species of *Tylenchorhynchus* from sugar-cane at Grand Isle, Louisiana, swarmed separately in mixtures⁸, indicate that both species and sub-generic (group or section) specificity of the swarming reaction exist in the genus *Tylenchorhynchus*. Morphologically, *T. martini* and *T. claytoni* are close relatives, whereas the Grand Isle *Tylenchorhynchus* is distinct from these species. The combined evidence suggests that swarming specificity lies at the sub-generic group level of morphological distinctions.

JERE M. MCBRIDE
JOHN P. HOLLIS

Department of Plant Pathology,
Louisiana State University,
Baton Rouge, Louisiana.

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Picrolonic Acid as a Hatching Agent for the Potato Cyst Nematode, *Heterodera rostochiensis* Woll.

Calam, Todd and Waring¹ reported that almost as many eggs of the potato cyst-nematode, *Heterodera rostochiensis*, were stimulated to hatch by a 3 mM aqueous solution of anhydrotetrone as by potato root diffusate; other tetrone acid derivatives they synthesized did not stimulate hatching. Marrian, Russell and Todd² synthesized various compounds based on an α -arylidene- $\Delta^8\gamma$ -butenolide skeleton and reported that two of these, α -(*p*-hydroxybenzylidene)- γ -methyl- $\Delta^8\gamma$ -butenolide and α -(3-methoxy-4-hydroxybenzylidene)- γ -methyl- $\Delta^8\gamma$ -butenolide, "showed definite activity" at a concentration of 0.1–0.5 mM, whereas the rest were inactive or only slightly active. That anhydrotetrone acid is a good synthetic hatching agent has been confirmed^{3–6}, and in our tests, at 3 mM concentration, its hatch rating⁷ was 90 (potato root diffusate = 100, water = 0), whereas 0.1–0.05 mM α -(*p*-hydroxybenzylidene)- γ -methyl- $\Delta^8\gamma$ -butenolide was only slightly active (hatch rating 7).

Fenwick⁷ and Doliwa⁸ reported, respectively, that picric acid and potassium permanganate hatched eggs of *H. rostochiensis*. We tested these but found that picric acid was inactive (hatch rating 4) and potassium permanganate hatched only few eggs (hatch rating 9), whereas both hatched eggs of the beet cyst nematode, *H. schachtii*, well (hatch ratings > 200 and 86, respectively)⁹.

We tested the ability of more than four hundred compounds to hatch eggs of *H. rostochiensis*, using techniques already described^{3,9,10}, and, except for anhydrotetrone acid, found only one compound, picrolonic acid¹¹ (4-nitro-3-methyl-1-*p*-nitrophenylpyrazolone), which, at concentrations of 0.4–4 mM, hatches eggs as effectively as potato root diffusate (hatch rating 102). By comparison, zinc salts, which hatch eggs of several *Heterodera* spp.⁸, have a hatch rating of 50 for *H. rostochiensis*. Other

tetrone acid derivatives, pyrazolones and closely related compounds were inactive.

Picrolonic acid, like anhydrotetrone acid, is formed of two linked rings and has an acidic, enolic group as part of a potentially tautomeric system of two polarizable atoms separated by an extended chain.

Picrolonic acid also hatched many eggs of the soybean cyst-nematode, *H. glycines*, and some of the tobacco cyst-nematode, *H. tabacum*, but none of the cabbage cyst-nematode, *H. cruciferae*. We also confirmed that anhydrotetrone acid does not hatch *H. cruciferae*⁶.

Unlike anhydrotetrone acid, picrolonic acid is a commercial product, so it is the first easily obtainable, efficient, synthetic hatching agent for *H. rostochiensis*. By contrast, more than fifty such compounds are known to hatch eggs of *H. schachtii*.

A. J. CLARKE
AUDREY M. SHEPHERD

Rothamsted Experimental Station,
Harpenden, Hertfordshire.

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Esterase Activity in the Arachnida

DESPITE the immense amount of work which has been carried out on the physiology of the insects, there is little comparative information available for the Arachnida. The present note is a report on current studies of the comparative biochemistry of these animals.

Using polyacrylamide gel electrophoresis the esterase activity of eight species belonging to seven genera of Arachnida has been investigated. Following homogenization, supernatants containing 300 γ protein/0.05 ml. were run for 24 min at a constant current of 5 m.amp per tube. The tubes were made of soda-glass and were 65 mm long with an internal diameter of 5 mm; the gels were prepared according to the method of Ornstein and Davis¹. After electrophoresis, the gel columns were removed and incubated in the appropriate substrate media.

The reaction mixtures used were those developed by Holt and Withers², Laufer³, and Gomori⁴. The distribution of protein bands was indicated by staining for 1 h in 1 per cent amido-black in acetic acid, followed by the standard de-staining procedure. The association between total esterase activity and the protein bands was demonstrated by incubation in 5-bromo indoxyl acetate for 2–4 h at 21°C; and also α -naphthyl acetate together with either fast blue RR, or fast garnet GBC, for 2 h at 21°C. Incubation in solutions of acetylthiocholine iodide and butyrylthiocholine iodide demonstrated the presence of enzymes capable of hydrolysing these substrates, that is to say, specific and non-specific cholinesterases. Work is in progress in which selective inhibitors are being used to distinguish between these enzyme types. Table 1 summarizes the results obtained for the eight species

Table 1. OCCURRENCE OF ESTERASE ACTIVITY IN EIGHT SPECIES OF ARACHNIDA

	Diptynidae <i>Cimiflo</i> <i>similis</i> Blackwall	Agelenidae <i>Agelena</i> <i>labyrinthica</i> Clerck	Meta <i>segmentata</i> Clerck	Argiopidae <i>Meta</i> <i>merianae</i> Scop	<i>Araneus</i> <i>diadematus</i> Clerck	<i>Zygiella</i> <i>x-notata</i> Clerck	Linyphiidae <i>Linyphia</i> <i>triangularis</i> Clerck	Phalangida <i>Mitopus</i> <i>morio</i> Fab
Substrates								
5-Bromoindoxyl acetate	+	+	+	+	+	+	+	+
α -Naphthyl acetate	non det	+	+	+	+	+	+	+
+ fast blue	non det	non det	+	+	+	+	+	+
+ fast garnet	+	+	+	+	+	+	+	+
Acetylthiocholine iodide	+	+	+	+	+	+	+	+
Butyrylthiocholine iodide	?	?	+	+	?	+	+	?