A NEW PREDATORY ANT *AENICTUS PACHYCERUS* SMITH (HYMENOPTERA: FORMICIDAE) ON WIREWORM *AGRIOTES* SP. (COLEOPTERA: ELATERIDAE)

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WIRLWORMS are important pests of many field crops destroying the tender seedlings[1]. So far, no record of ants as predators on wireworms is available, although other insects and spider mites have been studied (*Tapinoma melanocephalum* (Fab.) on sorghum mite *Oligonychus indicus* (Hirst)[2], custard apple (*Annona squamosa*) scale *Ceroplastes* sp., coccids on tender bamboo shoots, caterpillars *Catachysops enejus* (Fab.) and aphids of many field crops[3]). About 30–100% reduction in first and second instar caterpillars of *Plutella xylostella* (Linn.) has been reported to be caused by ants belonging to *Pheidole* sp., *Camponotus* sp. and *T. melanocephalum*[4].

During our investigations on the seasonal incidence of green gram *Vigna radiata* (Linn.) Roxb., mothbean *Vigna aconitifolius* (Jacq) and cowpea *Vigna unguiculata* (Linn.) Walp (1983–1986), the wireworm *Agriotes* sp. was noticed in abundance during September and October inflicting damage to mothbean and green gram seedlings to 30–40%. The grubs were attacked by an ant *Aenictus pachycerus* (Smith). The ants were harboured in underground nests and they came out during cooler hours of the day attacked and killed the wireworm grubs gregariously and carried away the dead grubs to their nests. The present observations on the ant *Aenictus pachycerus* (Smith) as a predator on wireworm *Agriotes* sp. form a new record.

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LEAF-AGE CORRELATED CHANGES IN OXIDATIVE ENZYMES IN *RETITHRIPS SYRIACUS* (MAYET) INFESTED *RICINUS COMMUNIS*

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RETITHRIPS SYRIACUS, a thrips of economic importance having a wide host range is known to exhibit preferential feeding to completely open younger leaves of *Ricinus communis*. The degree of infestation (in terms of infestation factor, IE, i.e. number of adults and nymphs per 100 cm^2 area) in relation to leaf morphology, the stomatal frequency in particular, as well as the respiratory rate resulted in an immunity line, due to the fact that respiration rates increased gradually up to IE = 50, thereafter becoming uniform indicating tolerance of castor leaves to infestation[1]. Adults occur in greater numbers than nymphs in younger leaves and the proportion gradually reduces during ageing of the leaves indicating the preparedness of the numerous adults in the younger upper leaves for fertilization and oviposition[2]. The tolerance of *Ricinus communis* leaves (in terms of respiratory rate) and synchronization of leaf ageing to infestation pattern prompted an analysis of peroxidase (PO) and polyphenol oxidase (PPO), the change in activity/isoenzyme composition of which is an accompanying characteristic of the changed metabolic activity of the plant under the influence of exogenous/endogenous factor(s)[3].

Healthy as well as agewise-comparable infested leaf stages of *Ricinus communis* were collected, based on their relative position of origin from the shoot apex, and labelled. Leaves were washed thoroughly and known amounts were ground in a mortar and pestle using acid-washed sand and Tris-HCl buffer of pH 8.2, 0.2 M (with 0.085% NaCl, 0.1% cysteine hydrochloride and ascorbic acid) and centrifuged at 12,000 *g* for 30 min. Supernatant was used as the enzyme extract. Peroxidase and polyphenol oxidase[4] (figure 1) were assayed using pyrogallol and H_2O_2 and dihydroxy phenylalanine as substrates respectively. Unit of enzyme

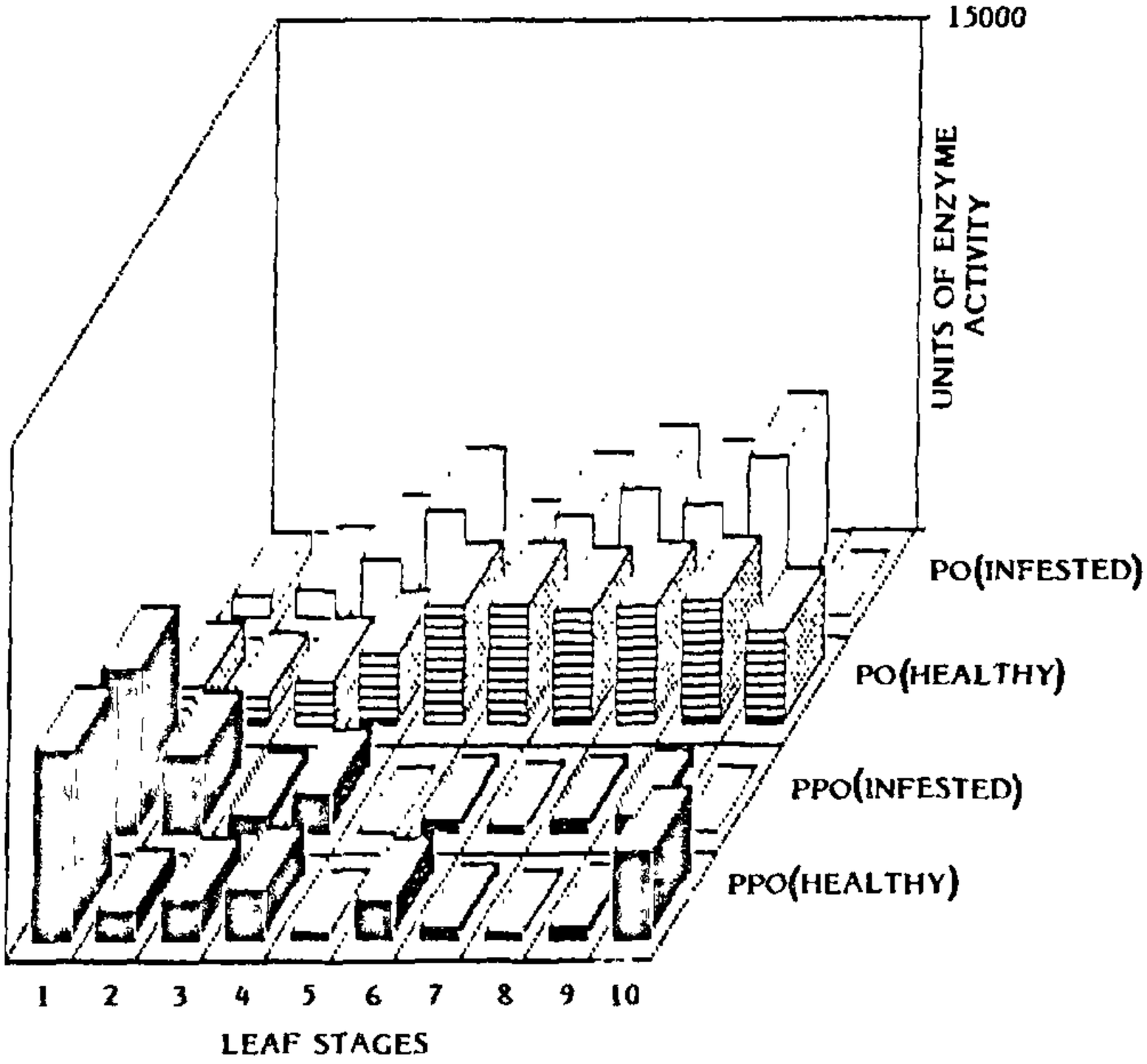

Figure 1. Quantitative analysis of peroxidase (PO) and polyphenol oxidase (PPO) of healthy and thrips infested leaf stages of *Ricinus communis*.

activity was expressed as the increase in the optical density by 0.1 (for peroxidase) or 0.001 (for polyphenol oxidase) per minute per gram of the fresh leaf tissue. For qualitative analysis, polyacrylamide gel electrophoresis (PAGE) was carried out in the running gel using the supernatant (300 μg eqv. of protein per gel). After the run, the gels were stained using 0.2% benzidine and 0.1 ml of 1% H_2O_2 for peroxidase and 0.2% DOPA for polyphenol oxidase[5] (figure 2). After the isozyme colour development, the gels were fixed in 7% acetic acid and scanned using a LKB laser beam densitometer.

Peroxidase activity gradually increased both in the healthy and infested leaves during development, excepting the senescent leaf stage at which a decreasing trend was noticed. Heightened activity was characteristic of all infested leaf stages compared to their respective healthy leaf stages. A reverse trend i.e. decreasing polyphenol oxidase levels were noticed during ageing of leaves and only minor quantitative variations were noticed between healthy and infested leaf stages. Qualitative analysis based on PAGE clearly revealed the increasing numbers of peroxidase isoenzymes from leaf stage 1 to stage 5, both in the healthy and the infested plants. Thereafter, a reduction in isozymes in an increasing leaf age order was noticed in healthy plants, while in infested leaves, the number of isoenzymes were maintained till leaf stage 9. In both infested and healthy senescing yellowing leaves (stage 10), there was considerable reduction in the number as well as concentration (based on colour intensity) of isoenzyme bands. Comparison of healthy leaf stages with their respective infested ones, showed that extracts from infested leaves revealed a lower number of isoenzymes. But it is relevant to note here that, larger variation occurred in the isoenzyme pattern in that only a few isoenzymes were found to be commonly present in both healthy and infested leaves. Disappearance of isoenzymes detected in the healthy leaves alongside the appearance of newer isozymes (based on R_f values) was noticed in infested counterparts. Such variation is comparatively reduced in polyphenol oxidase patterns since the major enzyme was commonly detected in both healthy and infested leaves.

Increased peroxidase/polyphenol oxidase activity has been implicated to the oxidation of phenolic compounds in the invaded plants, thereby resulting in the induced tolerance/resistance due to the toxicity of the oxidation products. In many instances enhanced activity of polyphenol oxidases and perox-

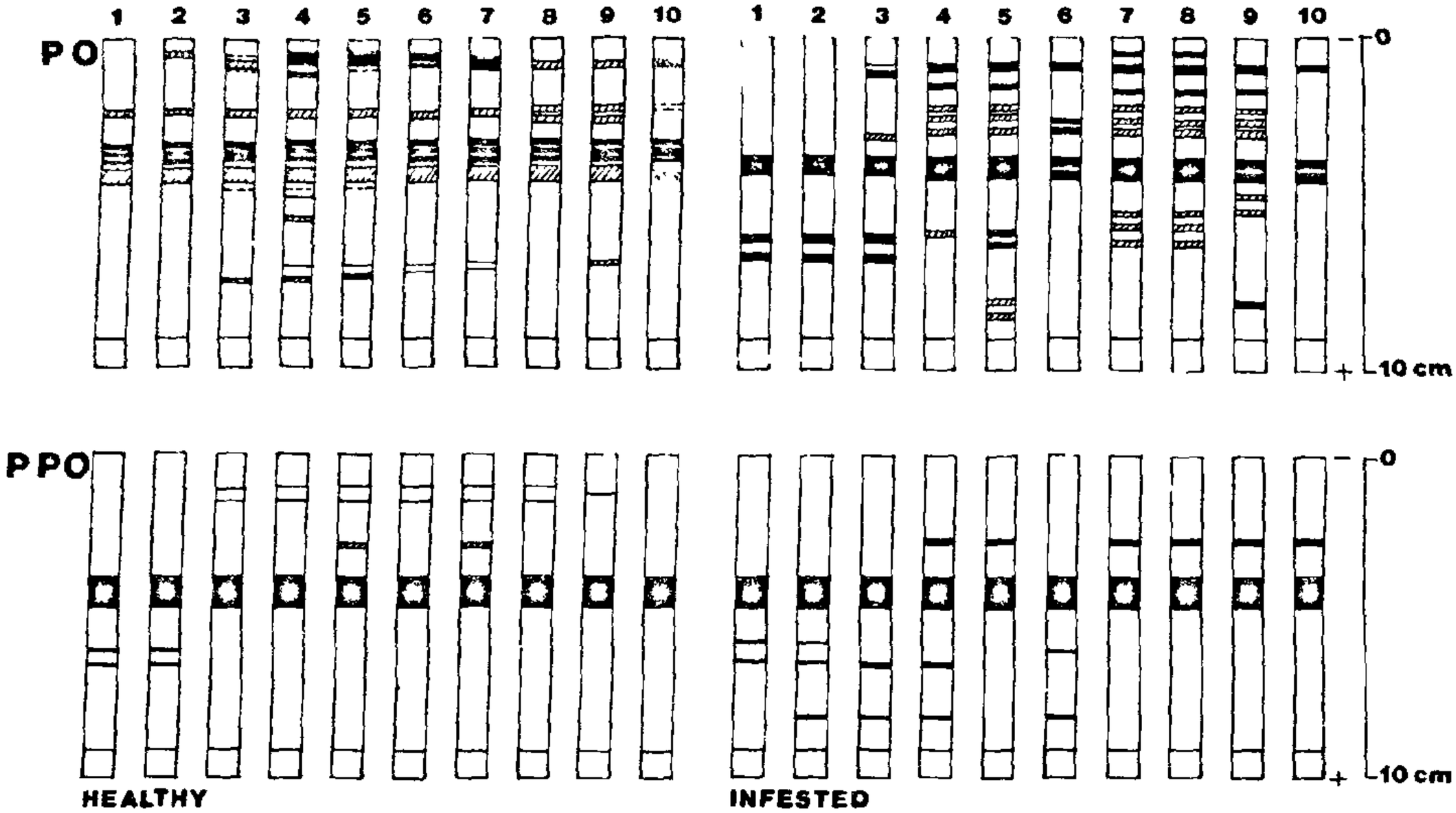

Figure 2. Polyacrylamide gel electropherograms of peroxidase (PO) and polyphenol oxidase (PPO) of healthy and thrips infested leaf stages of *Ricinus communis*.

idase has been correlated with increased phenolic content at and around infection sites[3]. Taking into account the fact that biochemical symptoms of infestation are determined not only by the genetic, physiological and biochemical characteristics of the responding host, but also by the insect invader, increasing concentrations of phenol oxidising enzymes in host as well as changes in the isoenzyme composition do not appear to be specific reactions of the plant to infestation, but relate more to the metabolic changes resulting from infestation by *Retithrips syriacus*. It appears therefore that oxidised and polymerised products of phenolics of varying toxicity, being the products of oxidative enzyme activity, would be decisive in tolerance/resistance of castor leaves to thrips infestation. In turn, an analysis of the role of oxidases/reductases of insect origin may explain the tolerance of insects to the heightened secondary metabolic components of plant tissues.

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