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THE DETECTION OF ARTIFICIAL (IMITATION) GEMS.

IN most works on gems much stress is laid upon "hardness" as a means of distinguishing real from artificial "stones." Having had occasion during the past two years to examine several emeralds, rubies, etc., as to their genuineness, I have come to the conclusion that this property — which is, as everyone knows, of great assistance in the determination of uncut minerals — is of very little value in the examination of cut and polished gems, inasmuch as cutting a stone renders its surface much softer — in some cases reducing the hardness by over one-tenth — so that it can be "scratched" by minerals considerably lower in the scale of hardness than itself in its natural condition. On the other hand, many artificial gems will scratch ordinary window-glass quite readily, and have a hardness nearly equal to that of quartz, although it is popularly believed that if a "diamond" scratch glass it must be real.

Polishing the surface of a stone also necessarily affects its specific gravity, especially if the specimen be of small size, as is the case with most gems. Specific gravity as a means of detecting false gems is also rendered practically valueless by reason of the fact that special care is often taken in the manufacture of these articles to make them have specific gravities as nearly like the natural species which they are intended to imitate as possible.

Gems being usually much facetted, an examination of their optical properties becomes difficult and is of very little use in their practical determination.

Many gems are thought by their owners to be genuine on account of their having been in the possession of themselves or families as heirlooms for many years. Age in this case is no criterion as to value, as it is well known that the ancient Egyptians and Greeks were well versed in the manufacture of artificial stones.

The grand and really only reliable test, it seems to me, as to the genuineness or otherwise of a gem — in case we do not wish to totally destroy the specimen — is an examination of its fusibility. Artificial diamonds, emeralds, etc., if held in the border of the flame of a spirit-lamp or Bunsen burner soon become rounded on their edges, their fusibilities being generally considerably under three, according to von Kobell's scale of the fusibilities of minerals. The real stones, diamonds, etc., with the exception of the garnet, are practically infusible.

Great care should be taken in the examination of the fusibility of a gem, as, if the latter be genuine, it may, unless heated gradually and carefully, crack and fly to pieces on exposure to a high temperature. Moreover, some gems will change color if heated too highly.

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THE SYSTEMATIC POSITION OF THE DIPTERA.

HAVING been a student of the Diptera for two years, I have come to the conclusion that the order is entitled to the distinction of being, as a whole, more highly specialized than any other. Entomologists who have attempted a general classification of insects have almost uniformly regarded the Hymenoptera as the highest order, placing the Lepidoptera second, and the Diptera third. The only exception in America, I believe, is Professor Hyatt, who, in a recent book ("Insecta," by Alpheus Hyatt and J. N. Arms), has placed the Diptera at the head of the class, with the Hymenoptera second, and the Lepidoptera third. His argument for this arrangement is brief and forcible. The main features may be summarized as follows: —

The essential question which settles the rank of any insect is, How far does it deviate in structure, and through what line of descent has it developed, from its Thysanuriform ancestors? To introduce the subject of instinct or of usefulness to man is to confuse our ideas, for we cannot translate the data furnished by such a criterion into terms of the other standard. Applying this principle, he takes the following features of Diptera to show that they possess a degree of specialization surpassing any other order: —

1. Larval structure: "The young of even the generalized forms of Diptera are, as a whole, farther removed from the Thysanuriform type than those of any other group. The secondary larval form, which in the case of the Diptera is always footless and often an almost headless maggot, has complete possession of the younger stages. As Friedrich Brauer has pointed out, the general absence in the larvæ of Diptera of the thoracic legs, even although living in situations that seem to demand their development, shows that they must have inherited this peculiarity from an ancestral form whose larva had lost them. This comparative inflexibility of the larval stage is sufficient of itself to show that there is now a wide gap between the existing Diptera and all other orders of insects, and that this chasm is not closed by the resemblances of the parts in the adult to those of the Lepidoptera or isolated forms in other orders" (pp. 273, 274).

2. The presence of but two wings: "The tendency to the enlargement of one pair of wings, like the tendency to the enlargement of certain pairs of thoracic legs and the reduction of other pairs, or a change in their structure and function, so that the insect makes a departure from the conventional normal type of four equal membranous wings and six equal-jointed legs, is everywhere an index of specialization" (p. 274).

3. The mouth parts are developed for sucking only.

4. The attachment of the abdomen to the thorax in some flies shows that they once possessed a pedunculated abdomen, similar to that of Hymenoptera (p. 251).

Of these features, the first is the most weighty. Had not its importance been overlooked, the order could never have been thought inferior to the Lepidoptera, of which the members have while larvæ thoracic legs and usually abdominal ones also. Among the Hymenoptera, the Tenthredinidæ have thoracic legs and even more numerous abdominal ones than the Lepidoptera. The Uroceridæ also have rudimentary thoracic legs, although the larvæ are borers in wood.

The second and third arguments are essentially one in principle. In the lower winged insects, we find both pairs of wings of equal size and importance. The Hymenoptera show a condition in which the hind wings are much smaller and so of less use. Now, why do not the Diptera represent the extreme of this series? The question is not whether two pairs of wings or one pair are in themselves "higher;" it is rather, Which type shows the greater departure from the forms universally acknowledged as ancestral? So regarding the mouth development: If the mandibular mouth of Thysanura, Odonata, etc., be admitted as representing the ancestral form, then surely the mouth combining mandibular and suctorial apparatus is intermediate, and that with only suctorial organs is the ultimate degree of specialization. The recent researches of Dr. John B. Smith (Trans. Am. Ent. Soc., XVII.) show that true mandibles are almost never present in Diptera (he found them only in Simulium). Although his conclusions in this respect, as well as in regard to the homologies of the dipterous mouth in general, are widely different from those of earlier investigators, they are probably correct. In summing up, he says (p. 339), "The development required is simply a further development of the line started in the Hymenoptera."

An argument that strongly reinforces the first one above is found in the fact that the embryo in Diptera, at least in the higher forms, does not develop any traces of legs, differing in this respect from even the highest Hymenoptera, which first develop the legs and then reabsorb them before hatching (*Psyche*, June, 1891, p. 98).

The subject of mimicry also throws some light on these relations. As is well known, the Diptera afford many interesting cases of mimicry, and it is important to our theory to notice that they generally imitate the Hymenoptera, especially the very highest forms, such as wasps, humble-bees, and even honey-bees. One of the most widespread of all species, *Eristalis tenax* Linn., is such a good imitation of the honey-bee as to deceive the very elect. One of my students, an enthusiastic collector and well acquainted with this case of mimicry, once grasped a bee in his hand, under the impression that he was capturing one of these flies. Now, on any theory, we must admit that these species of flies are of more recent origin than the species which they mimic. Most of these imitative flies belong to the family Syrphidæ, which is considered to be one of the oldest of the group Cyclorrhapha, comprising the higher flies.

The Diptera, as a whole, are wonderfully rich in peculiar modifications of structure. In almost any organ the variety of forms exceeds that of any other order. Even the antennæ of beetles do not surpass, if they equal, those of flies in this respect. The wings are far more variable in venation than those of any other order. The variety and complexity of organs for grasping the female are almost beyond belief to one who has not seen them.

The one thing which has prevented the recognition of the real rank of the Diptera is a lingering notion that specialization by reduction really brings an insect down to a lower position in the scale. The word "high" suggests the idea of "complete," or "perfect," or "typical." If Professor Hyatt's test were to exclude every other, as it ought to, there could scarcely be any further disagreement on the question of the highest order.

The line of argument here suggested points to the Pupipara as the highest of all insects; nor would I in the least seek to evade the conclusion. Of the group, I have seen only the Hippoboscidæ; among these the sheep tick, *Melophagus ovinus* Linn, appears to deserve the highest rank.

J. M. ALDRICH.

DEBLOOMING MINERAL OILS.

It is a common practice with dealers in mineral lubricating oils and what are known as wool-stock and neutral oils to add certain chemicals to these oils to destroy the bluish fluorescence or "bloom." The bloom on ordinary refined kerosene is very noticeable, while paraffin oil, i.e., oil that has been distilled from petroleum tar, or residuum, is intensely blue. A good way to see the bloom of an oil is to view it through the ordinary four-ounce sample bottle. These bottles are made with straight sides and of white glass. A test-tube answers very well. The bottle should be held in front of a window and viewed through the bottom.

If a drop of oil be put on a piece of black glass, or on a piece of window-glass painted black on the bottom, the bloom will show even when the oil appears bloomless in the bottle. The bloom of oils may be destroyed or masked by nitric acid, nitro-benzol, di-nitro-naphthalene, and some other nitro-compounds. The use of nitric acid, of course, destroys the oil for lubricating purposes.

The di-nitro-naphthalene of commerce is a very efficient deblooming agent. I found, however, that if this material be washed in hot water until the free acid and free nitro-benzol (?) be washed out, it loses its deblooming properties.

A small percentage of oil of myrbane added to wool-oil or neutral oil will destroy or mask the bloom altogether. At the same time it, like the di-nitro-naphthalene, darkens the oil, and gives it the odor of benzol.

The usual practice is to add a quantity of di-nitro-naphthalene to a portion of the oil to be treated, warming it gently meanwhile, and then, when the oil is about to be sold, to add this strong solution to the bulk of the oil. This is done because the nitro compound is liable to crystallize out in the cold, and also to stain yellow the containing vessel and to darken the oil on standing.

If a bright piece of steel be put into oil containing much di-nitro-naphthalene the steel becomes corroded. It will be readily seen that such oil is unfit for lubricating purposes. If the oil be filtered while cold, fine crystals of di-nitro-naphthalene will collect on the filter, and at the same time the filter is stained yellow. The bloom reappears in the filtered oil, showing that the bloom was only covered up and not destroyed.

The only safe and proper way to bleach and debloom oil is to expose it to the sun and air for a long time — two or three weeks or so — depending on the weather. By this method no deleterious substances are added to the oil, while at the same time it is rendered sweeter in odor and the "body" is somewhat increased. The bleacher consists of a shallow tank, sometimes covered with glass, but more generally exposed to the sun and rain. Into these tanks a few