The desert locust, *Schistocerca gregaria* (Forskal, 1775) (Orthoptera: Acrididae) is a voracious and polyphagous pest of worldwide importance. Locust control relies on repetitive application of insecticides, rendering this option expensive and environmentally-damaging. New locust control initiatives emphasise the use of botanicals, entomopathogens, Insect Growth Regulators (IGRs), and pheromones. Phenylacetonitrile (PAN), the major and key component of the aggregation pheromone of older male adult desert locusts showed deleterious effects on conspecific nymphs. The nymphal pheromone blend (NPB) de-aggregated conspecific adults and lead gravid females to disperse their eggpods. However, the optimum use of PAN and NPB on desert locust control has not been investigated yet. The aim of this study was to optimise the use of PAN in enhancing susceptibility of S. *gregaria* nymphs to fenitrothion and neem oil and assess the effects of nymphal pheromone blend (NPB) on conspecific adults. The whole work was carried out under laboratory conditions.

The results showed that desert locust nymphs were sensitive to all carriers that were tested [Tween 20, paraffin oil, polyethylene glycol 200 (PEG 200), paraffin oil, cyclohexanone], either applied topically or in vapour form regardless of the monitored parameters including food uptake, grouping behaviour and walking behaviour.

Comparison of two modes of application of PAN showed that the release of PAN from a vial with a vent of 2 mm on its cap was significantly more effective in reducing the food uptake compared to their respective controls than its
release from impregnated cotton roll. However, in both cases, the effect of PAN on the food uptake of test nymphs was dose-dependent.

The optimum release rate of PAN (3.9 ± 0.14 mg / day) significantly reduced the grouping behaviour of treated nymphs compared to the controls throughout the experiment. It also reduced the food uptake and the total haemocyte count of treated nymphs compared to the controls. Of the haemocyte groups, the coagulocytes were the most affected by PAN.

The NPB affected the haemocyte population of three and 15 day-old adults and gravid females. The NPB significantly increased the total haemocyte count (THC) of treated, three day-old adults and gravid females, but marginally
decreased the THC of 15 days-old locusts. The increase of the numbers of plasmatocytes in the haemolymph of NPB-treated insects compared to the controls was significant in both three day-old adults and gravid females.

Gregarious female locusts treated with NPB significantly dispersed their egg pods (75%) similar to the solitarious insects (81.25%). Only 25 and 37.5 % of the controls and carrier-treated females, respectively, dispersed their egg-pods.

PAN enhanced mortality caused by sub-lethal doses of fenitrothion (1.19×10^{-2}, and 1.79×10^{-2} mg a.i / nymph), and the lowest recommended dose of the pesticide (2.38×10^{-2} mg a.i / nymph) in third and fifth instar nymphs. This was significant on fifth instar nymphs for all three doses of fenitrothion applied three and five days after the start of PAN treatment.

Similar mortality rates on fifth instar nymphs were obtained with 75% and 100% of the recommended dose of fenitrothion, when both doses of the pesticide
were combined with the higher dose of PAN (3.9 ± 0.14 mg / day). Also, the results showed that at 75% of recommended dose of fenitrothion the two releases rate of PAN (3.9 ± 0.14 and 0.93 ± 0.06 mg / day) enhanced the mortality caused by fenitrothion to similar levels (66.16 and 66.19%, respectively). The best

combination of both products was the application of 75% of recommended dose of fenitrothion three days after start of exposure to the lowest dose of PAN on to the nymphs.

PAN also enhanced the efficacy of fenitrothion on third instar nymphs, but to a lesser extent than on fifth instar. In fifth instar nymphs, the combination of PAN and fenitrothion killed up to 4.34 times nymphs more than fenitrothion alone. This ratio was less by 1.2 times in third instar nymphs.

The youngest three-day-old nymphs were significantly more susceptible to fenitrothion alone than the six or eight day-old nymphs in both third and fifth instar nymphs.

PAN enhanced the mortality rate and induced growth disruptive effects characterized by delay of the moult and malformation of fledgelings. The overall mortality in all experiments was less than 50%. The malformations affected mostly the wings, hind legs, and the antennae, affecting either one, two or three organs or all three in different insects. The best combination in this study with regard to all parameters monitored (mortality and mal-growth) is that of PAN and the medium and sub-lethal dose of neem oil (39.72×10^{-5} mg a.i / nymph) applied on the same day.