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<td>63.2±2.2</td>
<td>77.6±3.3*</td>
<td>83.1±1.1*</td>
<td>81.7±2.3*</td>
<td>82.8±1.2*</td>
<td>22.78</td>
</tr>
<tr>
<td></td>
<td></td>
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<td>DDR♀</td>
<td>CPR♀</td>
<td>CFR♀</td>
<td>CYR♀</td>
<td>DDR♀</td>
</tr>
<tr>
<td>5</td>
<td>Larvae</td>
<td>76.7±0.0</td>
<td>88.9±1.4*</td>
<td>96.4±4.6*</td>
<td>96.9±0.5*</td>
<td>95.6±0.9*</td>
<td>15.90</td>
</tr>
<tr>
<td>6</td>
<td>Pupae</td>
<td>69.9±3.4</td>
<td>80.8±4.5*</td>
<td>81.7±0.0*</td>
<td>80.1±4.7*</td>
<td>81.5±5.1*</td>
<td>15.59</td>
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<tr>
<td>7</td>
<td>Adults</td>
<td>71.7±2.7</td>
<td>83.5±3.0*</td>
<td>86.8±1.1*</td>
<td>85.1±5.0*</td>
<td>87.4±1.9*</td>
<td>16.45</td>
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</tbody>
</table>

S: Susceptible; DDR: DDT resistant; CPR: Chloropyrifos resistant; CFR: Carbofuran resistant; CYR: Cyfluthrin resistant strains

Values are mean ± SD based on six observations

* Significant (P<0.05)
Figure 6: Histogram showing the Soluble Protein (Sop) (μg/mg of body weight) in the developmental stages of Susceptible (S), DDT (DDR), Chloropyrifos (CPR), Carbofuran (CFR) and Cyfluthrin (CYR) resistant strains of *An. stephensi*. 
Table 11: α esterases profile (in n moles of α naphthyl acetate hydrolyzed /μg protein/min) in the developmental stages of the Susceptible, DDT, Chloropyrifos, Carbofuran and Cyfluthrin resistant strains of *An. stephensi*

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Stage</th>
<th>S</th>
<th>DDR</th>
<th>CPR</th>
<th>CFR</th>
<th>CYR</th>
<th>Percent increase over susceptible</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
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<td></td>
<td>DDR</td>
</tr>
<tr>
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<td>Eggs</td>
<td>155±5</td>
<td>191±4*</td>
<td>199±10*</td>
<td>202±5*</td>
<td>201±6*</td>
<td>23.22</td>
</tr>
<tr>
<td></td>
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<td>DDR♂</td>
<td>CPR♂</td>
<td>CFR♂</td>
<td>CYR♂</td>
<td>DDR♂</td>
</tr>
<tr>
<td>2</td>
<td>Larvae</td>
<td>645±10</td>
<td>878±5*</td>
<td>949±2*</td>
<td>956±3*</td>
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<td>781±10*</td>
<td>797±1*</td>
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<td>796±5*</td>
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<tr>
<td>4</td>
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<td>900±5</td>
<td>1160±10*</td>
<td>1172±10*</td>
<td>1192±5*</td>
<td>1165±10*</td>
<td>28.88</td>
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<tr>
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<td>S♀</td>
<td>DDR♀</td>
<td>CPR♀</td>
<td>CFR♀</td>
<td>CYR♀</td>
<td>DDR♀</td>
</tr>
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<td>701±2</td>
<td>896±7*</td>
<td>1003±2*</td>
<td>1034±7*</td>
<td>1009±1*</td>
<td>27.81</td>
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<tr>
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<td>Pupae</td>
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<td>801±2*</td>
<td>878±2*</td>
<td>817±10*</td>
<td>815±20*</td>
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</tr>
<tr>
<td>7</td>
<td>Adults</td>
<td>930±10</td>
<td>1190±3*</td>
<td>1205±5*</td>
<td>1188±5*</td>
<td>1172±10*</td>
<td>27.95</td>
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</table>

S: Susceptible; DDR: DDT resistant; CPR: Chloropyrifos resistant; CFR: Carbofuran resistant; CYR: Cyfluthrin resistant strains

Values are mean ± SD based on six observations

* Significant (P<0.05)
Figure 7: Histogram showing the α esterase activity (in n moles of α naphthyl acetate hydrolyzed / μg protein/ min) in the developmental stages of Susceptible (S), DDT (DDR), Chloropyrifos (CPR), Carbofuran (CFR) and Cyfluthrin (CYR) resistant strains of *An. stephensi*. 
Table 12: β esterases profile (in n moles of β naphthyl acetate hydrolyzed /μg protein/min) in the developmental stages of the Susceptible, DDT, Chloropyrifos, Carbofuran and Cyfluthrin resistant strains of *An. stephensi*

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Stage</th>
<th>S</th>
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<th>CPR</th>
<th>CFR</th>
<th>CYR</th>
<th>Percent increase over susceptible</th>
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<tbody>
<tr>
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<td>Larvae</td>
<td>483±4</td>
<td>587±2*</td>
<td>596±3*</td>
<td>605±3*</td>
<td>599±2*</td>
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<td>Pupae</td>
<td>490±5</td>
<td>589±6*</td>
<td>598±9*</td>
<td>605±8*</td>
<td>603±7*</td>
<td>20.53</td>
</tr>
<tr>
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<td>555±3</td>
<td>671±4*</td>
<td>672±10*</td>
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<td>665±11*</td>
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</table>

<table>
<thead>
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<th>Sl. No.</th>
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<th>Female</th>
<th>Male</th>
<th>Female</th>
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<tbody>
<tr>
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<td>DDR♂</td>
<td>CPR♂</td>
<td>CFR♂</td>
<td>CYR♂</td>
</tr>
<tr>
<td>6</td>
<td>Pupae</td>
<td>491±15</td>
<td>608±4*</td>
<td>600±3*</td>
<td>609±7*</td>
</tr>
<tr>
<td>7</td>
<td>Adults</td>
<td>597±15</td>
<td>730±14*</td>
<td>737±6*</td>
<td>739±15*</td>
</tr>
</tbody>
</table>

S: Susceptible; DDR: DDT resistant; CPR: Chloropyrifos resistant; CFR: Carbofuran resistant; CYR: Cyfluthrin resistant strains

Values are mean ± SD based on six observations

* Significant (P<0.05)
Figure 8: Histogram showing the β esterase activity (in n moles of β naphthyl acetate hydrolyzed/μg protein/min) in the developmental stages of Susceptible (S), DDT (DDR), Chloropyrifos (CPR), Carbofuran (CFR) and Cyfluthrin (CYR) resistant strains of An. stephensi.
Table 13: Acid phosphatase profile (in n moles of α-naphthol released/µg protein/min) in the developmental stages of the Susceptible, DDT, Chloropyrifos, Carbofuran and Cyfluthrin resistant strains of An. stephensi

<table>
<thead>
<tr>
<th>SL No.</th>
<th>Stage</th>
<th>S</th>
<th>DDR</th>
<th>CPR</th>
<th>CFR</th>
<th>CYR</th>
<th>Percent increase over susceptible</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
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<td></td>
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<td></td>
<td>DDR</td>
</tr>
<tr>
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<td>93±8*</td>
<td>97±4*</td>
<td>95±10*</td>
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</tr>
<tr>
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<td>DDR♂</td>
<td>CPR♂</td>
<td>CFR♂</td>
<td>CYR♂</td>
<td>DDR♂</td>
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<tr>
<td></td>
<td></td>
<td>193±2</td>
<td>229±5*</td>
<td>232±7*</td>
<td>246±5*</td>
<td>236±3</td>
<td>18.65</td>
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<td>Larvae</td>
<td>202±2</td>
<td>239±3</td>
<td>253±7*</td>
<td>249±5*</td>
<td>253±6*</td>
<td>18.31</td>
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<td>234±1</td>
<td>232±3</td>
<td>237±6*</td>
<td>240±4*</td>
<td>17.00</td>
</tr>
<tr>
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<td>DDR♀</td>
<td>CPR♀</td>
<td>CFR♀</td>
<td>CYR♀</td>
<td>DDR♀</td>
</tr>
<tr>
<td></td>
<td></td>
<td>207±6</td>
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<td>269±6*</td>
<td>259±1*</td>
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<td>250±7*</td>
<td>257±5*</td>
<td>265±9</td>
<td>249±1</td>
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</tr>
</tbody>
</table>

S: Susceptible; DDR: DDT resistant; CPR: Chloropyrifos resistant; CFR: Carbofuran resistant; CYR: Cyfluthrin resistant strains

Values are mean ± SD based on six observations

* Significant (P<0.05)
Figure 5: Histogram showing the Acid phosphatase enzyme activity (in n moles of α naphthol released/µg protein/min) in the developmental stages of Susceptible (S), DDT (DDR), Chloropyrifos (CPR), Carbofuran (CFR) and Cyfluthrin (CYR) resistant strains of An. stephensi.
Table 14: Alkaline phosphatase profile (in n moles of α naphthol released/μg protein/min) in the developmental stages of the Susceptible, DDT, Chloropyrifos, Carbofuran and Cyfluthrin resistant strains of *An. stephensi*

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Stage</th>
<th>S</th>
<th>DDR</th>
<th>CPR</th>
<th>CFR</th>
<th>CYR</th>
<th>Percent increase over susceptible</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>DDR</td>
</tr>
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<td>85±9</td>
<td>96±8*</td>
<td>101±4*</td>
<td>100±5*</td>
<td>104±2*</td>
<td>12.94</td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
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<td>Larvae</td>
<td>234±3</td>
<td>281±4*</td>
<td>290±9*</td>
<td>290±8*</td>
<td>289±7*</td>
<td>20.08</td>
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<td>249±5*</td>
<td>267±9*</td>
<td>262±10*</td>
<td>261±11*</td>
<td>13.18</td>
</tr>
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<td>232±10</td>
<td>281±1*</td>
<td>281±5*</td>
<td>283±5*</td>
<td>284±6*</td>
<td>21.12</td>
</tr>
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<td></td>
<td></td>
<td>DDR♀</td>
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<td>244±8</td>
<td>297±5*</td>
<td>303±8*</td>
<td>305±6*</td>
<td>297±5*</td>
<td>21.72</td>
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<td>284±5*</td>
<td>293±4*</td>
<td>284±6*</td>
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<td>308±9*</td>
<td>306±4*</td>
<td>299±10*</td>
<td>23.97</td>
</tr>
</tbody>
</table>

S: Susceptible; DDR: DDT resistant; CPR: Chloropyrifos resistant; CFR: Carbofuran resistant; CYR: Cyfluthrin resistant strains

Values are mean ± SD based on six observations

* Significant (P<0.05)
Figure 10: Histogram showing the Alkaline phosphatase enzyme activity (in n moles of α-naphthol released/μg protein/min) in the developmental stages of Susceptible (S), DDT (DDR), Chloropyrifos (CPR), Carbofuran (CFR) and Cyfluthrin (CYR) resistant strains of *Ae. stephensi*. 
Table 15: Acetylcholinesterase (AChE) profile (in n moles acetyl thiocholine hydrolyzed /mg protein/min) in the developmental stages of the Susceptible, DDT, Chloropyrifos, Carbofuran and Cyfluthrin resistant strains of *An. stephensi*

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Stage</th>
<th>S</th>
<th>DDR</th>
<th>CPR</th>
<th>CFR</th>
<th>CYR</th>
<th>Percent increase over susceptible</th>
</tr>
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<tbody>
<tr>
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<td></td>
<td>DDR</td>
</tr>
<tr>
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<td>20.2±0.8</td>
<td>15.1±0.4*</td>
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<td>15.3±0.2*</td>
<td>15.2±0.2*</td>
<td>-25.24</td>
</tr>
<tr>
<td>3</td>
<td>Pupae</td>
<td>21.6±0.5</td>
<td>15.9±0.3*</td>
<td>16.3±0.9*</td>
<td>16.0±0.5*</td>
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<td>23.6±0.4</td>
<td>16.1±0.3*</td>
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<td>16.5±0.2*</td>
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<td>-31.78</td>
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**Male**

<table>
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<th></th>
<th>S♂</th>
<th>DDR♂</th>
<th>CPR♂</th>
<th>CFR♂</th>
<th>CYR♂</th>
<th>DDR♂</th>
<th>CPR♂</th>
<th>CFR♂</th>
<th>CYR♂</th>
</tr>
</thead>
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<td>21.4±0.1</td>
<td>15.9±0.4*</td>
<td>16.5±0.5*</td>
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<td>16.1±0.3*</td>
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<td>-22.89</td>
<td>-24.77</td>
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<tr>
<td>6</td>
<td>Pupae</td>
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<td>16.1±0.5*</td>
<td>16.7±0.4*</td>
<td>16.7±0.7*</td>
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<td>-26.81</td>
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<td>-24.09</td>
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<tr>
<td>7</td>
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<td>16.8±0.6*</td>
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<td>-25.94</td>
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**Female**

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<th>CPR♀</th>
<th>CFR♀</th>
<th>CYR♀</th>
<th>DDR♀</th>
<th>CPR♀</th>
<th>CFR♀</th>
<th>CYR♀</th>
</tr>
</thead>
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<tr>
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<td>16.7±0.4*</td>
<td>16.7±0.7*</td>
<td>16.5±0.1*</td>
<td>-26.81</td>
<td>-24.09</td>
<td>-24.09</td>
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<tr>
<td>7</td>
<td>Adults</td>
<td>23.9±0.8</td>
<td>17.5±0.3*</td>
<td>16.9±0.1*</td>
<td>17.7±0.7*</td>
<td>16.8±0.6*</td>
<td>-26.78</td>
<td>-29.29</td>
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</table>

S: Susceptible; DDR: DDT resistant; CPR: Chloropyrifos resistant; CFR: Carbofuran resistant; CYR: Cyfluthrin resistant strains

Values are mean ± SD based on six observations

* Significant (P<0.05)
Figure 11: Histogram showing Acetylcholinesterase (AChE) profile (n moles acetyl thiocholine hydrolyzed/mg protein/min) in the developmental stages of Susceptible (S), DDT (DDR), Chloropyrifos (CPR), Carbofuran (CFR) and Cyfluthrin (CYR) resistant strains of *An. stephensi*. 
Table 16: Lactate dehydrogenase (LDH) profile (in µg pyruvate converted /µg protein/min) in the developmental stages of the Susceptible, DDT, Chlorpyrifos, Carbofuran and Cyfluthrin resistant strains of *An. stephensi*

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Stage</th>
<th>S</th>
<th>DDR</th>
<th>CPR</th>
<th>CFR</th>
<th>CYR</th>
<th>Percent increase over susceptible</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DDR</td>
</tr>
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<td>0.39±0.04*</td>
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S: Susceptible; DDR: DDT resistant; CPR: Chlorpyrifos resistant; CFR: Carbofuran resistant; CYR: Cyfluthrin resistant strains

Values are mean ± SD based on six observations

* Significant (P<0.05)
Figure 12: Histogram showing Lactate dehydrogenase (LDH) activity (in μg pyruvate converted/μg protein/min) in the developmental stages of Susceptible (S), DDT (DDR), Chloropyrifos (CPR), Carbofuran (CFR) and Cyfluthrin (CYR) resistant strains of *An. stephensi*. 
PLATE II:

Electrophoretic pattern of Protein profile in the eggs of DDT, Chloropyrifos, Cyfluthrin Resistant and Susceptible strains of *An. stephensi*.

b. Electrophoretic pattern of Protein profile in the larvae of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of *An. stephensi*.

c. Electrophoretic pattern of Protein profile in the pupae of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of *An. stephensi*.

d. Electrophoretic pattern of Protein profile in the adults of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of *An. stephensi*.

S: Susceptible; DDR: DDT resistant; CPR: Chloropyrifos resistant; CFR: Carbofuran resistant; CYR: Cyfluthrin resistant
Fig 13: Zymogram showing the protein profile in the eggs of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of *An. stephensi*.

Fig 14: Zymogram showing the protein profile in the larvae of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of *An. stephensi*.

*S*: Susceptible  
*DDR*: DDT resistant  
*CPR*: Chloropyrifos resistant  
*CFR*: Carbofuran resistant  
*CYR*: Cyfluthrin resistant  

- **faint band**  
- **light band**  
- **medium band**  
- **dark band**
Table 17: Relative mobility (Rm) values of Protein profile in the eggs of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Susceptible and Resistant strains of *An. stephensi*.

<table>
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<th>CFR</th>
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*S*: Susceptible  
*CFR*: Carbofuran resistant  
*DDR*: DDT resistant  
*CPR*: Chloropyrifos resistant  
*CYR*: Cyfluthrin resistant
Table 18: Relative mobility (Rm) values of Protein profile in the larvae of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Susceptible and Resistant strains of An. stephensi.

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S: Susceptible  
DDR: DDT resistant  
CPR: Chloropyrifos resistant  
CFR: Carbofuran resistant  
CYR: Cyfluthrin resistant
Fig 15: Zymogram showing the protein profile in the pupae of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of *An. stephensi*.

Fig 16: Zymogram showing the protein profile in the adults of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of *An. stephensi*.

S: Susceptible  
CPR: Carbofuran resistant  
CFR: Cyfluthrin resistant  
DDR: DDT resistant  
CYR: Chloropyrifos resistant  
- - : faint band  
- - : light band  
- - : medium band  
- - : dark band
Table 19: Relative mobility (Rm) values of Protein profile in the pupae of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Susceptible and Resistant strains of *An. stephensi*.

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S: Susceptible  
DDR: DDT resistant  
CPR: Chloropyrifos resistant  
CPR: Carbofuran resistant  
CYR: Cyfluthrin resistant
Table 20: Relative mobility (Rm) values of Protein profile in the adults of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Susceptible and Resistant strains of *An. stephensi*.

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<th>Female</th>
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<td>S DDR CPR CFR CYR</td>
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S: Susceptible  
DDR: DDT resistant  
CPR: Chloropyrifos resistant  
CFR: Carbofuran resistant  
CYR: Cyfluthrin resistant
PLATE III:

a. Electrophoretic pattern of α - Esterase profile in the eggs of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of An. stephensi.

b. Electrophoretic pattern of α - Esterase profile in the larvae of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of An. stephensi.

c. Electrophoretic pattern of α - Esterase profile in the pupae of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of An. stephensi.

d. Electrophoretic pattern of α - Esterase profile in the adults of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of An. stephensi.

S: Susceptible; DDR: DDT resistant; CPR: Chloropyrifos resistant; CFR: Carbofuran resistant; CYR: Cyfluthrin resistant
Fig 17: Zymogram showing the α-Esterase profile in the eggs of DDT, Chlorpyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of *An. stephensi*.

![Zymogram showing α-Esterase profile in the eggs of DDT, Chlorpyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of *An. stephensi*.](image1)

Fig 18: Zymogram showing the α-Esterase profile in the larvae of DDT, Chlorpyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of *An. stephensi*.

![Zymogram showing α-Esterase profile in the larvae of DDT, Chlorpyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of *An. stephensi*.](image2)

- **S**: Susceptible
- **CFR**: Carbofuran resistant
- **DDR**: DDT resistant
- **CPR**: Chlorpyrifos resistant
- **CYR**: Cyfluthrin resistant
- **faint band**: light band
- **light band**: medium band
- **medium band**: dark band
Table 21: Relative mobility (Rm) values of α-Esterase profile in the eggs of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Susceptible and Resistant strains of An. stephensi.

<table>
<thead>
<tr>
<th>Band</th>
<th>Rm</th>
<th>S</th>
<th>DDR</th>
<th>CPR</th>
<th>CFR</th>
<th>CYR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>0.153</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>2.</td>
<td>0.320</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>3.</td>
<td>0.346</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4.</td>
<td>0.538</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>5.</td>
<td>0.564</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>6.</td>
<td>0.628</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>7.</td>
<td>0.705</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>8.</td>
<td>0.717</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>9.</td>
<td>0.730</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>10.</td>
<td>0.743</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>11.</td>
<td>0.769</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>12.</td>
<td>0.782</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 22: Relative mobility (Rm) values of α-Esterase profile in the larvae of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Susceptible and Resistant strains of An. stephensi.

| Band | Rm | Male | | Female |
|------|----|------|------|
| S    | DDR| CPR  | CFR  | CYR | S | DDR| CPR  | CFR  | CYR |
| 1.   | 0.11| +    | +    | +    | +  | +  | +    | +    | +    |
| 2.   | 0.15| +    | +    | +    | +  | +  | +    | +    | +    |
| 3.   | 0.33| +    | +    | +    | +  | +  | +    | +    | +    |
| 4.   | 0.37| +    | +    | +    | +  | +  | +    | +    | +    |
| 5.   | 0.5 | +    | +    | +    | +  | +  | +    | +    | +    |
| 6.   | 0.65| -    | +    | +    | +  | -  | +    | +    | +    |
| 7.   | 0.66| -    | -    | +    | -  | -  | +    | +    | -    |
| 8.   | 0.68| +    | +    | +    | +  | +  | +    | +    | +    |
| 9.   | 0.70| -    | -    | +    | -  | -  | +    | +    | -    |
| 10.  | 0.72| +    | +    | +    | -  | +  | +    | +    | -    |
| 11.  | 0.73| -    | -    | +    | -  | -  | +    | +    | -    |
| 12.  | 0.74| -    | +    | -    | -  | -  | +    | -    | -    |
| 13.  | 0.76| -    | +    | -    | -  | -  | +    | -    | -    |
| 14.  | 0.77| +    | +    | +    | -  | +  | +    | -    | -    |
| 15.  | 0.80| -    | +    | -    | -  | -  | +    | -    | -    |
| 16.  | 0.81| +    | -    | +    | +  | -  | +    | +    | +    |
| 17.  | 0.85| -    | +    | -    | -  | +  | -    | -    | -    |

S: Susceptible  DDR: DDT resistant  CPR: Chloropyrifos resistant
CFR: Carbofuran resistant  CYR: Cyfluthrin resistant
Fig 19: Zymogram showing the α-Esterase profile in the pupae of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of An. stephensi.

Fig 20: Zymogram showing the α-Esterase profile in the adults of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of An. stephensi.

S: Susceptible
DDR: DDT resistant
CPR: Chloropyrifos resistant
CFR: Carbofuran resistant
CYR: Cyfluthrin resistant

- - - - : faint band
- - - : light band
- - - - : medium band
- - - - - : dark band
Table 23: Relative mobility (Rm) values of α-Esterase profile in the pupae of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Susceptible and Resistant strains of *An. stephensi*.

<table>
<thead>
<tr>
<th>Band</th>
<th>Rm</th>
<th>Male</th>
<th></th>
<th>Female</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>DDR</td>
<td>CPR</td>
<td>CFR</td>
<td>CYR</td>
</tr>
<tr>
<td>1.</td>
<td>0.12</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>2.</td>
<td>0.33</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3.</td>
<td>0.36</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>4.</td>
<td>0.37</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>5.</td>
<td>0.38</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>6.</td>
<td>0.47</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>7.</td>
<td>0.64</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>8.</td>
<td>0.65</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>9.</td>
<td>0.68</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>10.</td>
<td>0.69</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>11.</td>
<td>0.72</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>12.</td>
<td>0.74</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>13.</td>
<td>0.75</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>14.</td>
<td>0.78</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>15.</td>
<td>0.79</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 24: Relative mobility (Rm) values of α-Esterase profile in the adults of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Susceptible and Resistant strains of *An. stephensi*.

<table>
<thead>
<tr>
<th>Band</th>
<th>Rm</th>
<th>Male</th>
<th></th>
<th>Female</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>DDR</td>
<td>CPR</td>
<td>CFR</td>
<td>CYR</td>
</tr>
<tr>
<td>1.</td>
<td>0.075</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>2.</td>
<td>0.112</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>3.</td>
<td>0.312</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4.</td>
<td>0.318</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>5.</td>
<td>0.387</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>6.</td>
<td>0.4</td>
<td>-</td>
<td>-</td>
<td>+</td>
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</tr>
<tr>
<td>7.</td>
<td>0.512</td>
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<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>8.</td>
<td>0.587</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>9.</td>
<td>0.593</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>10.</td>
<td>0.6</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>11.</td>
<td>0.612</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>12.</td>
<td>0.637</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>13.</td>
<td>0.65</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>14.</td>
<td>0.687</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>15.</td>
<td>0.7</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>16.</td>
<td>0.762</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

S: Susceptible  DDR: DDT resistant  CPR: Chloropyrifos resistant
CFR: Carbofuran resistant  CYR: Cyfluthrin resistant
PLATE IV:

a. Electrophoretic pattern of β- Esterase profile in the eggs of DDT, Chlorpyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of *An. stephensi*.

b. Electrophoretic pattern of β - Esterase profile in the larvae of DDT, Chlorpyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of *An. stephensi*.

c. Electrophoretic pattern of β - Esterase profile in the pupae of DDT, Chlorpyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of *An. stephensi*.

d. Electrophoretic pattern of β - Esterase profile in the adults of DDT, Chlorpyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of *An. stephensi*.

S: Susceptible; DDR: DDT resistant; CPR: Chloropyrifos resistant; CFR: Carbofuran resistant; CYR: Cyfluthrin resistant
Fig 21: Zymogram showing the of β-Esterase profile in the eggs of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of *An. stephensi*.

Fig 22: Zymogram showing the of β-Esterase profile in the larvae of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of *An. stephensi*.

---

S: Susceptible  
CPR: Carbofuran resistant  
DDR: DDT resistant  
CYR: Cyfluthrin resistant  

---

: faint band  
: light band  
: medium band  
: dark band
Table 25: Relative mobility (Rm) values of β-Esterase profile in the eggs of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Susceptible and Resistant strains of An. stephensi.

<table>
<thead>
<tr>
<th>Band</th>
<th>Rm</th>
<th>S</th>
<th>DDR</th>
<th>CPR</th>
<th>CFR</th>
<th>CYR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>0.171</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>2.</td>
<td>0.421</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>3.</td>
<td>0.447</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4.</td>
<td>0.526</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>5.</td>
<td>0.552</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>6.</td>
<td>0.592</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>7.</td>
<td>0.842</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>8.</td>
<td>0.855</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 26: Relative mobility (Rm) values of β-Esterase profile in the larvae of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Susceptible and Resistant strains of An. stephensi.

<table>
<thead>
<tr>
<th>Band</th>
<th>Rm</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>S</td>
<td>DDR</td>
</tr>
<tr>
<td>1.</td>
<td>0.079</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>2.</td>
<td>0.14</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3.</td>
<td>0.37</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>4.</td>
<td>0.51</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>5.</td>
<td>0.65</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>6.</td>
<td>0.67</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>7.</td>
<td>0.69</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>8.</td>
<td>0.72</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>9.</td>
<td>0.75</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>10.</td>
<td>0.77</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>11.</td>
<td>0.81</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>12.</td>
<td>0.83</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>13.</td>
<td>0.84</td>
<td>+</td>
<td>-</td>
</tr>
</tbody>
</table>

S: Susceptible  DDR: DDT resistant  CPR: Chloropyrifos resistant
CFR: Carbofuran resistant  CYR: Cyfluthrin resistant
Fig 23: Zymogram showing the of β-Esterase profile in the pupae of DDT, Chlorpyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of An. stephensi.

Fig 24: Zymogram showing the of β-Esterase profile in the adults of DDT, Chlorpyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of An. stephensi.

S : Susceptible  DDR : DDT resistant  CPR : Chlorpyrifos resistant
CFR : Carbofuran resistant  CYR : Cyfluthrin resistant

: faint band  : light band  : medium band  : dark band
Table 27: Relative mobility (Rm) values of β-Esterase profile in the pupae of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Susceptible and Resistant strains of *An. stephensi*.

<table>
<thead>
<tr>
<th>Band</th>
<th>Rm</th>
<th>Male</th>
<th></th>
<th>Female</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>S</td>
<td>DDR</td>
<td>CPR</td>
<td>CFR</td>
</tr>
<tr>
<td>1.</td>
<td>0.13</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>2.</td>
<td>0.34</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>3.</td>
<td>0.47</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>4.</td>
<td>0.63</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>5.</td>
<td>0.67</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>6.</td>
<td>0.70</td>
<td>-</td>
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<td>-</td>
<td>-</td>
</tr>
<tr>
<td>7.</td>
<td>0.73</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>8.</td>
<td>0.74</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>9.</td>
<td>0.75</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>10.</td>
<td>0.77</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>11.</td>
<td>0.79</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>12.</td>
<td>0.80</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>13.</td>
<td>0.81</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>14.</td>
<td>0.82</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>15.</td>
<td>0.83</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 28: Relative mobility (Rm) values of β-Esterase profile in the adults of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Susceptible and Resistant strains of *An. stephensi*.

<table>
<thead>
<tr>
<th>Band</th>
<th>Rm</th>
<th>Male</th>
<th></th>
<th>Female</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>S</td>
<td>DDR</td>
<td>CPR</td>
<td>CFR</td>
</tr>
<tr>
<td>1.</td>
<td>0.2</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>2.</td>
<td>0.37</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>3.</td>
<td>0.45</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>4.</td>
<td>0.66</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>5.</td>
<td>0.67</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>6.</td>
<td>0.68</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>7.</td>
<td>0.71</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>8.</td>
<td>0.75</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>9.</td>
<td>0.8</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

S: Susceptible  
DDR: DDT resistant  
CPR: Chloropyrifos resistant  
CFR: Carbofuran resistant  
CYR: Cyfluthrin resistant
PLATE V:

a. Electrophoretic pattern of Acid phosphatase profile in the eggs of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of *An. stephensi*.

b. Electrophoretic pattern of Acid phosphatase profile in the larvae of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of *An. stephensi*.

c. Electrophoretic pattern of Acid phosphatase profile in the pupae of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of *An. stephensi*.

d. Electrophoretic pattern of Acid phosphatase profile in the adults of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of *An. stephensi*.

S: Susceptible; DDR: DDT resistant; CPR: Chloropyrifos resistant; CFR: Carbofuran resistant; CYR: Cyfluthrin resistant
Fig 25: Zymogram showing the Acid phosphatase profile in the eggs of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of *An. stephensi*.

Fig 26: Zymogram showing the Acid phosphatase profile in the larvae of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of *An. stephensi*.

S: Susceptible  
CFR: Carbofuran resistant  
DDR: DDT resistant  
CPR: Chloropyrifos resistant  

---  : faint band  
-----: light band  
---------: medium band  
----------: dark band
Fig 27: Zymogram showing the Acid phosphatase profile in the pupae of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of *An. stephensi*.

Fig 28: Zymogram showing the Acid phosphatase profile in the adults of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of *An. stephensi*.

\[ S: \text{Susceptible} \quad \text{DDR: DDT resistant} \quad \text{CPR: Chloropyrifos resistant} \]
\[ CFR: \text{Carbofuran resistant} \quad \text{CYR: Cyfluthrin resistant} \]
\[ \text{---} : \text{faint band} \quad \text{---} : \text{light band} \quad \text{---} : \text{medium band} \quad \text{---} : \text{dark band} \]
Table 31: Relative mobility (Rm) values of Acid phosphatase profile in the pupae of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Susceptible and Resistant strains of *An. stephensi*.

<table>
<thead>
<tr>
<th>Band</th>
<th>Rm</th>
<th>Male</th>
<th></th>
<th></th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>DDR</td>
<td>CPR</td>
<td>CFR</td>
<td>CYR</td>
</tr>
<tr>
<td>1.</td>
<td>0.075</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>2.</td>
<td>0.137</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>3.</td>
<td>0.162</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4.</td>
<td>0.225</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

Table 32: Relative mobility (Rm) values of Acid phosphatase profile in the adults of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Susceptible and Resistant strains of *An. stephensi*.

<table>
<thead>
<tr>
<th>Band</th>
<th>Rm</th>
<th>Male</th>
<th></th>
<th></th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>DDR</td>
<td>CPR</td>
<td>CFR</td>
<td>CYR</td>
</tr>
<tr>
<td>1.</td>
<td>0.10</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>2.</td>
<td>0.162</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>3.</td>
<td>0.237</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>4.</td>
<td>0.487</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>5.</td>
<td>0.5</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

S: Susceptible  
DDR: DDT resistant  
CPR: Chloropyrifos resistant  
CFR: Carbofuran resistant  
CYR: Cyfluthrin resistant
PIATE VI:

a. Electrophoretic pattern of Alkaline phosphatase profile in the eggs of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of An. stephensi.

b. Electrophoretic pattern of Alkaline phosphatase profile in the larvae of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of An. stephensi.

c. Electrophoretic pattern of Alkaline phosphatase profile in the pupae of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of An. stephensi.

d. Electrophoretic pattern of Alkaline phosphatase profile in the adults of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of An. stephensi.

S: Susceptible; DDR: DDT resistant; CPR: Chloropyrifos resistant; CFR: Carbofuran resistant; CYR: Cyfluthrin resistant
Fig 29: Zymogram showing the Alkaline phosphatase profile in the eggs of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of *An. stephensi*.

Fig 30: Zymogram showing the Alkaline phosphatase profile in the larvae of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of *An. stephensi*.

S: Susceptible  DDR: DDT resistant  CPR: Chloropyrifos resistant
CFR: Carbofuran resistant  CYR: Cyfluthrin resistant

- faint band  - light band  - medium band  - dark band
Table 33: Relative mobility (Rm) values of Alkaline Phosphatase profile in the eggs of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Susceptible and Resistant strains of *An. stephensi*.

<table>
<thead>
<tr>
<th>Band</th>
<th>Rm</th>
<th>S</th>
<th>DDR</th>
<th>CPR</th>
<th>CFR</th>
<th>CYR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>0.283</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2.</td>
<td>0.297</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>3.</td>
<td>0.310</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4.</td>
<td>0.324</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>5.</td>
<td>0.743</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>6.</td>
<td>0.76</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

Table 34: Relative mobility (Rm) values of Alkaline Phosphatase profile in the larvae of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Susceptible and Resistant strains of *An. stephensi*.

<table>
<thead>
<tr>
<th>Band</th>
<th>Rm</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>S</td>
<td>DDR</td>
</tr>
<tr>
<td>1.</td>
<td>0.012</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2.</td>
<td>0.38</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>3.</td>
<td>0.089</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>4.</td>
<td>0.12</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>5.</td>
<td>0.15</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>6.</td>
<td>0.87</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>7.</td>
<td>0.64</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>8.</td>
<td>0.66</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>9.</td>
<td>0.69</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>10.</td>
<td>0.70</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>11.</td>
<td>0.72</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

S: Susceptible  DDR: DDT resistant  CPR: Chloropyrifos resistant

CFR: Carbofuran resistant  CYR: Cyfluthrin resistant
Fig 31: Zymogram showing the Alkaline phosphatase profile in the pupae of DDT, Chlorpyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of An. stephensi.

Fig 32: Zymogram showing the Alkaline phosphatase profile in the adults of DDT, Chlorpyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of An. stephensi.

S : Susceptible  DDR : DDT resistant  CPR : Chlorpyrifos resistant
CFR : Carbofuran resistant  CYR : Cyfluthrin resistant
- - : faint band  - - - : light band  - - - - : medium band  - - - - - : dark band
Table 35: Relative mobility (Rm) values of Alkaline Phosphatase profile in the pupae of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Susceptible and Resistant strains of *An. stephensi*.

<table>
<thead>
<tr>
<th>Band</th>
<th>Rm</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>S</td>
<td>DDR</td>
</tr>
<tr>
<td>1.</td>
<td>0.06</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>2.</td>
<td>0.1</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>3.</td>
<td>0.23</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4.</td>
<td>0.324</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>5.</td>
<td>0.675</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>6.</td>
<td>6.689</td>
<td>-</td>
<td>+</td>
</tr>
</tbody>
</table>

Table 36: Relative mobility (Rm) values of Alkaline Phosphatase profile in the adults of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Susceptible and Resistant strains of *An. stephensi*.

<table>
<thead>
<tr>
<th>Band</th>
<th>Rm</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>S</td>
<td>DDR</td>
</tr>
<tr>
<td>1.</td>
<td>0.086</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>2.</td>
<td>0.092</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>3.</td>
<td>0.101</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>4.</td>
<td>0.14</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>5.</td>
<td>0.642</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>6.</td>
<td>0.691</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>7.</td>
<td>0.728</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

S: Susceptible  DDR: DDT resistant  CPR: Chloropyrifos resistant
CFR: Carbofuran resistant  CYR: Cyfluthrin resistant
PLATE VII:

a. Electrophoretic pattern of Acetylcholinesterase profile in the eggs of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of *An. stephensi*.

b. Electrophoretic pattern of Acetylcholinesterase profile in the larvae of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of *An. stephensi*.

c. Electrophoretic pattern of Acetylcholinesterase profile in the pupae of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of *An. stephensi*.

d. Electrophoretic pattern of Acetylcholinesterase profile in the adults of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of *An. stephensi*.

S: Susceptible  DDR: DDT resistant  CPR: Chloropyrifos resistant
CFR: Carbofuran resistant  CYR: Cyfluthrin resistant
Fig 33: Zymogram showing the Acetylcholinesterase profile in the eggs of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of *An. stephensi*.

Fig 34: Zymogram showing the Acetylcholinesterase profile in the larvae of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of *An. stephensi*.

\[ S \quad DDR \quad CPR \quad CFR \quad CYR \quad S \quad DDR \quad CPR \quad CFR \quad CYR \]

**Male**

**Female**

- **S**: Susceptible
- **DDR**: DDT resistant
- **CPR**: Chlorpyrifos resistant
- **CFR**: Carbofuran resistant
- **CYR**: Cyfluthrin resistant
- : light band
- : medium band
- : dark band
Fig 35: Zymogram showing the Acetylcholinesterase profile in the pupae of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of An. stephensi.

Fig 36: Zymogram showing the Acetylcholinesterase profile in the adults of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of An. stephensi.

S: Susceptible
CFR: Carbofuran resistant
DDR: DDT resistant
CPR: Chloropyrifos resistant
CYR: Cyfluthrin resistant

light band : medium band : dark band
Table 37: Relative mobility (Rm) values of Acetylcholinesterase profile in the eggs of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Susceptible and Resistant strains of *An. stephensi*.

<table>
<thead>
<tr>
<th>Band</th>
<th>Rm</th>
<th>S</th>
<th>DDR</th>
<th>CPR</th>
<th>CFR</th>
<th>CYR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.44</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td>+</td>
</tr>
</tbody>
</table>

Table 38: Relative mobility (Rm) values of Acetylcholinesterase profile in the larvae of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Susceptible and Resistant strains of *An. stephensi*.

<table>
<thead>
<tr>
<th>Band</th>
<th>Rm</th>
<th>S</th>
<th>DDR</th>
<th>CPR</th>
<th>CFR</th>
<th>CYR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.39</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td>+</td>
</tr>
</tbody>
</table>

Table 39: Relative mobility (Rm) values of Acetylcholinesterase profile in the pupae of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Susceptible and Resistant strains of *An. stephensi*.

<table>
<thead>
<tr>
<th>Band</th>
<th>Rm</th>
<th>S</th>
<th>DDR</th>
<th>CPR</th>
<th>CFR</th>
<th>CYR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.407</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td>+</td>
</tr>
</tbody>
</table>

Table 40: Relative mobility (Rm) values of Acetylcholinesterase profile in the adults of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Susceptible and Resistant strains of *An. stephensi*.

<table>
<thead>
<tr>
<th>Band</th>
<th>Rm</th>
<th>S</th>
<th>DDR</th>
<th>CPR</th>
<th>CFR</th>
<th>CYR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.358</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td>+</td>
</tr>
</tbody>
</table>

S: Susceptible  
DDR: DDT resistant  
CPR: Chloropyrifos resistant  
CFR: Carbofuran resistant  
CYR: Cyfluthrin resistant
PLATE VIII:

a. Electrophoretic pattern of Lactate dehydrogenase profile in the eggs of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of An. stephensi.

b. Electrophoretic pattern of Lactate dehydrogenase profile in the larvae of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of An. stephensi.

c. Electrophoretic pattern of Lactate dehydrogenase profile in the pupae of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of An. stephensi.

d. Electrophoretic pattern of Lactate dehydrogenase profile in the adults of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of An. stephensi.

S: Susceptible; DDR: DDT resistant; CPR: Chloropyrifos resistant; CFR: Carbofuran resistant; CYR: Cyfluthrin resistant
Fig 37: Zymogram showing the Lactate dehydrogenase profile in the eggs of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of *An. stephensi*.

Fig 38: Zymogram showing the Lactate dehydrogenase profile in the larvae of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of *An. stephensi*.

<table>
<thead>
<tr>
<th>S</th>
<th>DDR</th>
<th>CPR</th>
<th>CFR</th>
<th>CYR</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>DDR</td>
<td>CPR</td>
<td>CFR</td>
<td>CYR</td>
</tr>
</tbody>
</table>

Male

S: Susceptible  DDR: DDT resistant  CPR: Chloropyrifos resistant
CFR: Carbofuran resistant  CYR: Cyfluthrin resistant

---: faint band  : light band  ---: medium band  : dark band
Table 41: Relative mobility (Rm) values of Lactate dehydrogenase profile in the eggs of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Susceptible and Resistant strains of *An. stephensi*.

<table>
<thead>
<tr>
<th>Band</th>
<th>Rm</th>
<th>S</th>
<th>DDR</th>
<th>CPR</th>
<th>CFR</th>
<th>CYR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>0.527</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2.</td>
<td>0.541</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>3.</td>
<td>0.547</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 42: Relative mobility (Rm) values of Lactate dehydrogenase profile in the larvae of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Susceptible and Resistant strains of *An. stephensi*.

<table>
<thead>
<tr>
<th>Band</th>
<th>Rm</th>
<th>S</th>
<th>DDR</th>
<th>CPR</th>
<th>CFR</th>
<th>CYR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>0.303</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2.</td>
<td>0.348</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>3.</td>
<td>0.367</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>4.</td>
<td>0.42</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>5.</td>
<td>4.37</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

*S*: Susceptible  
*DDR*: DDT resistant  
*CPR*: Chloropyrifos resistant  
*CFR*: Carbofuran resistant  
*CYR*: Cyfluthrin resistant
Fig 39: Zymogram showing the Lactate dehydrogenase profile in the pupae of DDT, Chlorpyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of *An. stephensi*.

Fig 40: Zymogram showing the Lactate dehydrogenase profile in the adults of DDT, Chlorpyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of *An. stephensi*.

S: Susceptible  DDR: DDT resistant  CPR: Chlorpyrifos resistant
CFR: Carbofuran resistant  CYR: Cyfluthrin resistant
---: faint band  -----: light band  ----: medium band  -----: dark band
Table 43: Relative mobility (Rm) values of Lactate dehydrogenase profile in the pupae of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Susceptible and Resistant strains of *An. stephensi*.

<table>
<thead>
<tr>
<th>Band</th>
<th>Rm</th>
<th>Male S</th>
<th>Male DDR</th>
<th>Male CPR</th>
<th>Male CFR</th>
<th>Male CYR</th>
<th>Female S</th>
<th>Female DDR</th>
<th>Female CPR</th>
<th>Female CFR</th>
<th>Female CYR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>0.096</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>2.</td>
<td>0.185</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>3.</td>
<td>0.208</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>4.</td>
<td>0.309</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

Table 44: Relative mobility (Rm) values of Lactate dehydrogenase profile in the adults of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Susceptible and Resistant strains of *An. stephensi*.

<table>
<thead>
<tr>
<th>Band</th>
<th>Rm</th>
<th>Male S</th>
<th>Male DDR</th>
<th>Male CPR</th>
<th>Male CFR</th>
<th>Male CYR</th>
<th>Female S</th>
<th>Female DDR</th>
<th>Female CPR</th>
<th>Female CFR</th>
<th>Female CYR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>0.142</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>2.</td>
<td>0.156</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3.</td>
<td>0.194</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>4.</td>
<td>0.220</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>5.</td>
<td>0.233</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>6.</td>
<td>0.246</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>7.</td>
<td>0.48</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

S: Susceptible  
DDR: DDT resistant  
CPR: Chloropyrifos resistant  
CFR: Carbofuran resistant  
CYR: Cyfluthrin resistant
PLATE IX:

a. Electrophoretic pattern of Glucos-6-phosphate dehydrogenase profile in the eggs of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of *An. stephensi*.

b. Electrophoretic pattern of Glucos-6-phosphate dehydrogenase profile in the larvae of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of *An. stephensi*.

c. Electrophoretic pattern of Glucos-6-phosphate dehydrogenase profile in the pupae of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of *An. stephensi*.

d. Electrophoretic pattern of Glucos-6-phosphate dehydrogenase profile in the adults of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of *An. stephensi*.

S: Susceptible; DDT R: DDT resistant; CPR: Chloropyrifos resistant; CFR: Carbofuran resistant; CYR: Cyfluthrin resistant
Fig 41: Zymogram showing the Glucose-6-phosphate dehydrogenase profile in the eggs of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of *An. stephensi*.

Fig 42: Zymogram showing the Glucose-6-phosphate dehydrogenase profile in the larvae of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of *An. stephensi*.

S: Susceptible  
CFR: Carbofuran resistant  
DDR: DDT resistant  
CPR: Chloropyrifos resistant  
---: faint band  
---: light band  
---: medium band  
---: dark band
Fig 43: Zymogram showing the Glucose-6-phosphate dehydrogenase profile in the pupae of DDT, Chlorpyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of *An. stephensi*.

Fig 44: Zymogram showing the Glucose-6-phosphate dehydrogenase profile in the adults of DDT, Chlorpyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of *An. stephensi*.

---

S: Susceptible  
DDR: DDT resistant  
CPR: Chlorpyrifos resistant  
CFR: Carbofuran resistant  
CYR: Cyfluthrin resistant  

- faint band  
- light band  
- medium band  
- dark band
Table 45: Relative mobility (Rm) values of Glucose-6-phosphate dehydrogenase profile in the eggs of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Susceptible and Resistant strains of *An. stephensi*.

<table>
<thead>
<tr>
<th>Band</th>
<th>Rm</th>
<th>S</th>
<th>DDR</th>
<th>CPR</th>
<th>CFR</th>
<th>CYR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>0.225</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2.</td>
<td>0.237</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3.</td>
<td>0.262</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

Table 46: Relative mobility (Rm) values of Glucose-6-phosphate dehydrogenase profile in the larvae of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Susceptible and Resistant strains of *An. stephensi*.

<table>
<thead>
<tr>
<th>Band</th>
<th>Rm</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>S DDR CPR CFR CYR</td>
<td>S DDR CPR CFR CYR</td>
</tr>
<tr>
<td>1.</td>
<td>1.146</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2.</td>
<td>1.16</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>3.</td>
<td>1.173</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 47: Relative mobility (Rm) values of Glucose-6-phosphate dehydrogenase profile in the pupae of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Susceptible and Resistant strains of *An. stephensi*.

<table>
<thead>
<tr>
<th>Band</th>
<th>Rm</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>S DDR CPR CFR CYR</td>
<td>S DDR CPR CFR CYR</td>
</tr>
<tr>
<td>1.</td>
<td>0.266</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

Table 48: Relative mobility (Rm) values of Glucose-6-phosphate dehydrogenase profile in the adults of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Susceptible and Resistant strains of *An. stephensi*.

<table>
<thead>
<tr>
<th>Band</th>
<th>Rm</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>S DDR CPR CFR CYR</td>
<td>S DDR CPR CFR CYR</td>
</tr>
<tr>
<td>1.</td>
<td>0.201</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

S: Susceptible  
DDR: DDT resistant  
CPR: Chloropyrifos resistant  
CFR: Carbofuran resistant  
CYR: Cyfluthrin resistant
PLATE X:

a. Electrophoretic pattern of Xanthine dehydrogenase profile in the eggs of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of *An. stephensi*.

b. Electrophoretic pattern of Xanthine dehydrogenase profile in the larvae of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of *An. stephensi*.

c. Electrophoretic pattern of Xanthine dehydrogenase profile in the pupae of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of *An. stephensi*.

d. Electrophoretic pattern of Xanthine dehydrogenase profile in the adults of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of *An. stephensi*.

S: Susceptible; DDR: DDT resistant; CPR: Chloropyrifos resistant; CFR: Carbofuran resistant; CYR: Cyfluthrin resistant
Fig 45: Zymogram showing the Xanthine dehydrogenase profile in the eggs of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of *An. stephensi*.

Fig 46: Zymogram showing the Xanthine dehydrogenase profile in the larvae of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of *An. stephensi*.

<table>
<thead>
<tr>
<th></th>
<th>S</th>
<th>DDR</th>
<th>CPR</th>
<th>CFR</th>
<th>CYR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

S : Susceptible  DDR : DDT resistant  CPR : Chloropyrifos resistant
CFR : Carbofuran resistant  CYR : Cyfluthrin resistant
: light band  : medium band  : dark band
Fig 47: Zymogram showing the Xanthine dehydrogenase profile in the pupae of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of An. stephensi.

Fig 48: Zymogram showing the Xanthine dehydrogenase profile in the adults of DDT, Chloropyrifos, Carbofuran and Cyfluthrin Resistant and Susceptible strains of An. stephensi.

S: Susceptible  DDR: DDT resistant  CPR: Chloropyrifos resistant
CFR: Carbofuran resistant  CYR: Cyfluthrin resistant
: light band  : medium band  : dark band
Table 49: Relative mobility (Rm) values of Xanthine dehydrogenase profile in the eggs of DDT, Chlorpyrifos, Carbofuran and Cyfluthrin Susceptible and Resistant strains of *An. stephensi*.

<table>
<thead>
<tr>
<th>Band</th>
<th>Rm</th>
<th>S</th>
<th>DDR</th>
<th>CPR</th>
<th>CFR</th>
<th>CYR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>0.209</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

Table 50: Relative mobility (Rm) values of Xanthine dehydrogenase profile in the larvae of DDT, Chlorpyrifos, Carbofuran and Cyfluthrin Susceptible and Resistant strains of *An. stephensi*.

<table>
<thead>
<tr>
<th>Band</th>
<th>Rm</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>S</td>
<td>DDR</td>
</tr>
<tr>
<td>1.</td>
<td>0.24</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

Table 51: Relative mobility (Rm) values of Xanthine dehydrogenase profile in the pupae of DDT, Chlorpyrifos, Carbofuran and Cyfluthrin Susceptible and Resistant strains of *An. stephensi*.

<table>
<thead>
<tr>
<th>Band</th>
<th>Rm</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>S</td>
<td>DDR</td>
</tr>
<tr>
<td>1.</td>
<td>0.26</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

Table 52: Relative mobility (Rm) values of Xanthine dehydrogenase profile in the adults of DDT, Chlorpyrifos, Carbofuran and Cyfluthrin Susceptible and Resistant strains of *An. stephensi*.

<table>
<thead>
<tr>
<th>Band</th>
<th>Rm</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>S</td>
<td>DDR</td>
</tr>
<tr>
<td>1</td>
<td>0.089</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>3</td>
<td>0.115</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

S: Susceptible  DDR: DDT resistant  CPR: Chlorpyrifos resistant  CFR: Carbofuran resistant  CYR: Cyfluthrin resistant
Table 53: The Effect of DDT on fecundity, egg hatchability and sex-ratio of *An. stephensi*

<table>
<thead>
<tr>
<th>Gorugunte patula strain females</th>
<th>Total eggs</th>
<th>Egg/female</th>
<th>Ratio</th>
<th>Total larvae</th>
<th>Larvae/female</th>
<th>% hatch</th>
<th>Ratio</th>
<th>No. of males</th>
<th>No. of females</th>
<th>M:F</th>
<th>Female/female Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Parent</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.1 ppm</td>
<td>25</td>
<td>1911</td>
<td>76.44</td>
<td>0.77</td>
<td>1684</td>
<td>67.36</td>
<td>88.12</td>
<td>0.91</td>
<td>773</td>
<td>911</td>
<td>0.84:1</td>
</tr>
<tr>
<td>0.25 ppm</td>
<td>25</td>
<td>1732</td>
<td>69.28</td>
<td>0.70</td>
<td>1417</td>
<td>56.68</td>
<td>81.81</td>
<td>0.84</td>
<td>674</td>
<td>743</td>
<td>0.90:1</td>
</tr>
<tr>
<td>Control</td>
<td>25</td>
<td>2467</td>
<td>98.68</td>
<td>1.00</td>
<td>2385</td>
<td>95.4</td>
<td>96.67</td>
<td>1.00</td>
<td>1158</td>
<td>1227</td>
<td>0.94:1</td>
</tr>
<tr>
<td><strong>F₁</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.1 ppm</td>
<td>25</td>
<td>1965</td>
<td>78.60</td>
<td>0.80</td>
<td>1673</td>
<td>66.92</td>
<td>85.13</td>
<td>0.88</td>
<td>763</td>
<td>910</td>
<td>0.83:1</td>
</tr>
<tr>
<td>0.25 ppm</td>
<td>25</td>
<td>1709</td>
<td>68.36</td>
<td>0.69</td>
<td>1433</td>
<td>57.32</td>
<td>83.85</td>
<td>0.87</td>
<td>731</td>
<td>681</td>
<td>1.07:1</td>
</tr>
<tr>
<td>Control</td>
<td>25</td>
<td>2448</td>
<td>97.92</td>
<td>1.00</td>
<td>2349</td>
<td>93.96</td>
<td>95.95</td>
<td>1.00</td>
<td>1129</td>
<td>1209</td>
<td>0.93:1</td>
</tr>
<tr>
<td><strong>F₂</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.1 ppm</td>
<td>25</td>
<td>2030</td>
<td>81.20</td>
<td>0.82</td>
<td>1782</td>
<td>71.28</td>
<td>87.78</td>
<td>0.89</td>
<td>875</td>
<td>893</td>
<td>0.97:1</td>
</tr>
<tr>
<td>0.25 ppm</td>
<td>25</td>
<td>1752</td>
<td>70.08</td>
<td>0.71</td>
<td>1439</td>
<td>57.56</td>
<td>82.13</td>
<td>0.83</td>
<td>657</td>
<td>759</td>
<td>0.86:1</td>
</tr>
<tr>
<td>Control</td>
<td>25</td>
<td>2454</td>
<td>98.16</td>
<td>1.00</td>
<td>2401</td>
<td>96.04</td>
<td>97.84</td>
<td>1.00</td>
<td>1176</td>
<td>1208</td>
<td>0.97:1</td>
</tr>
</tbody>
</table>
Table 54: Effect of Chlorpyrifos on fecundity, egg hatchability and sex-ratio of *An. stephensi*

<table>
<thead>
<tr>
<th>Gorugunte</th>
<th>No. of females</th>
<th>Total eggs</th>
<th>Egg/female</th>
<th>Ratio</th>
<th>Total larvae</th>
<th>Larvae/female</th>
<th>% hatch</th>
<th>Ratio</th>
<th>No. of males</th>
<th>No. of female</th>
<th>M:F</th>
<th>Female/female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parent</td>
<td>25</td>
<td>1727</td>
<td>69.08</td>
<td>0.76</td>
<td>1463</td>
<td>58.52</td>
<td>84.71</td>
<td>0.88</td>
<td>773</td>
<td>679</td>
<td>1.13:1</td>
<td>27.16</td>
</tr>
<tr>
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<td>25</td>
<td>1553</td>
<td>62.10</td>
<td>0.68</td>
<td>1214</td>
<td>48.56</td>
<td>78.17</td>
<td>0.81</td>
<td>561</td>
<td>640</td>
<td>0.87:1</td>
<td>25.60</td>
</tr>
<tr>
<td>Control</td>
<td>25</td>
<td>2252</td>
<td>90.10</td>
<td>1.00</td>
<td>2166</td>
<td>86.64</td>
<td>96.18</td>
<td>1.00</td>
<td>1071</td>
<td>1082</td>
<td>0.99:1</td>
<td>43.28</td>
</tr>
</tbody>
</table>

F<sub>1</sub>

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<thead>
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<th>No. of females</th>
<th>Total eggs</th>
<th>Egg/female</th>
<th>Ratio</th>
<th>Total larvae</th>
<th>Larvae/female</th>
<th>% hatch</th>
<th>Ratio</th>
<th>No. of males</th>
<th>No. of female</th>
<th>M:F</th>
<th>Female/female</th>
</tr>
</thead>
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<tr>
<td>0.001 ppm</td>
<td>25</td>
<td>1712</td>
<td>68.48</td>
<td>0.71</td>
<td>1406</td>
<td>56.24</td>
<td>82.12</td>
<td>0.87</td>
<td>648</td>
<td>740</td>
<td>0.87:1</td>
</tr>
<tr>
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<td>25</td>
<td>1562</td>
<td>62.48</td>
<td>0.65</td>
<td>1288</td>
<td>51.52</td>
<td>82.45</td>
<td>0.87</td>
<td>539</td>
<td>730</td>
<td>0.73:1</td>
</tr>
<tr>
<td>Control</td>
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<td>2384</td>
<td>95.36</td>
<td>1.00</td>
<td>2239</td>
<td>89.56</td>
<td>93.91</td>
<td>1.00</td>
<td>1124</td>
<td>1108</td>
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F<sub>2</sub>

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<th>Egg/female</th>
<th>Ratio</th>
<th>Total larvae</th>
<th>Larvae/female</th>
<th>% hatch</th>
<th>Ratio</th>
<th>No. of males</th>
<th>No. of female</th>
<th>M:F</th>
<th>Female/female</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.001 ppm</td>
<td>25</td>
<td>1799</td>
<td>71.96</td>
<td>0.76</td>
<td>1573</td>
<td>62.92</td>
<td>87.43</td>
<td>0.89</td>
<td>791</td>
<td>770</td>
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<tr>
<td>0.0025 ppm</td>
<td>25</td>
<td>1606</td>
<td>64.24</td>
<td>0.68</td>
<td>1276</td>
<td>51.04</td>
<td>79.45</td>
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<td>547</td>
<td>724</td>
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<tr>
<td>Control</td>
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<td>1.00</td>
<td>2297</td>
<td>91.88</td>
<td>97.86</td>
<td>1.00</td>
<td>1182</td>
<td>1104</td>
<td>1.07:1</td>
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Table 55: Effect of Carbofuran fecundity, egg hatchability and sex-ratio of *An. stephensi*

<table>
<thead>
<tr>
<th>Sample</th>
<th>Egg production</th>
<th>Egg hatchability</th>
<th>Sex ratio</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>No. of females</td>
<td>Total eggs</td>
<td>Ratio</td>
</tr>
<tr>
<td>Gorugunte</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Parent</td>
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<td>2227</td>
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<tr>
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<td>2321</td>
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<td>F₁</td>
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<td>2338</td>
<td>93.52</td>
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<tr>
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<td>2373</td>
<td>94.92</td>
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<tr>
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<td>25</td>
<td>1990</td>
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<td>2391</td>
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<td>Gorugunte</td>
<td>No. of females</td>
<td>Total eggs</td>
<td>Egg/ female</td>
</tr>
<tr>
<td>-----------</td>
<td>----------------</td>
<td>------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Parent</td>
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<td></td>
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<td>68.76</td>
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<tr>
<td>0.00025 ppm</td>
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<td>59.64</td>
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Table 57: The Effect of DDT, Chlorpyrifos, Carbofuran and Cyfluthrin on fecundity, egg hatchability and sex-ratio of homozygous resistant strains of An. stephensi

<table>
<thead>
<tr>
<th>Gorugunte-palya strain</th>
<th>Egg production</th>
<th>Egg hatchability</th>
<th>sex ratio</th>
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<tbody>
<tr>
<td></td>
<td>No. of females</td>
<td>Total eggs</td>
<td>Egg/ female</td>
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<td>DDT resistant strain</td>
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<td>1905</td>
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