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INDEPENDENT AND COMBINED ACTION OF CARBARYL AND PHENTHOATE ON SNAKE HEAD, *CHANNA PUNCTATUS* (BLOCH)

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FISH serves as a bio-indicator of water quality and this can easily be testified by its morphological, physical and behavioural changes in any altered environmental condition[1]. Since pesticides are known to affect the quality of water, this has a profound influence on the biochemical and physiological parameters, which also influence the behavioural patterns. Based on this, the present study aims to probe into some physical, morphological and behavioural changes in *Channa punctatus* exposed to sublethal concentrations of carbaryl (C) (1.49×10^4 M–in ppm : 3 ppm), phenthoate (P) (0.04×10^4 M–in ppm : 0.16 ppm) and their combination (C + P) (0.01×10^4 M–0.25 ppm). In our earlier study[2], it was observed that the C + P combination was found to exhibit markedly synergism (potentiation of toxicity during interaction). In C + P combination, though the concentration of both C and P is very low when compared to their corresponding individual pesticides, still exhibiting synergism, might be due to the manifestation of additive effect during interaction.

I. Physical changes

The body weight of the fish showed an insignificant decrease and the per cent water content showed no significant change in the fish exposed to C, P and C + P combination of pesticides. However, under C + P combination, the per cent change in these parameters was relatively greater than in individual exposures. The insignificant values obtained regarding these two parameters suggest the loss of some constituents other than water, probably ions, amino acids, amines etc which are known to function in the maintenance of ionic and osmotic balance[3].

II. Morphological changes

Colour: The skin colour of the normal fish is black or dark grey which becomes light grey under pesticide exposure. This is more conspicuous with C + P combination. The black spots on fins were found to fade predominantly under C + P combination.

Secretion of mucous: There is copious mucous secretion under pesticide exposure, particularly in C + P combination. If secretion of mucous is regarded as a defense response, the high amount of mucous secretion in C + P exposed fish can be attributed due to the manifestation of additive effect. It is likely that the secretion of mucous may help in protecting vital organs like, gills against pesticide toxicity[4].

III. Behavioural changes

(a) Irregular, erratic and sometimes jerky movements were observed in the fish exposed to individual and combination of pesticides. Manifestation of this abnormal behavioural pattern is certainly a sign of pesticide toxicity which is greater under C + P combination. After 30–36 hr of exposure, the fish exhibits a peculiar behaviour of trying to jump out from the pesticide medium, which can be taken as an escape phenomenon.
(b) After 36–40 hr of exposure, the fish resorts to erratic swimming indicating loss of equilibrium. It is likely that the region in the brain which is associated with the maintenance of equilibrium should have been effected under the insecticidal impact. This strange phenomenon is greater under C + P combination, suggesting that the C + P combination would exhibit additive effect, indicating the manifestation of synergism.
(c) The frequency of surfacing phenomenon was greater under pesticidal exposure, wherein the fish frequently comes to water surface. This peculiar behaviour is more frequent in fish exposed to C + P combination (5–8 times/min) followed by phenthoate

(4–6 times/min) and carbaryl (3–5 times/min) over control fish (2–3 times/min). This increase in the frequency of surfacing in pesticide medium might either be due to hypoxic condition in the medium, or difficulty to respire in the medium[4].

(d) The rate of opercular movement was also reduced significantly under pesticide and the decrease was greater under C+P exposure confirming its higher impact. The reduction in the rate of opercular movement may be regarded as a protective mechanism to minimize gill damage[5,6]

The organophosphate (Phenthoate) and carbamate (Carbaryl) pesticides are known to inhibit acetylcholinesterase, a neurotransmitter enzyme and causes hyper excitability[7,8], which in turn might also influence behavioural patterns. Though the behavioural patterns, mostly neurological, are also influenced by other metabolic changes, the sum total of all these neurological, physiological and biochemical changes at the tissue level contributes to the abnormal behaviour of the fish which is greater under C+P combination than under individual exposures. This shows that this combination has an additive effect on the physical, morphological conditions and behavioural patterns of the fish. In a way, the abnormal behaviour exhibited by the fish can be taken as a useful parameter in assessing the extent of pollution by pesticides, because, the fish serves as a bio-indicator of aquatic pollution. Thus, behavioural studies need much emphasis in understanding changes in the animal's habitat, because an altered environmental condition manifests stress on the animal.

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A RECORD OF A MERMITHID FROM MAIZE BORER, *CHILO PARTELLUS* (SWINHOE) (PYRALIDAE: LEPIDOPTERA)

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MERMITHIDS are important nematode parasites of agricultural pests. Tent caterpillar, *Malacosoma americanum* (Fab) has been reported as a host of *Hexamermis* sp in USA[1]. This species has been found in *Spodoptera frugiperda* (J. E. Smith), a pest of maize in Nicaragua[2]. *Heliothis* spp have also been reported as hosts of *Hexamermis*[3]. Up to 25% parasitism of shoot borer, *Hypsipyla grandella* was noticed in Costa Rica[4].

Maize borer, *Chilo partellus* (Swinhoe) is an important pest of maize in Pakistan. It is commonly found in all the maize growing areas of the country[5].

A survey of the maize fields in Swat, Pakistan was conducted during 1978 from March to July for nematode parasitism in larvae of *C. partellus* by dissecting infested plants at random. Larval parasitism by *Hexamermis* sp nr *albicans* ranged from 0.3 to 3.0%. Parasitism was extremely localized. The nematodes emerged through the intersegemental membrane of the host and killed the larvae upon emergence. Only one nematode per larva was observed.

Most of the Mermithids spend a part of their life in soil to moult after emergence from the host. During 1979 pits of 40 cm diameter were dug in the fields from January to December to find out vertical distribution of nematodes in the soil. Pits were dug at random in the fields in which infestation was found in 1978. Nematodes were found coiled in the soil from soil surface to a depth of 60 cm. The number of parasites was recorded for every 10 cm depth from the surface. The highest number (19) was found at a depth of 21–30 cm and the lowest (2) at 51–60 cm. The number of nematodes increased from 1–10 to 21–30 cm and then decreased up to 51–60 cm from the soil surface.