cultural practices remained the same in both the treatments. The fresh weight of *Azolla* was determined before its incorporation in soil and 100 g of fresh *Azolla* was oven-dried for dry weight and N estimation. The plant height, panicle numbers, grain and straw yields of rice crop were recorded. The nitrogen content of *Azolla* was determined by modified micro Kjeldahl method[3].

The observations (table 1) show that mixing carbofuran with *Azolla* inoculum increased the biomass production and nitrogen fixation of *Azolla* during its cultivation. *Azolla* inoculated in rice field 15 DBT, 10 and 30 DAT with carbofuran covered the water surface 7 DBT, 22 and 45 DAT, respectively during wet season and 8 DBT, 20 and 42 DAT, respectively during dry season and no insect infestation was observed. The *Azolla* crop in the rice field without carbofuran was attacked by *Pyralids, Nymphula* and *Chironomus* sps of insects and could not cover the water surface. The total biomass produced by three crops of *Azolla* with carbofuran was 46.9 and 46.0 t ha^{-1} during wet and dry seasons, which fixed 87.8 and 86.8 kg N, respectively. These three crops of *Azolla* without application of carbofuran produced only 30.7 and 31.0 t ha^{-1} fresh *Azolla* containing 55.1 and 55.3 kg N, respectively during those seasons. Thus, application of carbofuran with *Azolla* inoculum produced 48.4 to 52.8% more biomass which fixed 57 to 59.2% more nitrogen (table 1). Singh[4] observed that *Azolla* crop was attacked by insects and application of 2.50 kg furadan effectively controlled them. Sasmal and Kulshrestha[5] reported that *Azolla* was attacked by two pyralid caterpillars, *Nymphula responsalis* and *Cryptoblabes gnidiella* (Mill) and application of 0.5 kg a.i. ha^{-1} carbofuran reduced 94.6% caterpillar population after 7 days of its application.

The application of carbofuran increases the height, panicle number, grain and straw yields of rice crop (table 2). An increase of 13.9, 20.2 and 23.5% in panicle number, grain and straw yields, respectively was observed due to insecticide application with *Azolla* during wet and 17.3, 16.4 and 26.5%, respectively, during dry seasons (table 2). This was due to greater biomass production and N_2-fixation by *Azolla* in the insecticide treated field than the untreated one. However, Lee[6] reported the promotion of growth of plant through inhibition of IAA-oxidase by carbofuran and its metabolite and suggested that plant interacts with the insecticide. Thus, it was concluded that mixing carbofuran with *Azolla* inoculum enhanced the growth and N_2-fixation of *Azolla* and also benefited the rice crop.

Table 2 *Effects of carbofuran application with Azolla inoculum on yields and yield attributing characters of rice variety Ratna*

	No insecticide	Carbofuran (1 kg a.i.ha^{-1})
Wet 1983		
Grain yield (t ha^{-1})	3.994	4.800 (20.2)
Straw yield (t ha^{-1})	4.150	5.125 (25.5)
Panicle number (m^{-2})	238	271 (13.9)
Plant height (cm)	87	93 (6.9)
Dry 1984		
Grain yield (t ha^{-1})	4.578	5.328 (16.4)
Straw yield (t ha^{-1})	4.891	6.188 (26.5)
Panicle number (m^{-2})	318	373 (17.3)
Plant height (cm)	76	81 (6.6)

Figure in parentheses indicate percentage increase over control (no insecticide).

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EFFECT OF EXPERIMENTAL *TRYPANOSOMA EVANSI* INFECTION ON LACTATE-DEHYDROGENASE ACTIVITY OF ALBINO RATS

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PARASITIC protozoa of the genus *Trypanosoma* cause tropical diseases including sleeping-sickness in man, and surra in domestic animals. A large number of non-specific stress result in the elevation of serum enzyme levels[1]. The elevation of serum enzymes is generally attributed either to pathological lesions and cellular necrosis or change in the permeability

of cell membrane[2-4]. Pathogenic trypanosomes produce definite tissue lesions[5]. Trypanosomes of brucei-group cause necrosis of host-connective tissues as well as perivascular tissues[6]. Consequently the organ-specific enzymes are released into host blood stream which in turn elevate the serum enzyme levels[1]. The present study was undertaken to elucidate changes in the lactate-dehydrogenase (LDH) activity of various tissues like liver, kidney, skeletal muscle, brain as well as serum LDH levels the experimentally *T. evansi* infected rats in relation to degree of parasitemia.

A bovine strain of *T. evansi* was collected from infected cattle and maintained in albino rats through syringe passage. The male rats were divided into 4 groups. One of these groups was used as control and the other 3 groups were intraperitoneally infected with 10^6 trypanosomes. Thereafter the blood obtained from the tail vein of the rat was daily examined for the presence of parasites. After the onset of infection the parasitemia was counted on haemocytometer. The tissue LDH activity was assayed by the modified method of Nachlas *et al* as described by Reddanna and Govindappa[7]. The protein in the tissue was estimated by the method of Lowry *et al*[8]. The serum LDH activity was colorimetrically assayed as per Oser[9] and the enzyme activity is expressed in terms of units per ml serum (A unit is equal to a decrease of 0.001/min in extinction at 340 mμ). The other details were previously described[10].

The parasitemia appeared in the peripheral blood after an incubation period of 4 days. After the onset of infection the parasitemia increased progressively and the peak parasitemia was observed on the third day. A decrease in the tissue LDH activity with an increase in the serum enzyme levels was reported in terminally *T. evansi* infected experimental hosts[10]. The data presented in table 1 show that the decrease in the LDH activity of various tissues with subsequent increase in the serum LDH activity is associated with the degree of parasitemia. Since *T. evansi* is a member of brucei-group trypanosomes[11], the decrease in the tissue LDH activity with subsequent elevation in the serum enzyme levels can be attributed to necrosis of tissues as LDH activity was reported to be absent in *T. evansi* by Marshall[12].

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Table 1 *Activity levels of LDH in different tissues (μmoles of formazan formed/mg protein/hr) and serum (units/ml) of albino rats infected with Trypanosoma evansi*

Day of infection	Parasitemia (mean tryps/ml of blood) ($\times 10^6$)	Tissues				
		Liver	Kidney	Skeletal muscle	Brain	Serum
Control	—	0.14 ± 0.004	0.07 ± 0.005	0.08 ± 0.001	0.06 ± 0.002	493 ± 29.3
1st	3	0.1 ± 0.006 (−28.6)	0.06 ± 0.004 (−14.3)	0.07 ± 0.003 (−12.5)	0.06 ± 0.003 —	511 ± 39.9 (+3.7)
2nd	7.5	0.06 ± 0.005 (−57)	0.05 ± 0.002 (−28.6)	0.03 ± 0.001 (−62.5)	0.04 ± 0.001 (−33)	680 ± 17.1 (+37.9)
3rd	44	0.03 ± 0.005 (−78.6)	0.03 ± 0.001 (−57)	0.03 ± 0.002 (−62.5)	0.04 ± 0.001 (−33)	894 ± 25.7 (+81.3)

Values are Mean ± SE of 10 observations. Figures in parentheses indicate % change.

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THE PLEUROPODIUM IN THE EMBRYOS OF TWO SPECIES OF VIVIPAROUS SPOROPHAGOUS SPECIES OF TUBULIFERAN THRIPS (THYSANOPTERA : INSECTA)

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OBSERVATIONS on the presence of developing embryo in the genital tract of viviparous species of Tubulifera are on record[1–12], but without adequate structural details regarding the nature of embryogenesis and the incidence of specialized nutritional structures to support the occurrence of viviparity in the respective species. Information presented here relates to some aspects of development of the viviparous/ovoviviparous individuals of *Tiarothrips subramanii* (Ramk) and *Elaphrothrips denticollis* Priesner with particular reference to the development of a special pseudoplacenta called 'Pleuropodium' during later stages of embryonic development.

Embryogenesis in typical oviparous species is initiated only subsequent to the laying of fully mature eggs with adequate yolk reserves. In the ovoviviparous ovaries, mature oocytes in partly yolk-accumulated condition ovulate into the lateral oviduct, where the development of the embryo continues up to blastokinesis. There is a positive correlation between the increase in the size of the embryos in the lateral oviducts and the distance traversed by the embryos in the lateral oviducts. This correlation suggests a quantitative increase in the size of the embryo as it descends down the lateral oviducts. The remaining embryonic development takes place after they are laid. In viviparous ovaries the yolkless pre-vitellogenic oocytes ovulate into the lateral oviduct where complete embryonic development occurs with the subsequent emergence of fully developed larvae. A histological picture of the lateral oviducts with developing embryos (figure 1) indicates the presence of a large number of embryos in various stages of development, more so towards the region of the lateral oviduct which opens into the common oviduct. A statistically significant, proportionate increase in the size of the embryos is also evident as they descend down in the lateral oviduct.

In the viviparous individuals of *T. subramanii* and *E. denticollis*, embryos develop within the lateral oviducts and a part of the nourishment for their development is obtained through the development of a specialized pseudoplacenta called 'Pleuropodium' during the later stages of embryonic development (figures 2 A–E). These pleuropodia are very similar to those described in *Hemimerus* sp, and members of family Polyctinidae[13, 14].

The pleuropodium is a persisting first abdominal segment, ectodermal in origin. The blunt, distal and projects beyond the body wall of the embryo and the proximal end projects inwards into the midline of the embryo. They are bulbous in shape with all the pleuropodial nuclei distributed at their inner margins. No nuclei can be distinguished in the distal projecting region of the pleuropodium. Moreover, no serosa intervenes between the embryo and the wall of the maternal oviduct, and embryo lies free in the lateral oviduct. During the embryonic development, the distal free margin of the pleuropodium on either side, spreads out completely surrounding the whole embryo, to form the pleuropodial sheath. The pleuropodium is only the part of the developing embryo to utilize the available nutrients from the maternal resource at its later stage of development.

In both complete ovoviviparous and viviparous ovaries, the lateral oviduct wall is without any secretory cells and is stretched into a thin membrane. The developing embryos without chorionic covering lie close to the wall of the lateral oviducts and derive nutrients through thin membranous part. Haga[11] also reported a similar thin and transparent lateral and common oviductal wall in ovoviviparous *B. brevitubus*. Studies on the embryogenesis indicated the presence of the pleuropodium only at a later stage in *Bactrothrips buffai* embryos[9]. Their possible role in nourishing the embryo was suggested only in the viviparous insect like *Hesperoctenes fumarius* Westwood by Jordan[15–17], and Hagan[13, 14]. In ovoviviparous forms, the nourishment of the embryo in the lateral oviduct is exclusively through direct absorption. As is the case with the embryos attaining an advance stage of