The cortical tissues show abundant development of pale yellowish brown, thickwalled, subsphaerical oospore-like bodies and intercellular, coenocytic hyphae of a phycomycetous parasite. The oogonia contain single eggs developing single oospores. Diseased tissues bearing the oospores were surface-sterilized and incubated for 2 days under moisture at room temperature (26 °C). A bit of growth was transferred to petri plates containing sterile distilled water and boiled hemp seed with extruded mucilage.

The mycelium was glassy translucent, coenocytic and branched; young branches became terminally sporogenous with no distinction from the vegetative hyphae. Slender tubular zoosporangia containing single rows of zoospores appeared in various stages of zoosporogenesis followed by exit of zoospores and their amassing in quiscence above the orifice. Secondary zoospores were ovate to reniform, laterally biflagellate showing a single period of motility. These indicate typical characters of a species of *Aphanomyces* de Bary in the Saprolegniales.

Few species of the genus *Aphanomyces* have been reported to be parasitic on crop plants from different world regions[1,2]. *Aphanomyces eutiches* Drechsler was found parasitic in the roots of several other host plants[3]. Damping-off and tip rot of sugar beets and other crop hosts are incited by *A. cochlioides* Drechsler[4,5]. KENDRICK[6] reported another species, *Aphanomyces raphani* Kendrick inciting black root of radish in Indiana (USA). The pathogenic species under study is tentatively identified as *A. raphani*. Distribution of this parasite appears limited and this report is perhaps the only one besides the type locality. The root rot disease and the pathogen hitherto unreported from India, and perhaps from any Asiatic country, may be a serious menace to cauliflower cultivation in view of its gradual spread.

Zusammenfassung. Eine Pilzinfektion der Blumenkohlwurzeln (*Brassica oleracea* var. *botrytis*) wird beschrieben. Als Urheber der Krankheit wird der pathogene Pilz *Aphanomyces raphani* Kendrick vermutet. Das Auftreten der Krankheit und ihres Erregers stellt für Indien und eventuell auch für andere asiatische Länder eine Neuentdeckung dar.

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The Relationship Between the Orientation of the Early Chick Embryo and the Shape of the Egg Shell

The alignment of an avian embryo in the early stage of development can to a certain extent be predicted on the basis of VON BAER's rule[1]. According to this rule when the egg is placed with the blunt end to the left, the cephalo-caudal axis is perpendicular to the long axis of the shell and the head of the embryo is directed forwards. Although in all the species examined this type of orientation predominates, a considerable intraspecific as well as interspecific variation is observed.

CLAVERT[2-4], CLAVERT and VINTEMBERGER[5-8] demonstrated experimentally that the factor determining the bilateral symmetry of the blastoderm and the alignment of the embryo is the position of the egg in the uterus during rotations to which the egg is submitted under the influence of the uterine muscles. If the long axis of the shell is parallel to the axis of the uterus and the egg faces cloaca with its sharp end, the direction of the embryonic axis will be concordant with VON BAER's rule. The period when the position of the embryo is being determined is called 'a critical phase' and corresponds in time to the formation of area pellucida. In species more closely obeying VON BAER's rule (hen, pigeon, quail) the egg remains relatively stable during this period; it rotates about its long axis, but rarely rotates about the short axis. The behaviour of the duck egg in the uterus is quite different; X-ray photographs of CLAVERT[3] demonstrate clearly that the egg alters its position several times. The consequence of this 'instability' is a more even distribution of alignments of embryos and the relatively small percentage of embryos strictly obeying VON BAER's rule. It must also be added that in the non-incubated duck blastoderm the embryonic axis is not yet irreversibly determined, and its course can be experimentally altered by a mechanical factor, such as transection of the blastoderm (ROGULSKA[9]).

In the light of observations of CLAVERT and VINTEMBERGER, it occurred to us that one of the factors defining the behaviour of the egg in the uterus, and in consequence the orientation of the embryo, may be the shape of the shell. According to this assumption, the degree of stability of the egg would increase with the elongation of the shell, which in turn would increase the number of embryos directed towards '12' of a hypothetical clock face. Conversely, more rounded eggs would have a greater tendency to various rotations, thus leading to a greater variability in the orientation of embryos. In order to check the correctness of this hypothesis, observations were made on the orientation of chick embryos in relation to the shape of the shell.

The material consisted of 389 eggs of the Rhode Island strain. In view of the relatively rare occurrence of particularly elongated or rounded eggs part of the material was specially selected for these characteristics. The long and short axes of the shell were measured with accuracy

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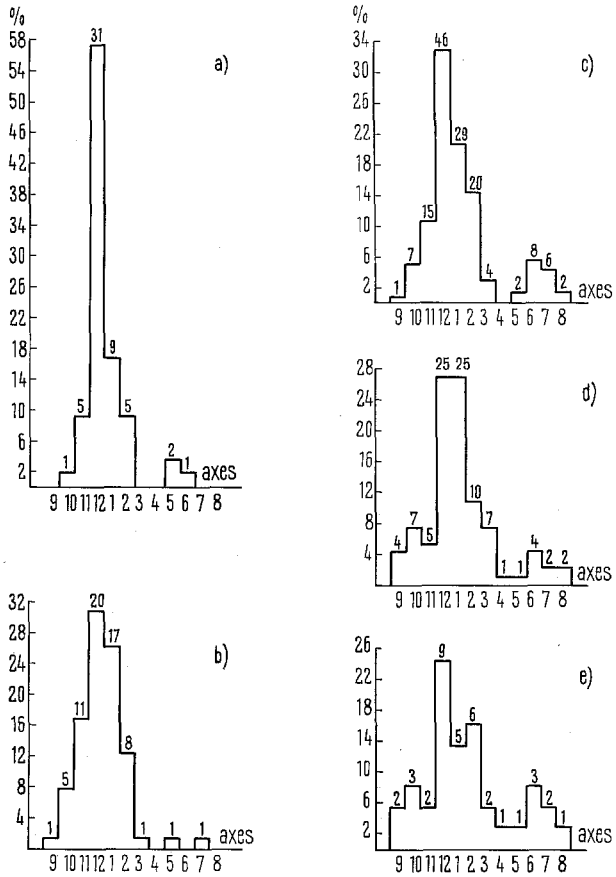

Fig. 1. Alignment of embryos along 12 axes of hypothetical clock face in various categories of the egg shape index (i). Numbers above columns denote number of embryos. (a) i = 61–69 (54 eggs); (b) i = 70–72 (65 eggs); (c) i = 73–75 (140 eggs); (d) i = 76–78 (93 eggs); (e) i = 79–84 (37 eggs).

Direction of embryonic axis	9	10	11	12	1	2	3
Mean index	76.75	74.65	73.39	72.84	74.01	74.27	76.14
No. of eggs	8	23	38	131	85	49	14

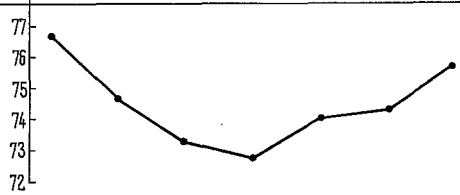

Fig. 2. Empirical line of regression of the egg shape ndex on the direction of the embryonic axis.

Variability of the orientation of the embryonic axis as expressed by the deviation (α) of the axis from 'direction 12' as depending on the egg shape index

Egg shape index	Variance of α	No. of eggs
≦69	22°19′	51
70–72	46°38′	63
73–75	48°26′	122
76–78	72°12′	83
≧79	82°19′	29
	Total	348

to 0.5 mm and the shape index calculated = breadth/length × 100. The eggs were incubated for 44–50 h at 37.8 °C, and the axis of the embryos defined in terms of a hypothetical clock face.

The distribution of the directions of the embryonic axes, plotted against the index value, is shown in the Figure 1, a–e. As can be seen from these figures, the frequency of embryos obeying VON BAER's rule (i.e. directed towards '12') is greatest among the most elongated shells: with an index value of ≦69, 58% of embryos are directed towards '12' and 83% fall within the sector '11–1' (Figure 1a). Corresponding figures for rounded eggs (index value ≧79) are respectively 24% and 43% (Figure 1e). It is noteworthy that the variability of the direction of the embryonic axes, as measured by the variance of this character, increases significantly as the shells become more spherical in shape. This is shown by the data given in the Table, showing variation of alignments in relation to '12'. A similar tendency is observed around '6', but it cannot be examined statistically on account of the small number of observations.

The strength of the relationship between the direction of the embryonic axis and the value of the egg shape index was examined by means of the correlation method. The above relation is curvilinear in character (Figure 2), and therefore the correlation ratio (η) rather than the usual correlation coefficient, was calculated. Its value $\eta = 0.813$, with a standard error $\delta\eta = 0.016$, proves that the relationship examined is statistically significant.

The data demonstrated above clearly indicate that the orientation of the embryo is dependant, to a considerable extent, upon the shape of the shell, and that the frequency of alignments towards '12' distinctly increases with the increasing elongation of the shell. The only explanation of this phenomenon is the hypothesis put forward previously, that eggs with differently shaped shells behave differently in the uterus: the rounder the egg, the less 'stable' it is and the more often the embryo fails to conform to VON BAER's rule. It remains an open question whether the interspecific differences in the alignments of embryos, such as those between the hen and the duck, can be attributed to the specific differences in the shape of the shell. It may, however, be suggested that the differences in the orientation of embryos of different females of the same species (FARGEIX[10]) may be due to differences in the shape of the shells.

The above observations may be useful in those experiments in which knowledge of the orientation of the non-incubated blastoderm is required. By chosing elongated eggs (with index values ≦69) the direction of the embryonic axis can be predicted with a high degree of probability[11].

Résumé. La forme de la coquille de l'œuf, chez la poule, a une influence réelle sur l'orientation de l'embryon. Si la coquille est très allongée, le plan de symétrie de l'embryon est perpendiculaire à l'axe long de la coquille et l'orientation de l'embryon conforme à la règle de VON BAER[1]. Au contraire, si la coquille est arrondie, l'orientation de l'embryon est quelconque et, souvent, non conforme à la règle de VON BAER.

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