mosquito control has been studied by estimating: (*a*) the mosquito ratio in its diet, (*b*) the extent of check exercised by the fish in natural pieces of water, and (*c*) the effect, in the field, of introducing and of withdrawing the fish.

Food analyses of collections of fish from diverse natural habitats of rather low larval density, from observation chambers and pits of fairly high larval density, and from experimental aquaria with equal supplies of different food items, have revealed a decided preference for mosquito larvæ on the part of this fish. The author mentions the following attractive features of mosquito larvæ: convenient size, suitable pose of rest at the surface, enough mobility, absence of obnoxious exoskeleton, palatable nature and easy availability. All these must be factors which find favour with the fish.

Surveys of various types of natural water showed that whenever *Aplocheilus panchax* and mosquito larvæ occur in mutual association, and so long as the fish population is of an appreciable strength and the mechanical barriers, if any, are penetrable by the fish, the larvæ seldom thrive beyond the early instars. So far as *Aplocheilus panchax* is concerned, its efficiency for mosquito control, as proved from previous records and the present investigations, is fully established, and, being the most widely distributed and easily acclimatized of Indian killifishes, the practical possibilities of using it extensively in anti-mosquito campaigns is obvious.

The efficiency of the glassfishes (Ambassis) has also been estimated[2], and though they are less efficient than the killifish in control of malaria mosquitoes, their larvicidal activity is found to be of some significance. It is, however, in the control of the guinea-worm that the importance of Ambassis is shown, through their cyclopsidal habits. The intermediate host of the guinea-worm is known to be the copepod Cyclops or some closely related genus, and the glassfishes feed voraciously on these.

A third paper by the same author[3] deals with the bionomics of the spring eel, *Mastacembelus pancalus* (Hamilton), and shows that the number of mosquito larvæ in the gut contents is insignificant and that, "though to a small extent the fish may help to reduce the number of larvæ in marshy pools, it is not of any cognizable value in control of mosquitoes. Again . . . the proportion of *Cyclops* met with in the food of the species is too small to have any significance in the control of the Guinea-worm".

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[1] Efficiency of the Killifish *Aplocheilus panchax* (Hamilton) in the Control of Mosquitoes. By T. J. Job, *Proc. Nat. Inst. Sci. India*, **7**, No. 3 (1941).

[2] "Food and Feeding Habits of the Glassfishes (*Ambassis* Cuv. and Val) and their Bearing on the Biological Control of the Guinea-worm and Malaria", by T. J. Job, *Indian J. Med. Research*, **29**, No. 4 (1941).

[3] "Life History and Bionomics of the Spiny Eel, *Mastacembelus pancalus* (Hamilton), with Notes on the Systematics of the Mastacelidae", by T. J. Job, *Rec. Ind. Mus.*, **43**, Part II (1941).

PROPERTIES OF RUBBER AT LOW TEMPERATURES

An interesting account of the effect of low temperatures upon the properties of rubbers is given by M. L. Selker in an article entitled "Brittle Temperature of Rubber" (*Bell Lab. Rec.*, 20, No. 7; March, 1942). When crude rubber is held at about 14° F. (−10° C.) for some days, crystallization occurs and the rubber becomes stiff and opaque but remains elastic to some extent, permitting slight bending and stretching without breaking. Well-vulcanized rubber does not crystallize, but loses its ability to retract when stretched. Crude or elastic rubber, however, loses elasticity completely if cooled to 70–80° F. below zero. If bent suddenly at right angles a glass-like breakage occurs. This transition to brittleness occurs at a sharply defined temperature which differs for various natural and synthetic rubbers.

To study these brittle temperatures, the Bell Telephone Laboratories recently constructed a simple apparatus consisting of a quadrant (arranged to carry as many as six rubber specimens) mounted on a shaft turned by a simple crank, and supported in a narrow insulated tank into which acetone and 'dry ice', or other cooling solution, may be placed. The specimen to be tested is fastened to the quadrant and turned down into the solution sufficiently long for it to assume the bath temperature. A quick rotation of the crank then brings the specimen sharply up against a rigid metal bar projecting from the edge of the tank towards the rim of the quadrant. If the brittle temperature has not been reached, the specimen will bend, but otherwise it will break off cleanly.

It has been found that the rubber becomes so tough at these low temperatures that considerable force is required to break it. Tests carried out on natural and synthetic rubbers showed that the brittle point of soft vulcanized rubber, about − 75° F. (− 59° C.), is essentially the same for all the vulcanizing periods common in industry. Certain of the synthetic mixtures show the same behaviour. With rubber compounds vulcanized with an accelerator and a large amount of sulphur, or sulphur alone, the brittle temperature was found to vary nearly linearly with the amount of chemically combined sulphur. All the usual rubber compounds have brittle temperatures above that of crude rubber. Any addition of asphalt or resin and of many oils tends to raise the brittle temperature a few degrees. Zinc oxide and carbon black, however, can be added in large quantities with small effect. The use of appreciable amounts of coarse fillers such as calcium carbonate, on the other hand, produces compounds with high brittle points after vulcanization. The various types of reclaimed rubber can be distinguished on the basis of their brittle temperatures, that from tyre tubes having the lowest.

Only two of the synthetic rubbers are comparable to natural rubber in elasticity at low temperatures. Synthetic rubbers also differ from natural rubber in having higher brittle temperatures than their compounds.

There seems to be little relationship between brittle temperature and the size of the molecule of the substance. In general, the large molecules have lower brittle temperatures than the small, but the change seems to be sudden rather than gradual. There appears to be a definite molecular size that must be attained before the brittle temperature characteristic of the material is reached. For rubber, this size corresponds to a molecular weight between 6,000 and 30,000, while for polyisobutylene it is between 1,500 and 10,000. The difference between the brittle temperatures for large and small molecules may be very great, as exemplified by polyethylene, which has a brittle temperature of + 5° F. (− 15° C.) for small molecules, and − 91° F. (− 68·5° C.) for the large.