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Preserved algae as food for *Penaeus monodon* larvae

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A large number of algal species have been selected as suitable food for *Penaeus monodon* larvae in SEAFDEC. These species include two diatoms: *Chaetoceros calcitrans* and *Skeletonema costatum* and two flagellates: *Tetraselmis chui* and *Isochrysis* sp. To insure an adequate and continuous supply of these algal foods and decrease dependence on live algal cultures during larval rearing operations, techniques for algae harvesting and preservation were developed.

The value of algal preservation lies in its usefulness as larval food. Other investigators have done studies on the use of frozen algae. Mock (1972) conducted successful experiments with frozen *Skeletonema* as feed for larvae of penaeid shrimps in Galveston Biological Laboratory, Texas, while the use of frozen *Tetraselmis* has been initiated at Aquacop, Tahiti (1977). Brown (1972) did similar studies on frozen and freeze-dried *Skeletonema* and *Thalassiosira* as feed for *Penaeus aztecus*. Neither frozen nor freeze-dried foods were as good as live diatoms at equal concentrations. Freeze-dried unicellular algae, however, has been successfully fed to larvae of hard-shell clam (Hidu & Ukeles, 1962).

Uni-algal cultures of *C. calcitrans*, *S. costatum*, *T. chui* and *Isochrysis* sp. obtained from the Phycology laboratory were harvested while in their logarithmic phase of growth by means of chemical flocculants: alum, as hydrated aluminum sulfate; lime, as calcium hydroxide and sodium hydroxide, to adjust the culture pH in simulated auto-flocculation process and used as test algal species.

The harvest, preserved by either freezing or sun-drying, was fed to the larvae of *P. monodon*. Among the test algal species, *Chaetoceros* and *Tetraselmis* were used in larval feeding trials with frozen food while *Chaetoceros*, *Tetraselmis* and *Isochrysis* species were utilized in feeding experiments with sun-dried algae. Their relative effects on larval survival and development were assessed.

Results showed that, except the alum-flocculated cells, both frozen *Chaetoceros* and *Tetraselmis* can support survival at the zoea stage. Best survival of 68 percent was attained with dried *Chaetoceros* followed by *Tetraselmis* at 44 percent (Table 1). Dried *Isochrysis* did not perform as well, a significantly low survival of only 25 percent was obtained.

Table 1. Survival rates of *P. monodon* zoea fed fresh and sun-dried algae.

	NH ₃ -N (mg/L)	NO ₂ -N (mg/L)	Survival rate* (%)
Fresh <i>Chaetoceros</i>	0.01-0.055	0.01-0.015	44
Sun-dried <i>Chaetoceros</i>	0.02-0.075	0.013-0.02	68
Sun-dried <i>Tetraselmis</i>	0.02-0.09	0.015-0.02	44
Sun-dried <i>Isochrysis</i>	0.0-0.05	0.015-0.02	25

*Average of four replications

Microscopic examination revealed an occasionally empty gut and slow motting in larvae fed dried *Isochrysis*. Full gut content and well formed feces, in those given dried *Chaetoceros* and *Tetraselmis*, were indications of their acceptability as food. Value of physico-chemical parameters did not vary widely from those of the control.

The use of sun-dried algae has also shown promise as food for both the zoal and mysid stage. Larval survival at the mysid stage was influenced in a consistent manner by the different feeding treatments. Results point to dried *Chaetoceros* as most suitable for larval survival and development. Survival of 58 percent was obtained with *Chaetoceros* followed by dried *Tetraselmis* (45 percent) and *Isochrysis* (20 percent). Survival of the control (fresh *Chaetoceros*) was 49 percent (Table 2).

Table 2. Survival of *P. monodon* mysid fed fresh and sun-dried algae.

	NH ₃ -N (mg/L)	NO ₂ -N (mg/g)	pH	Survival* (rate %)
Fresh <i>Chaetoceros</i>	0.02-0.035	0.02-0.038	8.9-9.05	49
Sun-dried <i>Chaetoceros</i>	0.01-0.025	0.015-0.04	8.85-9.0	58
Sun-dried <i>Tetraselmis</i>	0.01-0.02	0.01-0.028	8.65-9.0	45
Sun-dried <i>Isochrysis</i>	0.01-0.023	0.01-0.028	8.9-9.25	20

* Average of four replicates

The results are in agreement with those of Helm's (1977) experience with oyster larvae fed single species diet of *Tetraselmis* and *Isochrysis* sp., with better survival obtained from *Tetraselmis*.