readily eaten and followed by severe scouring. The experiences of youth provide an eloquent testimony of the diverse digestive effects following the abnormal intake of sour and ripe apples.

The disappearance of acidity due to the utilization of organic acids in respiration and in the synthesis of sugars is one of the concomitants of fruit ripening, but it is unlikely that this provides a valid explanation of the physiological disorders caused through eating unripe fruit, since medical experience indicates that the acidity of the digestive tract is entirely dependent on factors influencing the amount of the gastric secretion and its hydrogen-ion concentration.

Archbold[3] has demonstrated that the first stage in the growth-phase of apples following petal-fall is characterized by the formation of cell-wall material, and the intake of nitrogen. It is possible that the toxicity of immature fruit is due to a relatively high content of non-protein nitrogenous compounds, which are regarded as the principles responsible for similar physiological disturbances in larger farm livestock when unripe mangels or large quantities of young grass are suddenly introduced into the diet.

[1] Bayon, H. P., *Poultry Farmer* (August 20, 1943).
[2] Klimmer, M., "Scientific Feeding of the Domestic Animals" (Baillière, Tindall and Cox, 1933).
[3] Archbold, *Ann. Bot.*, **46**, 418 (1932).

CLEANSING OF MILK BOTTLES

MOST of us have received the familiar wide-mouthed milk bottle with its pressed-in cardboard stopper and, wiping with some anxiety its dirty neck, have wondered whether the milk is fit to drink. Remembering the difficulties of war and aware of the psychologist and his dirt-complex, we have reflected that anyhow the milk in our bottle is all the milk we can get and have tried not to be too fussy about it. The 'authorities', we know, have our cows tested for tuberculosis and do what they can to see that the milk we get is as clean as possible before it goes into the bottles ; the medical men—and some others—wrangle interminably about the obvious advantages of pasteurization ; but may not all these efforts be stultified by inefficient methods of washing, filling and distributing milk bottles ? May not a roundsman who is naturally unaware that he is a typhoid carrier undo all the labours of those who have provided him with typhoid-free milk ?

The first answer to these natural anxieties of the milk consumer is the Milk and Dairies Order, 1926—note the date—which requires that all milk containers and all appliances which come into contact with milk shall be thoroughly washed as soon as may be after use and shall be cleansed and scalded with boiling water or steam before they are used again ; the second answer is that the Ministry of Health, three years before the War, asked for a survey of bottle-washing plants to find out whether treatment of them with caustic detergents was as good bacteriologically as steam sterilization. The results of this inquiry, carried out between October 1937 and July 1939, by G. S. Wilson and Betty C. Hobbs, were given in a full report to the Ministry, a copy of which can be seen at the library of the London School of Hygiene and Tropical Medicine. An abridged version appears in the *Journal of Hygiene* (**43**, 96–120 ; 1943).

Its conclusions can be given only briefly here ; on the whole, they will reassure the householder. They agree largely with the results of similar investigations in the United States. A total of 2,406 milk bottles from 105 washing and distributing plants of 26 different types was examined. Hand washing of bottles is condemned. Small dairies often disregard the Milk and Dairies Order. Steam sterilization is efficient if it is carefully done ; otherwise it is not. But on the whole, equally good results were obtained in large and small rotary plants with either steam sterilization or hot caustic detergent (caustic soda with or without additions). The spray type of washing machine was the best, and the best results were obtained without brushes. Virtual sterility could be obtained with either strong caustic soda at a low temperature or with weak caustic soda at a high temperature, and it is not necessary to change the detergent more often than occasionally, provided that it is brought daily up to strength and that foreign matter is filtered out and deposit in the tanks is removed every few days.

One very interesting result was that no coliform bacilli were found in the washed bottles. The detergent killed these. This would eliminate, in well-conducted plants, milk-borne diseases derived from homes from which empty bottles are returned ; but can we be sure that all plants are conducted well enough to ensure this ? Of the organisms found in the washed bottles about half were saprophytic, one quarter were cocci and one quarter were yeasts, moulds, hæmophilic organisms and aerobic spore bearers. These, like the coliform bacilli, would have been killed by the detergent, so that they must have got into the bottles after they had left the detergent. It was found that most of them came from the rinsing water used to get rid of the detergent, which was heavily contaminated.

United States workers have recommended the use of chlorinated water to remove the detergent and to check the bacteria in the rinsing water, but Hobbs and Wilson prefer a rinse in water at 120° F., followed by cooling by washing the exterior only of the bottles at decreasing temperatures, until a temperature of 70° F. is reached. A final cold spray from the water main over both the outside and inside of the bottle completes their process. If bottles are hotter than 68° F. when milk is put into them, the life of the milk will suffer. Frequent cleaning of the washing machines is, of course, desirable.

To these complex problems of washing and cooling on a large scale must be added the important one of storage of bottles in small plants, where they are kept some hours or even overnight before they can be filled. Bottles should never be stored the right way up. When they are inverted their bacterial content depends on the amount of moisture and the temperature ; in warm damp weather it is likely to be higher.

Householders will be glad to learn that the familiar wide-mouthed bottle with its cardboard stopper is condemned ; it would be more satisfactory if a hooded cap covered its neck. A narrow-necked bottle with a press-over cap, or a bottle with recessed angles, would lessen the risk of contamination of the milk when it is poured over a dirty and frequently handled brim. A paper-board container which is used only once is the ideal, but it is too expensive at present.

The importance of clean milk bottles is shown by reference to the literature on typhoid epidemics and other milk-borne diseases. In the United States, 296 out of 373 outbreaks of typhoid were traced to carriers either on the farms or in the milk-distributing plants.

While we need not, in Great Britain, be unduly alarmed by such figures as these, the fact remains that clean milk is a vital concern of the whole community. If the farmer and the veterinary surgeon do their best to give us clean cows and clean milking, we should see to it that the bottling and distributing organizations do not introduce disease. The householder has an important responsibility too—he should see that used bottles are well washed in hot water before they are returned to the roundsman, especially if there is communicable disease in the house. The problem is complex, requiring, like so many features of our modern civilization, the willing co-operation of all who take part in the chain of operations which link the producer with the consumer. The authors of this paper are to be congratulated on the completion of a very complex and difficult piece of public work. Before they could do it they had to work out methods which are valuable contributions to knowledge.

G. LAPAGE.

PALÆONTOLOGY WITHOUT FOSSILS IN THE 'BIRD-WING' BUTTERFLIES

EVER since the days of the immortal Wallace, biologists have been intrigued with the distributional problems presented by the fauna of the Malay Archipelago. Probably the butterflies have proved more attractive than any other group, not only on account of their æsthetic charm, but also because the pattern and colour of their wings are susceptible to modification by isolation and climate. There is no doubt that Wallace had the butterflies in mind when he wrote in 1869 : "It is certainly a wonderful and unexpected fact, that an accurate knowledge of the distribution of birds and insects should enable us to map out lands and continents which disappeared beneath the ocean long before the earliest traditions of the human race".

The latest contribution to this subject is of considerable interest and is described by the author, Dr. F. E. Zeuner, as "palæontology without fossils".* Essentially, it comprises an attempt to reconstruct phylogenetic trees for the 'bird-wing' butterflies on the basis of the morphology of the species-groups and the present distribution, and the evolutionary patterns thus obtained are compared with the geological history of the Malay Archipelago. The more or less complete agreement found between these two methods of approach is highly satisfactory.

In order to obtain the requisite data for an accurate division of the 'bird-wing' butterflies into species-groups, a considerable amplification of previous systematic work on this genus has been necessary, and this has been carried out principally on the basis of the male genitalia. Accordingly, the 'bird-wing' butterflies are divided into two major groups, the *Troides* Hübner + *Trogonoptera* Rippon group and the *Ornithoptera* Boisduval + *Schoenbergia* Pagenstecher group.

The phylogenetic trees for these two major groups are reconstructed on the reasonable assumption that each of the groups of subspecies existing at the present time has been derived from a common ancestral form in comparatively recent times and that, at some earlier period, each of the species-groups present to-day was a subspecies-group, and so on until a stage is reached when there was a common ancestor for each of the two major groups. All the known species of the Troides + Trogonoptera group can be obtained from a single parent-form on the assumption that this division into subspecies which eventually became differentiated into species has taken place at least five times. There can be little doubt that the common ancestor of the essentially western Troides complex originated in Sundaland, that is, in the continental land-mass formed by the union of the Malay Peninsula, Sumatra, Java and Borneo in the Tertiary. The Ornithoptera + Schoenbergia group can also be reduced to a single form on the assumption of five successive phylogenetic waves. While it is clear that the Ornithoptera complex of species has developed in the Papuan area, its past history is by no means so manifest as that of the Troides group for, in its earlier stages, the distribution of Ornithoptera proper was discontinuous, representatives being confined to the Moluccas and the Solomon Islands, while there was an interclave of Schoenbergia in New Guinea.

Regarding the geological history of the Malay Archipelago, it is evident that the continual fluctuation in the sea-levels between the Malay Peninsula and the islands of Sumatra, Java and Borneo, which resulted in these lands being united and separated repeatedly during the Pleistocene, was a factor of outstanding importance as regards species formation in the Archipelago, and accounts for the very large number of groups of closely allied species existing in Malaysia to-day. Of less importance were the changes in sea-level between the Aru Islands, New Guinea and Australia on the Sahul Shelf during this period, although the effects were similar. The remaining large island groups were isolated throughout the periods under discussion.

The formation of a large number of the geographical races (subspecies) found in Malaysia and in the region of the Sahul Shelf to-day dates from the final elevation of the sea-level after the last low level of the Last Glaciation, whereby the then existing land-masses were separated finally into their constituent islands. While the present subspecies and species of the 'bird-wing' butterflies are approximately of Holocene and late Pleistocene origin respectively, the phylogenetic stages previous to these two belong to the late Tertiary. The author computes that the evolution of the Troides group as a whole has occupied a period of between three and twelve million years.

Two outstanding problems concerned with the distribution of the 'bird-wing' butterflies are the overlap of the two major groups in the Moluccas, and the curious discontinuous distribution of ancestral Ornithoptera, which occurred in the Moluccas and Solomons and was absent from New Guinea. It may be mentioned that one or two of the present-day species of *Euploea* Fabricius (Danaidæ) show a similar hiatus in distribution so far as New Guinea is concerned. Dr. Zeuner considers that both these anomalies are explicable on the theory of continental drift. If New Guinea has advanced to its present position from a more southerly one during the Tertiary and Pleistocene and pushed the Moluccas and Solomons apart, and the Moluccas have been moved round from a position whereby the northern Moluccas occupied a more easterly site than at present, then these distributional problems are resolved.

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* Studies in the Systematics of *Troides* Hübner (Lepidoptera Papilionidae) and its Allies : Distribution and Phylogeny in Relation to the Geological History of the Australasian Archipelago. By Dr. F. E. Zeuner. *Trans. Zool. Soc. Lond.*, 25, 107-184 (1943).