# LABORATORY EVALUATION OF CHINABERRY (*Melia azadarach* L.) PREPARATIONS AGAINST THE LARVAE OF THE COTTON LEAF WORM *Spodoptera littoralis* (Boisd.)

By

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## ABSTRACT

Different preparations of chinaberry fruits were evaluated against the 6th instar larvae of *S.littoralis*. Meridic diet, when mixed with the different chinaberry preparations at 5, 10 and 30% (Wt./Wt.) prolonged development and decreased weight gain of the larvae. Both roasted and unroasted seed meal prevented the formation of pupa regardless of the concentration tested. Activity of chinaberry preparations were found to be close to Neem-seed and similar in activity to insect growth regulators.

## INTRODUCTION

The leaves and seeds of the Indian neem tree, *Azadirachta indica* A. Juss, have been used as sources of insect repellents and insecticides (Jacobson, 1981), Neem oil and cake were indicated to be effective against more than 126 economic pests (Ladd et al., 1978 and Jacobson et al., 1983). Biological activity of neem extracted against insects, mites, nematodes and pathogens has been summarized by Warthen (1979) including effects on feeding, growth and toxicity. Chinaberry, *Melia azadarach* L., was shown to have antifeedant and growth-inhibiting effects against the corn earworm and fall armywarm, much like neem derivatives (Mc-Millan et al., 1969). The bioactivity

of the Egyptian chinaberry ecotype is not well investigated. Thus it was decided to evaluate the activity of various chinaberry fruit preparations against the larvae of the major polyphagous Egyptian pest, Spodoptera littoralis, by measuring development, survival and growth rate.

## MATERIALS AND METHODS

Fruits of chinaberry, Melia azadarach L., were collected fresh alongside the irrigation canals at Kafr El-Sheikh province. Whole fruit pulp, free oil pulp, acidified roasted seed, roasted seed meal and unroasted seed meal of the chinaberry fruit were prepared as described previously (Saleh and Moharam, 1987). Materials of each preparation were blended with the diet (Hegazi et al., 1977) to obtain 5, 10 and 30% final Wt./Wt. concentrations. Weighted amount of each diet-preparation concentration and the control were dispensed in plastic cups.

A susceptible strain of the Egyptian cotton leafworm Spodoptera littoralis (Boisd.) was obtained from the Pesticide Research Center in Cairo. The culture was reared under the laboratory conditions of 25±2°C and 65±5% R.H. on castor-oil leaves as described by Eldefrawi et al. (1964).

Only the healthy active 6th instar freshly moulted larvae were selected for the test. The larva was considered healthy if it appeared physically normal and crowded actively.

Ten 6th instar larvae were placed per cup for each prepared concentration as well as the control and kept at the previous laboratory conditions..

Mortality, larval weight, food consumed and larval feces weight were recorded daily. The difference between the amount of food

consumed and feces produced during the larval instar is the weight of food digested, (SOO HOO and Frankle, 1965).

## RESULTS AND DISCUSSION

Chinaberry fractions incorporated into meridic diet at the rates of 5, 10 and 30% (Wt./Wt.) affected the survival, development and growth rate of the 6th instar larvae of the cotton leafworm S.littoralis (Table 6). The 6th instar larvae underwent larval/pupal moult in 7 days. Larvae developed at a slower rate in various preparations of chinaberry regardless of the concentration of the tested fraction. The larvae reached the pupal stage within 10 days when maintained on diet mixed either whole fruit pulp or seed meal (roasted and unroasted); this period was 9 days using the different concentrations of the acidified roasted seeds. On the other hand, the free oil pulp did not affect the rate of development of the larvae at any of the used concentration (7 days as the control).

Larvae which survived to the pupal stage differed widely according to the chinaberry preparation and concentration, and ranged from 90% for the control to 0% for the seed meal. Both roasted and unroasted seed meals inhibited the normal formation of the pupae at the concentration of 10 and 30% and the unroasted seed meal at the low concentration of 5%. The other preparations including the whole fruit pulp, free oil pulp and acidified roasted seed affected the survival of the larvae in a lesser extent, mainly, with the highest concentration (30%).

Whole fruit pulp of chinaberry caused a high percent of mortality ranged from 66.67%to 88.89, according to the used concentrations.

The highest percent of mortality occurred in the 7th day of the larval instars when the food was treated with 10 and 30% of the whole pulp, (Table 1). When the food was treated with 5% of the whole pulp, the highest mortality was obtained in the 10th day (Table 1). On the contrary, the free oil pulp, acidified roasted seeds and roasted seed

meal preparations of chinaberry caused a low percentage of mortality which ranged from 10 to 30% in the first two concentrations (5 & 10%) while the third concentration (30%) caused 60:65% mortality (Tables 2, 3, 4).

The roasted seed meal gave the same percentages of mortality which were obtained by the whole pulp preparation (Tables 1 & 5).

According to the mortality percentages recorded in Tables 1, 2, 3, 4 and 5, it could be concluded that the different treatments of the chinaberry fruits (heating, acidifying and roasting) decreased the toxicity factors in these preparations.

Comparisons of larvae fed on diets mixed with various preparations of chinaberry were made on the basis of the weight gain per larva in relation to the average weight of the larva at the beginning and end of the fifth instar. The average weight gain was higher than the control especially for the low concentration (5%) of the acidified roasted and free oil pulp. However, the high concentration (30 %) of all chinaberry preparations decreased significantly the larval weight gain.

In conclusion, these results suggest that the active principle of chinaberry fruit is present mainly in the seeds and that heat treatment of the seeds (roasting) did not affect greatly the compound(s). The activity of the chinaberry seeds seemed to be similar to that of the neem-seeds (Prabhaker et al. 1986) where mortality occurred mostly during ecdysis. Thus the action of chinaberry seed meal acts in a manner close to the action of insect growth regulators (Ascher and Nemmy, 1984; Jones, 1984; Ladd et al., 1984 and Weaver, et al., 1984) and similar to the neem seed extract(Prabhaker et al., 1986).

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Table 1- The effect of the whole pulp of Melia azadarach on the successful development, digestability and larval weight of S.littoralis 6th instar larvae to the pupal stage.

| Conc. | Days after treatments | % mortality | x food consumed in mg/larva | x feces in mg/larva | Digestability | x larval weight in mg | % survival larvae | % prepupae |
|---|---|---|---|---|---|---|---|---|
| 5% | 1 | 0 | 211 | 5.6 | 97.35 | 143 | 100 | 0 |
| | 2 | 0 | 220 | 27.8 | 87.36 | 192 | 100 | 0 |
| | 3 | 0 | 164 | 34.4 | 79.02 | 221 | 100 | 0 |
| | 4 | 0 | 168 | 53.3 | 68.27 | 247 | 100 | 0 |
| | 5 | 33.33 | 213 | 70.0 | 67.32 | 297 | 66.67 | 0 |
| | 6 | 44.44 | 120 | 54.0 | 55.00 | 348 | 55.56 | 0 |
| | 7 | 44.44 | 118 | 32.0 | 72.88 | 320 | 55.56 | 0 |
| | 8 | 55.56 | 33 | 20.0 | 39.39 | 330 | 44.44 | 0 |
| | 9 | 55.56 | 13 | 17.5 | 23.91 | 325 | 44.44 | 0 |
| | 10 | 77.78 | 20 | 15.0 | 25.00 | 380 | 22.22 | 0 |
| | 11 | 77.78 | 20 | 15.0 | 25.00 | 310 | 22.22 | 0 |
| | 12 | 77.78 | 10 | 10.0 | 0.00 | 285 | 22.22 | 0 |
| | 13 | - | - | -* | - | - | - | 22.22 |
| 10% | 1 | 00 | 437.8 | 50.0 | 88.58 | 271.1 | 100 | 0 |
| | 2 | 11.11 | 513.8 | 128.8 | 74.93 | 342.5 | 88.09 | 0 |
| | 3 | 22.22 | 132.9 | 78.6 | 40.86 | 411.4 | 77.78 | 0 |
| | 4 | 44.44 | 132.2 | 84.0 | 36.46 | 405.0 | 55.56 | 0 |
| | 5 | 55.56 | 105.0 | 80.0 | 23.81 | 465.0 | 44.44 | 0 |
| | 6 | 55.56 | 212.5 | 50.0 | 76.47 | 435.0 | 44.44 | 0 |
| | 7 | 66.67 | 116.7 | 30.0 | 74.29 | 343.3 | 33.33 | 11.11 |
| | 8 | 66.67 | 70.0 | 10.0 | 85.71 | 253.3 | 33.33 | 11.11 |
| | 9 | 66.67 | 30.0 | 10.0 | 66.67 | 240.0 | 33.33 | 11.11 |
| | 10 | - | - | -* | - | - | - | 44.44 |
| 30% | 1 | 0 | 318.9 | 35.6 | 88.84 | 153.3 | 100 | 0 |
| | 2 | 11.11 | 302.5 | 43.8 | 85.52 | 160.0 | 88.09 | 0 |
| | 3 | 44.44 | 66.0 | 30.0 | 54.54 | 212.0 | 55.56 | 0 |
| | 4 | 77.78 | 150.0 | 75.0 | 50.00 | 215.0 | 22.22 | 0 |
| | 5 | 77.78 | 110.0 | 70.0 | 56.36 | 290.0 | 22.22 | 0 |
| | 6 | 77.78 | 90.0 | 55.0 | 38.89 | 250.0 | 22.22 | 0 |
| | 7 | 88.89 | 210.0 | 60.0 | 71.43 | 380.0 | 11.11 | 0 |
| | 8 | 88.89 | 110.0 | 30.0 | 72.73 | 300.0 | 11.11 | 0 |
| | 9 | 88.89 | 60.0 | 30.0 | 50.00 | 260.0 | 11.11 | 0 |
| | 10 | 88.89 | 50.0 | 30.0 | 40.00 | 240.0 | 11.11 | 0 |
| | 11 | - | - | -* | - | - | - | 0 |
| | 12 | - | - | -* | - | - | - | 11.11 |
| Control | 1 | 0 | 530.0 | 126.0 | 76.22 | 228.0 | 100 | 0 |
| | 2 | 0 | 408.0 | 145.0 | 64.46 | 450.0 | 100 | 0 |
| | 3 | 0 | 462.0 | 251.0 | 45.67 | 534.0 | 100 | 0 |
| | 4 | 0 | 500.0 | 421.0 | 15.80 | 600.0 | 100 | 0 |
| | 5 | 0 | 533.0 | 280.0 | 47.47 | 631.0 | 100 | 0 |
| | 6 | 10 | 140.0 | 16.0 | 88.57 | 630.0 | 90 | 90 |

* The larvae were fasting.

Table 2- The effect of the free oil pulp of Melia azadarach on the successful development, digestability and larval weight of S.littoralis 6th instar larvae to the pupal stage.

| Conc. | Days after treat-ments | % Morta-lity | x food consumed in mg/ larva | x feces in mg/ larva | Digesta-bility | x larval weight in mg. | % sur-vival larvae | % prepupa |
|---|---|---|---|---|---|---|---|---|
| 5% | 1 | 0 | 386 | 53 | 86.3 | 313 | 100 | 0 |
| | 2 | 0 | 375 | 177 | 52.8 | 443 | 100 | 0 |
| | 3 | 10 | 266 | 119 | 55.3 | 463 | 90 | 0 |
| | 4 | 20 | 924 | 258 | 72.1 | 686 | 80 | 0 |
| | 5 | 20 | 331 | 179 | 45.9 | 616 | 80 | 0 |
| | 6 | 20 | 243 | 193 | 20.6 | 463 | 80 | 50 |
| | 7 | 30 | 100 | 40 | 60.0 | 670 | 70 | 60 |
| | 8 | - | - | - | - | - | - | 70 |
| 10% | 1 | 0 | 444 | 55 | 87.6 | 361 | 100 | 0 |
| | 2 | 0 | 378 | 115 | 69.6 | 494 | 100 | 0 |
| | 3 | 10 | 198 | 102 | 48.5 | 498 | 90 | 0 |
| | 4 | 10. | 683 | 250 | 63.4 | 760 | 90 | 0 |
| | 5 | 10 | 352 | 337 | 4.3 | 508 | 90 | 0 |
| | 6 | 10 | 600 | 230 | 61.7 | 340 | 90 | 80 |
| | 7 | - | - | - | - | - | - | 90 |
| 30% | 1 | 0 | 390 | 40 | 89.7 | 328 | 100 | 0 |
| | 2 | 0 | 64 | 62 | 3.1 | 306 | 100 | 0 |
| | 3 | 0 | 166 | 76 | 54.2 | 286 | 100 | 0 |
| | 4 | 20 | 163 | 75 | 54.0 | 305 | 80 | 0 |
| | 5 | 60 | 170 | 80 | 52.9 | 385 | 40 | 0 |
| | 6 | 60 | 110 | 65 | 40.9 | 340 | 40 | 0 |
| | 7 | 60 | 55 | 45 | 18.2 | 280 | 40 | 0 |
| | 8 | - | - | - | - | - | - | 40 |

Table 3- The effect of the free oil pulp of Melia azadarach on the successful developmental, digestability and larval weight of S.littoralis 6th instar larvae to the pupal stage.

| Conc. | Days after treatments | % Mortality | x food consumed in mg/ larva | x feces in mg/ larva | Digestability | x larval weight in mg. | % survival larvae | %% prepupa |
|---|---|---|---|---|---|---|---|---|
| 5% | 1 | 0 | 222 | 22 | 90.1 | 193 | 100 | 0 |
| | 2 | 0 | 889 | 79 | 88.9 | 281 | 100 | 0 |
| | 3 | 0 | 263 | 89 | 62.7 | 378 | 100 | 0 |
| | 4 | 11.11 | 329 | 173 | 47.4 | 426 | 88.89 | 0 |
| | 5 | 11.11 | 446 | 156 | 65.0 | 530 | 88.89 | 11.11 |
| | 6 | 11.11 | 622 | 208 | 66.6 | 680 | 88.89 | 33.33 |
| | 7 | 22.22 | 184 | 156 | 15.2 | 496 | 77.78 | 33.33 |
| | 8 | 33.33 | 640 | 254 | 60.3 | 645 | 66.67 | 55.56 |
| 10% | 1 | 0 | 372 | 37 | 90.1 | 266 | 100 | 0 |
| | 2 | 0 | 411 | 102 | 75.2 | 429 | 100 | 0 |
| | 3 | 0 | 298 | 18 | 94.0 | 488 | 100 | 0 |
| | 4 | 0 | 697 | 321 | 53.9 | 743 | 100 | 0 |
| | 5 | 0 | 331 | 200 | 13.4 | 596 | 100 | 0 |
| | 6 | 0 | 502 | 360 | 28.4 | 480 | 100 | 66.67 |
| | 7 | - | - | - | - | - | - | 100 |
| 30% | 1 | 0 | 477 | 52 | 89.1 | 230 | 100 | 0 |
| | 2 | 0 | 300 | 77 | 74.3 | 262 | 100 | 0 |
| | 3 | 0 | 148 | 55 | 62.8 | 275 | 100 | 0 |
| | 4 | 0 | 128 | 68 | 46.9 | 273 | 100 | 0 |
| | 5 | 16.67 | 148 | 56 | 62.2 | 288 | 83.33 | 0 |
| | 6 | 16.67 | 114 | 52 | 54.4 | 274 | 83.33 | 0 |
| | 7 | 33.33 | 113 | 20 | 82.3 | 278 | 66.67 | 0 |
| | 8 | 66.67 | 695 | 25 | 96.4 | 400 | 33.33 | 0 |
| | 9 | - | - | - | - | - | - | 22.22 |

**Table 4-** The effect of the roasted seed meal of Melia azadarach on the successful development, digestability and larval weight of S.littoralis 6th instar larvae to the pupal stage.

| Conc. | Days after treat- | % Morta- lity | x food consumed in mg/ larva | x feces in mg/ larva | Digesta- bility | x larval weight in mg. | % sur- vival larvae | % prepupae |
|---|---|---|---|---|---|---|---|---|
| 5% | 1 | 0 | 244 | 7 | 71.3 | 174 | 100 | 0 |
| | 2 | 0 | 302 | 43 | 85.8 | 253 | 100 | 0 |
| | 3 | 0 | 290 | 81 | 72.1 | 367 | 100 | 0 |
| | 4 | 0 | 304 | 129 | 57.6 | 402 | 100 | 0 |
| | 5 | 11.11 | 286 | 127 | 55.6 | 496 | 88.89 | 11.11 |
| | 6 | 11.11 | 414 | 154 | 82.8 | 557 | 88.89 | 22.22 |
| | 7 | 22.22 | 200 | 175 | 12.5 | 475 | 77.78 | 44.44 |
| | 8 | 22.22 | 370 | 65 | 82.4 | 520 | 77.78 | 55.56 |
| | 9 | 22.22 | 520 | 90 | 82.7 | 330 | 77.78 | 55.56 |
| | 10 | 33.33 | 500 | 70 | 86.0 | 350 | 66.67 | 66.67 |
| | 11 | - | - | - | - | - | - | - |
| 10% | 1 | 0 | 278 | 12 | 95.7 | 172 | 100 | 0 |
| | 2 | 0 | 231 | 46 | 72.3 | 218 | 100 | 0 |
| | 3 | 0 | 188 | 54 | 71.3 | 276 | 100 | 0 |
| | 4 | 0 | 236 | 90 | 61.9 | 343 | 100 | 0 |
| | 5 | 22.22 | 141 | 93 | 34.0 | 386 | 77.78 | 0 |
| | 6 | 33.33 | 350 | 97 | 72.3 | 535 | 66.67 | 0 |
| | 7 | 33.33 | 213 | 87 | 59.1 | 497 | 66.67 | 0 |
| | 8 | 33.33 | 308 | 110 | 64.3 | 524 | 66.67 | 11.11 |
| | 9 | 33.33 | 275 | 50 | 81.8 | 320 | 66.67 | 11.11 |
| | 10 | 55.56 | 185 | 45 | 75.7 | 330 | 40.44 | 22.22 |
| 30% | 1 | 0 | 100 | 14 | 86.0 | 159 | 100 | 0 |
| | 2 | 0 | 231 | 24 | 69.6 | 162 | 100 | 0 |
| | 3 | 0 | 93 | 20 | 78.5 | 166 | 100 | 0 |
| | 4 | 22.22 | 153 | 37 | 75.8 | 194 | 77.78 | 0 |
| | 5 | 44.44 | 70 | 26 | 62.9 | 230 | 55.56 | 00 |
| | 6 | 44.44 | 172 | 60 | 65.1 | 232 | 55.56 | 0 |
| | 7 | 44.44 | 164 | 64 | 61.0 | 216 | 55.56 | 0 |
| | 8 | 66.67 | 67 | 17 | 74.6 | 263 | 33.33 | 0 |
| | 9 | 66.67 | 25 | 15 | 40.0 | 485 | 33.33 | 0 |
| | 10 | 66.67 | 20 | 10 | 50.0 | 490 | 33.33 | 0 |
| | 11 | 66.67 | 25 | 10 | 60.0 | 180 | 33.33 | 0 |
| | 12 | 66.67 | 15 | 5 | 66.7 | 185 | 33.33 | 0 |
| | 13 | 66.67 | 15 | 5 | 66.7 | 185 | 33.33 | 0 |
| | 14 | - | - | - | - | - | - | 22.22 |

Table 5- The effect of the roasted seed meal of Melia azadarach on the successful developmental, digestability and larval weight of S.littoralis 6th instar larvae to the pupal stage.

| Conc. | Days after treatments | % Mortality | x food consumed in mg/larva | x feces in mg/larva | Digestability | x larval weight in mg. | % survival larva | % prepupae |
|---|---|---|---|---|---|---|---|---|
| 5% | 1 | 0 | 269 | 19 | 92.9 | 196 | 100 | 0 |
| | 2 | 0 | 346 | 32 | 89.0 | 242 | 100 | 0 |
| | 3 | 33.33 | 162 | 58 | 64.2 | 345 | 66.67 | 0 |
| | 4 | 55.56 | 170 | 55 | 57.6 | 415 | 44.44 | 0 |
| | 5 | 55.56 | 238 | 53 | 77.7 | 381 | 44.44 | 0 |
| | 6 | 66.67 | 50 | 37 | 26.0 | 410 | 33.33 | 0 |
| | 7 | 77.78 | 75 | 65 | 13.3 | 400 | 22.22 | 0 |
| | 8 | 88.89 | 400 | 20 | 95.0 | 670 | 11.11 | 0 |
| | 9 | 88.89 | 110 | 50 | 54.5 | 500 | 11.11 | 0 |
| | 10 | 88.89 | 900 | 30 | 96.7 | 400 | 11.11 | 0 |
| | 11 | - | - | - | - | - | - | 11.11 |
| 10% | 1 | 0 | 299 | 17 | 94.3 | 166 | 100 | 0 |
| | 2 | 11.11 | 186 | 26 | 86.0 | 193 | 88.89 | 0 |
| | 3 | 11.11 | 108 | 18 | 83.3 | 191 | 88.89 | 0 |
| | 4 | 55.56 | 158 | 33 | 79.1 | 275 | 44.44 | 0 |
| | 5 | 77.78 | 360 | 20 | 94.4 | 365 | 22.22 | 0 |
| | 6 | 77.78 | 315 | 40 | 87.3 | 305 | 22.22 | 0 |
| | 7 | 77.78 | 200 | 35 | 82.5 | 260 | 22.22 | 0 |
| | 8 | 77.78 | 600 | 5 | 98.3 | 230 | 22.22 | 0 |
| | 9 | 88.89 | - | - | - | 280 | 11.11 | 0 |
| | 10 | 88.89 | - | - | - | 170 | 11.11 | 0 |
| | 11 | - | - | - | - | - | - | 11.11 |
| 30% | 1 | 0 | 452 | 10 | 97.8 | 153 | 100 | 0 |
| | 2 | 55.56 | 288 | 45 | 84.4 | 248 | 44.44 | 0 |
| | 3 | 77.78 | 170 | 30 | 82.3 | 390 | 22.22 | 0 |
| | 4 | 88.89 | 430 | 60 | 86.0 | 510 | 11.11 | 0 |
| | 5 | 88.89 | 330 | 20 | 93.9 | 440 | 11.11 | 0 |
| | 6 | 88.89 | 100 | 60 | 60.0 | 400 | 11.11 | 0 |
| | 7 | 88.89 | 120 | 20 | 83.3 | 360 | 11.11 | 0 |
| | 8 | 88.89 | -* | - | - | 280 | 11.11 | 0 |
| | 9 | 88.89 | - | - | - | 250 | 11.11 | 0 |
| | 10 | - | - | - | - | - | | 11.11 |

* The larvae were fasting.

Table 6- Weight gain, development and survival of Spodoptera lirroralis 6th instar larvae reared on diet treated with chinaberry preparations.

| Chinaberry preparation and conc. (%)in diet | Average weight gain per larva (mg.) | Average developmental time (days)* | Average % pupation |
|---|---|---|---|
| Whole pulp | | | |
| 5 | 193.6 | 10 | 22.2 |
| 10 | 179.2 | 10 | 22.2 |
| 30 | 92.3 | 10 | 11.1 |
| Free oil pulp | | | |
| 5 | 487.2 | 7 | 70.0 |
| 10 | 335.7 | 7 | 80.0 |
| 30 | 167.0 | 7 | 20.0 |
| Acidifies roasted seed | | | |
| 5 | 531.9 | 9 | 44.4 |
| 10 | 447.3 | 9 | 55.5 |
| 30 | 118.0 | 9 | 16.6 |
| Roasted seed meal | | | |
| 5 | 387.1 | 10 | 33.3 |
| 10 | 385.0 | -** | 0.0 |
| 30 | 73.2 | -** | 0.0 |
| Unroasted seed meal | | | |
| 5 | 238.9 | 10 | 0.0 |
| 10 | 155.0 | -** | 0.0 |
| 30 | 153.2 | -** | 0.0 |
| Control | 403.0 | 7 | 90 |

* From the beginning to the end of 6th larval stage.
** Failed to reach the pupal stage.

بسم الله الرحمن الرحيـــم

# " تقييم معملى للتحضيرات المختلفة من نبات الزنزلخت وذلك على يرقـــات دودة ورق القطـــــن "

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لقد تمت دراسة التحضيرات المختلفة من ثمار نبات الزنزلخت على العمر اليرقى السادس ليرقات دودة ورق القطن . ولقد تم خلط هذه التحضيرات كل على حدة وذلك على البيئة الصناعية وذلك بتركيزات كانت ٥ ، ١٠ ، ٣٠٪ وذلك بنسبة وزن لوزن . ولقد أدى ذلك الى اطالة فترة النمو والتطور كذلك سببت نقص فى وزن اليرقات المتوقع ـ وقد أدت المعاملة بكل من البذور المحمصة والغير محمصة الى منع تكوين العذارى وذلك بغض النظر عـــــن التركيزات المختبرة . وقد وجد أن نشاطات التحضيرات المختلفة للزنزلخت مشابهة لنشاط كل من بذور نبات النيم وكذلك لمنظمات النمو الحشرية .