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CUTICULAR PATTERN IN SOME BURROWING AND NON-BURROWING MARINE ISOPODS

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It is known that the cuticle of Crustacean plays an important role in transpiration, water balance and also acts as a protective covering to the internal organs of the body[1]. The structure and chemical composition of the cuticle of Crustaceans have been studied in detail[2,3]. Sphaeromatidae belong to a group of Isopod crustaceans which are predominantly marine and adapt themselves to different ecological niches. The peculiarities of their cuticle compared to those of other Crustaceans are traceable to the adaptation of semi-terrestrial habits shown in varying degrees by members of this group. However, knowledge on Sphaeromatidae has so far been meagre. This family includes isopods which are associated with underwater wooden structures, while some of them destroy wood by boring into them, others are foulers. Since the cuticle, which is an important organ system forming the boundary between the internal and external environments of the animal, may reflect in structure and chemical composition the adaptive modifications to the peculiar modes of life; a detailed study of its structure and chemical pattern in a wood borer, (*Sphaeroma terebrans*), a fouler (*Sphaeroma walkeri*) and a free living form (*Cirolana fluviatilis*), was made.

Paraffin sections of 8 μ were cut and stained in Mallory's triple and Masson's trichrome. Gelatine sections were used for detection of protein and calcium. Total protein content was estimated by micro-kjeldahl and calcium content was estimated by Ballentine and Burford[4] methods. Ten sets of the sample were taken to estimate protein and calcium.

A comparison of the structural peculiarities of the burrowing and non-burrowing Sphaeromids show differences. The epicuticle in *S. terebrans* lacks an outer lipid layer while in the allied forms *S. walkeri* and *C. fluviatilis* this layer is present. The cuticle of *S. terebrans* shows spinous projections on its outer surface whereas that of *S. walkeri* and *C. fluviatilis* have a thicker cuticle lacking spines. The protein component of the epicuticle of *S. terebrans* is unlike that of *S. walkeri* in not containing, a tyrosine containing fuchsinophilic protein. In *S. walkeri* the epicuticle contains a fuchsinophilic protein and gives evidence of primary tanning as indicated by its reaction to the detanning agents like alkaline stannite solution and diaphenol. In the free-living *C. fluviatilis* the epicuticle conforms to the condition noted in other crustaceans in containing a fuchsinophilic protein which in the intermoult stage undergoes hardening by tanning, resulting in the formation of sclerotin. The procuticle of *S. terebrans* is hardened throughout the moult cycle, giving evidence of only a biuret positive protein and a sulphur containing protein. In the procuticle of *S. walkeri* tanning resulting in sclerotin does not take place. In *C. fluviatilis* the outer layer of the procuticle is modified giving rise to a sclerotised exocuticle.

The total protein levels of the cuticle obtained in the three species show that its range is less in *S. terebrans* (6.6%) than the other two where it is 8.2% and 6.2%. In all the three species, an increase is seen in the protein content from the freshmoult to the postmoult upto the intermoult stage, when the maximum values are reached. The value decreases during premoult.

Though the cuticle is calcified in all the three isopods, quantitative variations are seen. The total calcium in the cuticle of *S. terebrans* shows that it is 13.6% while in *S. walkeri* it is 34.0%. The free-living *C. fluviatilis* contains even less calcium (9.5%).

Moulting in *S. walkeri* is peculiar in that the cuticle of the anterior half of the body moults first, followed by the shedding of the cuticle of the posterior half, unlike the condition normal to isopods.

From the above observations, it is suggested that the absence of protein precursor of tanning in the epicuticle and the absence of hardening in the epicuticle, as well as the abbreviation of calcification in the procuticle are features of *S. terebrans* which may be related to the boring habit of the animal. In the nature of the cuticle, the fouler *S. walkeri*, by com-

parison with that of *S. terebrans* and *C. fluviatilis* exhibits an intermediate condition between *C. fluviatilis* and *S. terebrans*.

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TOMATO SPOTTED WILT VIRUS (TSWV)—A NEW RECORD ON CHILLI IN INDIA

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CHILLI (*Capsicum annuum* L), an important crop grown for its fruits is susceptible to the mosaic disease[1, 2]. During the survey of chilli mosaic disease in Karnataka in 1978–79, some of the isolates of chilli mosaic from the fields showed different symptoms on *C. annuum* cvs California Wonder and Byadgi Kaddi. The cultures of such isolates were maintained on the above hosts. All the isolates maintained on *C. annuum* behaved alike. *Since the symptoms were entirely* different from the earlier reported chilli mosaic diseases in India, investigations were undertaken to identify the causal agent of this disease.

For mechanical transmission, diseased leaves of California Wonder were macerated in sterilized mortar and pestle using 1 ml phosphate buffer (0.067 m, pH 7). The resultant pulp was squeezed through the muslin cloth and test plants were inoculated with this sap as standard inoculum by conventional leaf rub method. Celite (600 mesh) was used as an abrasive. For aphid transmission, about 25 non-viruliferous, apterous forms of *Myzus persicae* Sulz., *Aphis gossypii* Glov., *A. craccivora* Koch., *Rhopalosiphum maidis* Fitch and *Hysteroneura setariae* Thomos were fasted for 90 min and given an acquisition feeding of 20 min on virus infected leaves before they were transferred to test plants for inoculation feeding of 24 hr. For thrips transmission about 25 nonviruliferous, both adults and nymphs of *Thrips tabaci* Lind (tobacco source); *T. tabaci* (onion source) and *Scirtothrips dorsalis* Hood (chilli source), were allowed for acquisition feeding for 5 days on the virus-infected leaves and inoculation feeding of 10 days on healthy young leaves. The insects were finally killed by spraying with 0.02% dimethoate insecticide.

The virus was readily transmitted by sap inoculation; however, the per cent transmission of this virus was limited, *i.e.* only 10–20% plants infected. None of the aphids used here transmitted this virus. Only the nymphs of *T. tabaci* isolated and maintained on onion plants transmitted to *C. annuum* cvs California Wonder and Byadgi Kaddi and not by *S. dorsalis* as reported on groundnut[3]. It was not seed-borne.

This virus first produced pin head necrotic spots on inoculated leaves. After 10–12 days of inoculation, young leaves showed chlorotic mottling with dense coalesced small rings and spots. One month after inoculation, the plants showed on older leaves small rings and concentric rings inside (figure 1a). The bright yellow chlorotic rings later became necrotic (figure 1b). Subsequent young leaves became small with chlorotic line patterns. Fruits also showed the same concentric rings.

Physical properties of the virus were studied by following the method of Noordam[4]. The virus had dilution end point between 1:500 and 1:1000, thermal inactivation point between 40 and 50°C and longevity *in vitro* of 2 hr at 21–26°C. The above characteristics clearly differentiate the causal virus from all other viruses reported on chilli in India[5–8]. The present virus resembles, however, TSWV in symptom production[3, 9, 10] sap transmission and insect transmission[11, 12], seed transmission[13] and physical properties in crude extract[3, 14].

In Ouchterlony test, the present virus did not show any reaction with antisera of 11 viruses reported on chilli indicating lack of any serological relationship with these viruses. However, *Lycopersicon esculentus* var Pusa Ruby first showed necrotic irregular brown spots and later plant produced bronze coloured leaves after 20 days of inoculation. Tomato fruits produced were round with chlorotic concentric rings on their surface. Some commercial chilli cultivars in Karnataka