Diagnostic characters of *Quadrastichus erythrinae*

Adults sexually dimorphic. Female 1.4–1.6 mm long, dark brown with yellow markings; head yellow except gena posteriorly brown; antenna pale brown except scape pale posteriorly; pronotum dark brown; mid lobe of mesoscutum with a characteristic inverted triangular dark brown area anteriorly; legs pale except fore- and hind-coxae brown, fore- and midfemur ventrally brown, pretarsi dark brown; gaster brown to dark brown; antenna with one large anellus and three funicular segments; postmarginal vein rudimentary. Male smaller than female, 1.0–1.2 mm long, pale-white to pale yellow as opposed to yellow in female; gaster in anterior half pale, rest dark brown; legs entirely pale; antenna with four funicular segments.

Erythrina is widely used as a live standard for trailing black pepper and vanilla would necessitate management measures on a large scale.

Wasps of the family Eulophidae are parasitoids on a variety of arthropods with a few phytophagous species. *Q. erythrinae* is the only phytophagous member of the genus.

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Activities of some catabolic and anabolic enzymes of carbohydrate metabolism during developmental phases of fruit-bodies of *Dictyophora indusiata* and *Geastrum fornicatum*

Many basidiomycetous fungi and particularly the members of Gasteromycetes are very important in forest ecosystem and help in recycling of cellulosic forest wastes[1]. Although metabolism of carbon compounds both *in vivo* and *in vitro* were studied in many soil bacteria[2] and lower fungi[3,4], little information is available in higher Basidiomycetes[5,6]. Operation of glyoxylate pathway and its involvement in the basidiospores of *Lycoperdon* and in some members of Agaricales has been reported earlier[7]. In these organisms, pathways for central carbohydrate metabolism were not studied. In the present study two key enzymes of catabolic pathways, viz. phosphofructokinase (PFK) and isocitrate dehydrogenase (ICDH), and two enzymes for anabolic pathways, viz. fructose bis-phosphatase (FBPase) and iso-citrate lyase (ICL) were assayed from the cell-free extracts (CFE) of different developmental phases of fruit bodies of *Dictyophora indusiata* and *Geastrum fornicatum*. Also presence of these enzymes in different parts of the mature fruit bodies was assessed.

Fruit bodies of *D. indusiata* and *G. fornicatum*[1] were collected from forest floor of Santiniketan at their different developmental phases as mentioned in Table 1. These were washed thoroughly, cut into pieces, homogenized, sonicated by ultrasonic needle probe and centrifuged to obtain cell-free extracts (CFE) following the method of Mandal and Chakrabartty[8]. These CFEs were used as source of enzymes. PFK (EC 2.7.1.11) and ICDH (EC 1.1.1.42) were assayed following the methods of Heath and Gaudy[9] and Khouw and McCurdy[10]. On the other hand, FBPase (EC 3.1.3.11) and ICL (EC 4.1.3.1) were determined following the standard methods[11,12]. Protein was estimated following the method of Lowry *et al.*[13].

Results from Table 1 indicate a slight increase of activity of PFK and ICDH up to emergence stage of fruit bodies, which followed a declining trend with the ageing of fruit bodies in both the fungi (Table 1). On the other hand, specific activity of FBPase, an enzyme responsible for gluconeogenesis increased gradually with the maturation of fruit bodies. This type of growth-phase-dependent expression of metabolic activities was reported in other organisms also[14]. Mandal and Chakrabartty[15] observed that key enzymes of Embden Meyerhof Parnas pathway and

Table 1. Specific activities* of two catabolic (PFK and ICDH) and two anabolic enzymes (FBPase and ICL) at different developmental phases of *Dictyophora indusiata* and *Geastrum fornicatum*

Developmental phases	PFK	ICDH	FBPase	ICL
D. indusiata				
Mycelial knot (early)	37	175	40	0
Mycelial knot (late)	52	170	35	0
Ball structure	48	180	30	0
Ball with emergence slits	55	180	38	10
Just emerged fruit body	50	175	35	08
Fruit body				
(2 day old)	50	160	50	16
(3 day old)	20	120	65	30
(4 day old)	08	90	93	45
G. fornicatum				
Mycelial knot (early)	24	140	28	0
Mycelial knot (late)	28	123	36	0
Ball immature	34	135	40	0
Ball mature	34	143	35	0
Ball with cracks	47	145	41	5
Full fruit body				
(1 day old)	45	152	50	5
(2 day old)	40	120	55	8
(3 day old)	25	95	58	10
(4 day old)	12	72	67	15

*Specific activity of enzymes is expressed as n-moles of substrates consumed min^{-1} mg^{-1} protein.

Table 2. Specific activities* of the catabolic – (PFK and ICDH) and anabolic – (FBPase and ICL) enzymes from different parts of mature fruit bodies of *D. indusiata* and *G. fornicatum*

	Enzymes			
Fruit body	PFK	ICDH	FBPase	ICL
D. indusiata				
Volva	21	90	12	07
Stipe	25	95	17	08
Indusium	29	125	25	13
Receptacle plus gleba	34	180	40	32
G. fornicatum				
Exo-peridium	22	110	19	05
Inner-peridium	27	105	14	09
Columella	35	125	35	25
Capillitium threads	39	134	30	22
Gleba	37	185	43	39

*Specific activity of enzymes is expressed as n-moles of substrates consumed min^{-1} mg^{-1} protein.

TCA cycle were much active when readily available carbon sources were present in the growth environment. Activities of the glycolytic pathway enzymes decreased with the exhaustion of readily available carbon sources and with more cell densities[16]. In many of the soil microorganisms, for further survival, a balance between catabolic and anabolic activities is maintained under such conditions[15]. So, with time, when the fruit bodies are getting matured and they enter into their senescence phase, probably gluconeogenic pathway enzymes such as FBP-ase and glyoxylate pathway that enzyme ICL were induced to maintain a balance of metabolism (Table 1). ICL, the key enzyme of glyoxylate pathway that was not operative during the mycelial stage, was induced after emergence of fruit bodies and attained maximum activity at 4th day of maturation, when fruit bodies were at their senescence stage. Induction of this enzyme was also observed in an ascomycetous fungus *Tuber borchii* during differentiation of its fruit bodies[17]. Decrease of specific activity of catabolic enzymes and increase of anabolic enzymes during carbon starvation and ageing were also noted in bacteria and in a mycelial fungus *Neurospora crassa*[18]. Our observation corroborates those earlier observations.

A differential pattern of activity of the enzymes was found when assayed from different parts of mature fruit bodies (2 days old). Glebal tissues contained highest specific activities of all the enzymes in comparison to the vegetative parts of the bodies (Table 2). A differential expression of glyoxylate pathway enzymes was reported in gleba and other parts of fruit bodies of *Lycoperdon* sp.[7]. As the spore dispersal mechanism is poor in Gasteromycetes in comparison to other Basidiomycetes, higher metabolic activities in the glebal tissues are probably for better survival of the reproductive structures.

As these fungi are common inhabitants of forest floor, their ability to break cellulose and starch was determined from their culture filtrates after growing them in malt extract broth for seven days. Cellulase and amylase activities were determined following the methods reported earlier[19,20]. Both of these enzymes were found to be active at 45°C and the activity of amylase was comparable with that of a potent thermophillic *Bacillus* sp.[19] (data not shown), thus indicating their role in recycling cellulosic wastes. Although importance of other soil fungi in recycling forest wastes has been studied[21,22], the possibility of Gasteromycetes for the purpose has not been reported so far.

As these two fungi are important in forest ecosystem and produce enough cellulase and amylase, it is very important to study their metabolic behaviour for their proper growth and better survival.

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Efficacy of natural product, *Clerodendron inerme* against dengue mosquito vector *Aedes aegypti*

Aedes aegypti is on focus worldwide because of its role as a vector of major diseases like dengue haemorrhagic fever and yellow fever. Development of resistance in mosquitoes against currently used synthetic insecticides coupled with their persistence and toxicity to non-target organisms has been widely recognized and has prompted the search for new means of control strategies. One approach to combat these insect vectors has been to make maximum use of the differences which exist between insects and vertebrates. This can be done using agents which will be selective in their action and create physiological imbalance during developmental stages, which are peculiar to insects. During their co-evolution between plants and insects, the former produced several metabolic by-products, which act as repellents, growth disruptors, larvicides, antifeedants and growth regulators against invading insects. Studies have shown that natural plant products could be effectively used against mosquitoes as alternatives to synthetic pesticides[1–4]. In this context, the work of Patterson *et al.*[5] is of significance. Over 2000 extracts of higher plants prepared from 325 different plant species were screened for insecticidal activity against the larvae of *A. aegypti*. There are a good number of reports on the successful use of neem and its by-products against mosquitoes[6–8]. However, these studies have shown that among the extracts prepared from different parts, the neem seed kernel extract obtained with organic solvents demonstrated higher effectiveness than that of aqueous extract against mosquitoes[9]. Literature survey has revealed that invariably organic solvents have been favoured to extract larvicidal factor(s) from the plant tissues against mosquitoes.

Clerodendron inerme Gaertn. (Verbinaceae), commonly known as Kashmir bouquet is a biennial, hardy plant and widely grown as a hedge plant along home gardens. The leaf extract of the plant has been shown to contain insecticidal properties against mosquitoes[10]. Review of the literature revealed that various solvent extracts of plant materials have been tested against mosquitoes. Therefore, it was thought rewarding to investigate the dry powder of leaf material as source of insecticidal properties against the mosquito larvae. In the present investigation, we have examined the effect of sun-dried leaf powder of *Clerodendron inerme* against fourth instar larvae of *A. aegypti*.

For the present study, leaves of *C. inerme* were collected from local areas of Dharwad city. They were washed in tap water and dried under the sun for four days. The leaves were pulverized (60–80 mash) and various quantities of this powder were tested against fourth instar larvae of *A. aegypti*.

Freshly molted fourth instar larvae were obtained from the cyclic colony maintained in the rearing house at temperature 28 ± 2°C, RH 70–75%, photoperiod 14 : 10 (light : dark), and pH of the rearing water 7.4–7.6. Twenty-five larvae were introduced into wide mouth (250 ml capacity) conical flasks containing 100 ml tap water, pH 7.4. After an hour of acclimatization, food in the form of a pellet containing yeast and dog biscuit (1 : 2 w/w) was added to each flask followed by known quantity of test compound. Food was given *ad libitum*. Four replicates were maintained (25 larvae in each) for each treatment tested. Control groups with four replicates were also maintained throughout the experiment. The mouth of the flasks was covered with cheese-cloth. All the experiments were continued till the emergence of adults, if any. Mortality was recorded during larval–pupal moult and pupal stage. In the present experiments both emergence inhibition of adult mosquitoes as well as fourth instar larval mortality were subjected to probit analyses[11] to determine effective 50% emergence inhibition (EI_{50}) and effective powder quantity to kill 50% of larval population (EPQ_{50}).

In the first experiment, the dry powder was tested from 10 to 60 mg against