ZOE

A BIOLOGICAL JOURNAL.

PUBLISHED QUARTERLY.

VOL. III. OCTOBER, 1892. No. 3.

CONTENTS:

SAN FRANCISCO:
ZOE PUBLISHING COMPANY,
P. O. BOX 2114.

Entered at the Post Office at San Francisco as Second-Class matter.

Yearly Subscription, $2.00
Single Copy, 75 cts.

ZOE

A BIOLOGICAL JOURNAL.

VOL. III. OCTOBER, 1892. No. 3.

BALANOGLOSSUS AS ONE OF THE GENERALIZED TYPES IN ZOOLOGY.*

With Plate xxii.

BY WILLIAM E. RITTER.

During the summer of 1890, it was my good fortune to be able to spend the vacation studying in Alexander Agassiz's Marine Laboratory at Newport, R. I. While there I became greatly interested in Balanoglossus and its larva, and collected considerable material for its study, and the original drawings here presented were made at that time.

I take this opportunity to call the attention of our Pacific Coast zoologists to this remarkable animal more particularly than the zoological text-books and the special papers treating of it would be likely to do, the desire being to hasten the bringing of the creature to light if it exist on these shores. At the same time, however, I will add a few observations and reflections of my own, that may not be altogether without interest to those who have made a detailed study of the animal. Since Kowalevski[1] published the results of his investigations on the development of the simple Ascidians in 1866, and there pointed out their relationship to the Vertebrates, no animal has been brought into court that has given such weighty testimony against the reality of a definite and hard fixed line separating Vertebrates from Invertebrates, such as was supposed by the older zoologists, as has this same wormlike Balanoglossus.

The credit of having first recognized the true nature of the animal

* Modified from a paper read before the California Zoological Club, San Francisco, March 26, 1892.

[1]A. Kowalevski, Entwickelungsgeschichte der einfachen Ascidien. Mém. Acad. Imp. Sci., St. P., viie sér. T. x, No. 15, 1866.

belongs to Mr. William Bateson,[2] a young English morphologist, who studied the structure and development of an American species found on our Atlantic coast; though it is an interesting fact that the distinguished Russian already mentioned was the first to study in detail the structure of the adult, he having published the results of his investigations on this subject in the same year that his classical Ascidian paper, mentioned above, appeared.

We will give a short account of the structure, development, and habits of the animal, and also consider briefly its claims to the right of being raised from the ranks of the "lowly worm" to a place among the nobler Chordata, which promotion was proposed by Mr. Bateson, and has been adopted by several more recent writers.

By the aid of Figs. 1 and 2 we may be able to get a fairly good idea of the appearance and anatomy of the adult animal. The original figure, here copied from Korschelt & Heider,[3] was made by Alexander Agassiz and represents the Atlantic coast species, *B. Kowalevskii.* The creature is divided into three very distinct regions: the proboscis, *pro.*; the collar, *col.*, and the abdomen, *abd.*, which is again composed of a pharyngeal or respiratory portion, and an abdomen proper or digestive portion. The proboscis is a firm muscular organ, cylindrical or somewhat conical in shape, but varying considerably both in form and length in different species; in most species it is, however, proportionally shorter than in the one here represented. The proboscis is joined to the collar by a short peduncle. In its normal condition the collar is nearly cylindrical in shape, and, as with the proboscis, there is nothing either in form, surface marking, or color, to readily distinguish the dorsal from the ventral side. The mouth is ventrally situated, but its position at the anterior end of the collar at the point of attachment of the peduncle to this latter is so effectually shut in by a sort of rim-like projection on the anterior edge of the collar that it is scarcely visible, particularly when the parts are in a state of contraction.

---

[2] Wm. Bateson. The Early Stages in the Development of Balanoglossus (sp. incert). Quart. Journ. Micro. Sci., Vol. xxiv, Apr., 1884. Also: Continued Account of the Later Stages in the Development of Balanoglossus Kowalevskii, and of the Morphology of the Enteropneusta, ibid Vol. xxvi, p. 511, 1886. Also: The Ancestry of the Chordata, ibid Vol. xxvi, p. 535, 1886.

[3] E. Korschelt und K. Heider, Lehrbuch der vergleichenden Entwicklungsgeschichte der wirbellosen Thiere, erstes Heft, Jena, 1890.

The abdomen is several times longer than the other two parts combined and is very distensible. It is soft and frail and one rarely sees it whole, so easily does it break as the animal is being extracted from its tube in the soft mud or sand in which it lives.

The surface of this region is much less regular than that of the other two parts previously described, it being, particularly in its anterior, pharnygeal portion, somewhat quadrilateral with irregular transverse folds affecting particularly the dorsal angles. As seen by the figure the gills, *gi.*, are arranged in a double series on the dorsal side of the animal, each series, as seen from the surface, being composed of a large number of crescentic openings.

The sexual orifices are also found in this region, but are very minute, *s. or.* The three portions of the animal differ from one another in color. The proboscis is a uniform very light yellow, the collar is also yellow but of a considerably more pronounced shade. The abdomen is of a brownish tint marked with darker spots, and for a portion of its length has a greenish shade from the presence of the liver within showing through the body wall. In size the creature may reach a length of eight inches in some of the larger species. It will be noticed from this description that the animal is entirely without paired appendages, either for locomotion, prehension, or sensation. Its only organ of movement is its proboscis.

The animal is entirely marine, so far as known, and is confined to shallow water near shore, and as already said, lives buried in mud or sand. The species found on the New England coast can be collected at low tide only, when the earth in which it lives is uncovered. It is usually found about a foot or two below the surface, and one readily determines where to dig for it by the very characteristic spirally coiled cast of sand and mud at the opening of its tube that has been ejected by the animal within.

As it is in the creature's role as a candidate for a place among the chordata that it has become chiefly distinguished in recent years, the attention that we here give to its anatomy may profitably be from the standpoint of a comparison with the fundamental chordate structure. In this way the points of agreement may be brought out with emphasis, and at the same time the points of disagreement may be made equally emphatic.

Bateson, who, as already said, was the first to carry out this comparison in detail, points out three primary and four secondary par-

ticulars in which its structure and development resemble the typical chordate. These are as follows: Of the first class, (1) the position and origin of the central nervous system; (2) the possession of a notochord; (3) the possession, method of origin and arrangement of gill-slits. Of the second class, (1) the origin of the mesoblast—the middle germ layer; (2) the asymmetry of the anterior parts; (3) the opercular fold; (4) the excretory funnels opening into the atrial cavity. It must serve our present purpose to consider the three primary features here enumerated; the secondary ones must be passed by with some general statements, merely.

All vertebrates are characterized by the possession, at least in embryonic life, of a notochord arising from the dorsal portion of the primitive digestive tract, and extending parallel with the long axis of the animal; by the possession of a cerebro-spinal nerve axis that arises from the ectoderm of the dorsal portion of the embryo, and extends parallel with the notochord along its dorsal side; by the possession of paired respiratory organs that arise from the anterior portion of the digestive tube and communicate with the external world, either through the mouth or independently of it; and by the possession of a large median dorsal blood vessel situated between the digestive tract and the notochord, in which the blood flow from before backward.

To all these fundamental features Balanoglossus certainly presents some remarkable resemblances. The nerve cord arises from the dorsal portion of the ectoderm of the embryo by a process that is quite similar to that by which the same structure arises in many of the fishes, as the lamprey and the bony fishes. However, certain important differences must not be disregarded.

In all vertebrates the posterior end of the medullary plate—the nerve cord in its early stage—terminates at the blastopore, while in Balanoglossus, it does not extend so far back; in fact the portion of it that seems most nearly to resemble the vertebrate cord is apparently confined to the collar, while the anus is situated at the extreme posterior end of the animal. Furthermore it seems quite doubtful if the canal, or space that finally appears in the cord of Balanoglossus, is in any sense morphologically comparable to the vertebrate neural canal.

Again, it is to be observed that in all vertebrates, even including Amphioxus, the nerve cord is encased in a connective-tissue or

cartilaginous sheath, which is directly continous with a corresponding sheath surrounding the notochord, while in Balanoglossus no such sheath is found, the nerve cord and notochord not only not being in close relation, but the dorsal blood vessel is situated between them. However, so far as the absence of the sheath is concerned, the difficulty is hardly a weighty one since we must suppose, both from developmental evidence and on *a priori* grounds, that the earliest vertebrate ancestors were without such a sheath. But the situation of the dorsal blood vessel as described is not so easily explained away, though Dr. Morgan[4] has suggested that the dorsal aorta of vertebrates is another vessel entirely. His suggestion would seem to imply that in vertebrates the dorsal aorta has arisen since the vertebrate phylum branched off from the common ancestral form, and that the dorsal vessel corresponding to the one now found in Balanoglossus has disappeared. This conjecture may receive support from the fact that the heart of Balanoglossus is situated in the proboscis, and hence cannot certainly have any relation to the vertebrate heart.

In this connection it seems to me worth while to refer to the lymph canals described by Lankester[5] within the notochordal sheath, one on the dorsal side and one on the ventral side, in Amphioxus. And the same author speaks of the great difficulty in distinguishing blood vessels from lymph vessels in this animal. It would be rash to maintain a homology between the lymph canal in the dorsal portion of the Amphioxus notochord and the dorsal blood vessel of Balanoglossus, yet no harm can come from a cautious suggestion of such a possibility.

The notochord of Balanoglossus originates from the dorsal wall of the digestive tube as it does in vertebrates, and in later stages of development resembles the vertebrate notochord in its histological structure considerably, thus satisfying two of the important criteria of homologous structures. But, in all vertebrates, without exception, the notochord arises from nearly or quite the entire length of the embryonic digestive tube, while in Balanoglossus it arises as an evagination from near the anterior end and grows out anteriorly

---

[4] T. H. Morgan. Growth and Metamorphosis of Tornaria, Journ. of Morphology, Vol. v, p. 407, 1892.

[5] E. Ray Lankester. Contributions to the knowledge of Amphioxus lanceolatus, Yarrell, Quart. Journ. Micro. Sci., Vol. xxix, p. 365, 1889.

in the form of a pouch extending through the peduncle somewhat into the base of the proboscis. Its connection with the digestive tube never becomes severed as it does in all vertebrates.

It appears to me that it is in the "branchial basket" and the parts immediately associated with it that we find the most convincing evidence of genetic relationship between Balanoglossus and vertebrates. In this particular greater similarity exists between Balanoglossus and Amphioxus, than between the Cyclostome fishes and higher fishes. And the resemblance is the more convincing because of the complexity of structure—the large number of points presented for comparison in the two cases. A detailed description and comparison of all these points is quite out of the question in the present connection. I may mention some of them, however, and refer those who may desire to examine the subject more carefully to the papers of Agassiz,[6] Spengel,[7] Bateson,[8] Lankester,[9] Morgan,[10] Willey,[11] and others. These are: the method of origin of the primary gill slits in the two cases, and the way in which these are each divided into two in later life by the so-called tongue bars; the very large and somewhat variable number of gill slits, as compared with all vertebrates, and the fact that the number increases till a late period in the developmental history of the animal; the similarity of the chitinoid bars that serve as a framework for the gill slits in the two cases; the beginning, so to speak, in Balanoglossus, of what would correspond, both in origin and in morphological relations, were the development carried further, to the atrium of Amphioxus; and finally, but by no means least in possible significance, the collar funnels in Balanoglossus comparable to the atrio-cœlomic funnels in Amphioxus. These latter structures

---

[6] Alexander Agassiz. The History of Balanoglossus and Tornaria. Mem. Amer. Acad. Arts and Sci., Vol. ix, 1867.

[7] J. W. Spengel. Ueber den Bau und der Entwicklung des Balanoglossus. Amtl. Ber. der 50 Vers. deutsche Naturf. u. Aertze in München, 1877.

Also: Zur Anatomie des Balanoglossus. Mittheil. aus der Zool. Stat. Neapel, Bd. v, 1884.

[8] l. c.

[9] l. c.

[10] l. c.

[11] Arthur Willey. Later Larval Development of Amphioxus, Quart. Journ. Mic. Sci., Vol. xxxii, 1892.

are probably in no wise connected, functionally, with the branchial apparatus (certainly not in Balanoglossus); but since structurally they are, and since we have no sure knowledge of what their function is, we may well enumerate them along with the structures in immediate connection with the branchial apparatus.

Now, having spoken briefly of the parts in the organization of Balanoglossus that do present strong resemblances to the corresponding parts in Amphioxus, we must turn our attention to those which do not.

The proboscis, which is so characteristic of the animal, not only cannot be compared with any structure in vertebrates, but the organs which it contains, viz.: the "proboscis gland," the heart, and the pore by which its cavity communicates with the exterior, are wholly unrepresented in any vertebrate. Likewise none of the portions of the abdomen lying behind the gill region can hardly be compared with anything found in vertebrates.

The structure of the body walls in the two animals is totally different. In Balanoglossus it is derived largely from the ectoderm, the muscular portion derived from the mesoderm being comparatively weak and small, showing nothing of the muscle plates so well developed in Amphioxus. Still it must be admitted that this conspicuous difference is rather secondary than fundamental since the origin of the mesoblastic pouches presents considerable resemblance in the two cases.

On the whole, then, it seems to me that by a careful weighing of all the evidence now at hand we are compelled to place this animal in our classification nearer the vertebrates than to any other group of animals (its comparison in several points with a remarkable creature brought from the depths of the ocean by the Challenger dredgings appears to be well founded. Unfortunately, however, all our knowledge of this animal rests upon the adult structure of a single species only and of a few individuals, even, of this one).

Strongly beliving in the affinities of the larva of Balanoglossus with the Echinoderm larva, Metschnikoff,[12] in 1881, attempted to follow out the logical consequences of this belief and to reduce the structure of the adult Echinoderm and Balanoglossus to a common fundamental type. The basal feature for this comparison is the

[12] E. Metschnikoff. Ueber die systematische Stellung von Balanoglossus, Zool. Anz., Bd. iv, 1881.

water system in the two groups, the proboscis of Balanoglossus being supposed to represent a single ambulacral tentacle of an Echinoderm. This is certainly a most ingenious speculation and one that must be admitted to be not wholly without plausibility, especially as regards this particular structure. The resemblance in other points of structure is very obscure, and it should be remembered that similarity between groups in several fundamental points of structure increases the probability of homology between these structures—and so of genetic relationship between the animals possessing them—many times beyond the number of points of resemblance. For example, we can see no *a priori* reason, either physiological or morphological, why a water system should not exist in correlation with several styles of animal organization. Consequently, when we find an animal possessing it that in other respects resembles other animals that possess it very obscurely if at all, the probability that the system is homologous in the two instances is not very great, it seems to me; at any rate there is great room for the possibility of analogy merely, i. e., that the structure has had an independent origin in the two cases. When, however, there is an essential agreement in several points of organization, as we have seen to be the case between Balanoglossus and vertebrates, the probabilities of mere analogy or independent origin are many times less.

Developmentally Balanoglossus presents some most interesting chapters in phyologenitic history—interesting both on account of the parts of them that we can understand, and of those that we cannot, as yet satisfactorily interpret. One of the most strikingly interesting things in this history is that the different species do not tell the same story, that they do not all present the same pedigree, and this is true, notwithstanding the fact that they are all so closely related that no one has ever pretended to claim more than specific differences between them.

So far as is known all the species excepting one pass through a very distinct and quite prolonged larval stage. This one—an American form — develops without any larval stage. The larva was discovered by the distinguished German zoologist, Johannes Müller,[13] in 1848. He was at this time studying the em-

[13] Johannes Müller. Ueber die Larven und die Metamorphose der Echinodermen, Zweite Abhandlung, Abhandl. d. Akad. d. Wiss. zu Berlin, Juli, 1848.

bryology of Echinoderms, and among the larvæ of the various groups of these animals that he collected with his tow net in the Mediterranean Sea was this which he named Tornaria from the fact that it constantly rotates about its long axis as it progresses through the water. He thought it was probably the larva of some Echinoderm and finally, after studying as many stages as he was ever able to find, decided it to be a Holothurian. Afterward several zoologists collected and described the same larva and were deceived as its original discoverer had been till finally, in 1869, Metschnikoff,[14] a Russian zoologist, was fortunate enough to see the Tornaria so far transformed into the Balanoglossus as to be able to recognize its true nature. The adult Balanoglossus had been well known for a long time. But although it was now soon established beyond a doubt that Tornaria is the larva of Balanoglossus and not of an Echinoderm its close resemblance to the larva of the latter, particularly to Auricularia, the larva of the Holothurian, was recognized by all who studied it. And I may here add that the advance of knowledge of both the Echinoderm larva and of Tornaria, even to the present moment, has only served to increase the belief in the minds of many morphologists that there is an actual genetic relationship between the two forms.

Figures 4, 5, 6 and 7 represent the Tornaria in several stages of its development. Figure 7 represents as early a stage as has ever been seen, the larvæ having always been captured after they have escaped from the egg and betaken themselves to their free swimming life. They are very transparent and at this stage very small, the specimen here figured being between .2 and .3 of a millimeter in length—barely large enough to be visible to the unaided eye, excepting it be accustomed to seeking such objects. From its extreme transparency the internal organs can be easily seen in the living animal.

On the surface are several thickened bands bearing cilia. In the smallest larvæ the course of these bands is comparatively simple, as is shown in Fig. 7, *c. b.* Were the opposite side of the larva to be seen, two more bands would be found in corresponding positions.

---

[14] E. Metschnikoff. Untersuchungen über die Metamorphose einiger Seethiere. 1. Ueber Tornaria. Zeitschr. f. Wiss. Zool., Bd. xx, 1870.

The four all unite at the apex of the anterior end of the larva, *a. p.;* and since the two short ones are continuous at their other ends by a cross-band in front of the mouth as are also the two longer ones by a similar band behind the mouth, the whole four form in reality a single band at this stage. At a little older stage these bands become much more complicated by being separated at the apex, and by taking on several loops in their course. The details of this need not be entered into, but a general idea of it can be gathered from Fig. 6, *c. b.* Moreover, an entirely new band appears, also ciliated, the cilia here being considerably longer than those of the other bands. This one passes around the anal end of the larva in the form of a girdle, and this form it never changes as long as it exists, viz.: throughout the larval life, Figs. 5 and 6, *c. c. b.* At the apex of the larva, at the point to which the longitudinal bands converge, is found a thickened spot in the ectoderm, supposed to be nervous; and in the center of this is a pair of pigmented eye-spots, *a. p.* and *e. s.* of the figures.

At the stage represented by Fig. 7, the only internal organs are the digestive tube consisting of an œsophagus, *œ.*, a stomach, *s.*, and a short intestine, *i.*, the mouth being placed at *m.*, and the anus at *a*, at the posterior end of the body; and the very small beginning of the "water vascular system," as it was originally called from its supposed identity with that organ in the Echinoderm larva. This is a single sac placed on the dorsal surface of the œsophagus, probably, however, not connected with it, even at this early stage. Its cavity communicates with the exterior by a tube, *c. t.*, the pore of which is on the dorsal side of the larva slightly to the left of the median line, *d. p.* A thread-like muscle band passes down from the apical plate to the sac *mu.*

Without attempting to follow the steps of development, we may pass to the condition that is presented by a larva just previous to its transformation into the Balanoglossus. Such a stage is shown by Fig. 4. The new organs that have appeared in addition to those already described are the so-called proboscis glands, *p. b.*, the mesoblastic pouches, *m. p.* [Fig. 5], the heart, *h.*, and three pairs of gills, *g.* The exact origin of the proboscis gland—or vesicle as it is sometimes called—is not known, neither is its function known, though in the adult animal it is thought by some to be an excretory organ, while others have called it an accessory gill.

The mesoblastic pouches have arisen as two paired evaginations from the lateral walls of the digestive tract. These four pouches become entirely severed from their original connection, and form large thin walled, entirely closed bags. They become so large in fact that each pair almost entirely surrounds the digestive tube, their inner walls being in contact with this latter while their outer walls are in contact with the inner surface of the ectoderm. In short, they form the real body cavity, or cœlom. The heart is a peculiar structure. It is said to arise as a space, merely, between the water vesicle and the proboscis gland. The walls of these two latter organs become closely pressed against each other, the contact being interrupted in a small area only, and this is the heart which becomes filled with a fluid in which there are no cellular elements. This makes the walls of the heart to consist of parts of the walls of two other organs, and this means that if each of these has a function of its own the tissue of the heart has a triple office, viz.: the portion forming a part of the wall of the water vesicle functions in that capacity; the portion belonging to the proboscis gland performs its office there, and finally the two parts together perform the functions of a heart. The organ can be very distinctly seen in the living larva when placed on its side and flattened down somewhat with a compressor (Fig. 4 is drawn from such a preparation). The walls are very distinct, and the contractions constant and regular. It should be pointed out, however, that the contractions are of quite a different character from what is seen in the hearts of most other animals. It does not consist either in a uniform, simultaneous contraction of the entire wall, as one sees take place, for instance, in the spherical vascular organs on the sides of certain marine leeches; or of a wave of contraction passing from one end to the other, the contraction affecting the entire circumference at each successive point passed over by the wave, as takes place in peristaltic movement, or as is seen in the heart of Ascidians, for example. But one-half of the wall does not contract at all, while in the other half a sharp fold sink deep into the cavity of the organ and travels across it, the edge of the fold not extending across, however, to the opposite wall.

The gills have arisen as paired pouches from the dorsal wall of the œsophagus, the anterior pair appearing first and the others in succession behind them. They do not fuse with the ectoderm and

break through to communicate with the outside world as in the adult animal, till a later period, after the metamorphosis has begun. While these new organs have been developing the old ones have been increasing in size and form. The water vesicle has elongated lengthwise of the animal; its walls have thickened in some regions, and as seen in Fig. 4, at X, a pair of horn-like processes now extend downward and a little backward, straddling the œsophagus. I would call particular attention to these because they have been seen and figured by Fewkes,[15] but their existence has been denied by Morgan.[16]

The changes that take place during the metamorphosis can here be touched upon only in the briefest way. The Tornaria loses its transparency, largely; gives up its free swimming career and settles down to the bottom of the vessel in which it is contained; its cilia disappear, and with them the thickened bands on which they are situated; the whole larva elongates, the anterior portion to become the proboscis, and the region behind the circular band of cilia to become the abdomen. The gills, which in the Tornaria are far forward, are brought to the position in which they are found in the adult, viz.: behind the collar, by the drawing backward of the stomach and œsophagus during the transformation. Figure 3 represents a young Balanoglossus about as far advanced as has yet been obtained by keeping them in confinement. The transformation to this stage takes place quite rapidly when once it sets in, but beyond this it seems to proceed very slowly. In fact, in the artificial conditions of the aquarium the little animal seems determined not to develop much further.

As already said, in the species the development of which was studied by Mr. Bateson, there is no Tornaria stage. It is in this species only that the method of cleavage and formation of the blastula and gastrula are known. In these early stages the processes are very similar to those which take place in Amphioxus and the Tunicates.

The very interesting question at once arises—it being remembered that the adults of all species are so nearly alike as to have never

---

[15] J. W. Fewkes. On the Development of Certain Worm Larvæ. Bull. Mus. Comp. Zool., Harvard University, Vol. xi, 1883.

[16] l. c.

raised a doubt that all belong to one genus—which is the more primitive way of development, directly without the larval stage, or through the larva? Did the first Balanoglossus reach its developmental goal by the long, indirect tornaria road, and did a more modern one, imbued with the rapid transit idea, cut across lots leaving the ancient roundabout way? Or did the older forms go across while the younger ones have taken to the longer road? No one has discussed this question at any length, and I am not going to undertake it at present. In fact without a knowledge of the first stages of development of the Tornaria, it would probably be impossible to arrive at any very satisfactory conclusion on the subject. It is suggested by Korschelt & Heider[17] that the direct development is the more primitive, their reason for this conclusion being found in the fact that the mouth and anus do not form in this larva till a comparatively late stage—a condition which would seem to be incompatible with a free swimming of larva.

There are, however, some quite serious difficulties in the way of this suggestion, one of which is that the circumanal ciliated band appears very early in the directly developing species, while it forms quite late in the Tornaria.

For the solution of this question, as well as of several others, it is of the utmost importance that we fill up the gap that now exists in our knowledge of the earliest embryonic stages of Tornaria; and to this end the more species we have access to, the better become our chances of being able to do this. It is quite probable that somewhere on our great extent of sand and mud beach a representative of the genus will be found.

Explanation of the Figures of Plate XXII.

Fig. 1. Balanoglossus kowalevskii. (After A. Agassiz, from Korschelt and Heider.)

Fig. 2. Sagittal longitudinal section through the proboscis and collar of Balanoglossus sarniensis. (After Köhler, from Korschelt and Heider.)

Fig. 3. The young Balanoglossus, shortly after its transformation; under the compressor.

Fig. 4. The anterior portions of a Tornaria shortly before its transformation to Balanoglossus. The larva was flattened down somewhat by the compressor. The outlines drawn with a camera lucida.

Fig. 5. A Tornaria at a somewhat older stage than Fig. 6, to show internal structures.

---

[17] l. c.

Fig. 6. The youngest stage of Tornaria yet seen. Actual size between .2 mm. and .3 mm.

Fig. 7. Surface view of Tornaria considerably older than the one shown in the following figure, to show the tortuous course of the ciliary bands.

Figures 3, 4, 5, 6 and 7 were all drawn by the writer from the living animals, at Newport, R. I., 1890.

ABBREVIATIONS USED IN THE FIGURES.

a.	Anus.	*h.*	Heart.
abd.	Abdomen.	*i.*	Intestine.
a.p.	Apical plate.	*m.*	Mouth.
c. b.	Ciliated band.	*mu.*	Muscle band.
ch.	Notochord.	*m. p.*	Mesoblastic pouches.
col.	Collar.	*n.*	Nerve cord.
c. t.	Tube of water system.	*œ.*	Œsophagus.
d. b.	Dorsal blood vessel.	*pro.*	Proboscis.
d. p	Dorsal pore.	*p. b.*	Proboscis gland.
e. s.	Eye spot.	*s. or.*	Sexual orifices.
g.	Gills.	*v. b.*	Ventral blood vessel.

RELICS FROM AN INDIAN BURYING GROUND.

BY L. BELDING.

On the north bank of the Stockton Slough on land of Mr. Edward F. Jones is an extensive Indian burying ground where hundreds, if not thousands, of Indians have been buried, and where I have, during the last fourteen or fifteen years, found some very interesting relics, but none of them interested me as much as those which were made of the adobe soil of the neighborhood, and which appear to me to be unique. The burying ground is in an extensive stoneless tract and substitutes for stones were made from the convenient soil, apparently by wetting, shaping with the hand, marking, and then baking in fire. These artificial stones were usually nearly round and would weigh about a half-pound each, but there was a considerable variety in size, form and marking; the latter of which was probably indicative of family or individual ownership, and the stones were probably used for cooking food, but they may have had some connection with the burial customs of these Indians.

Among other things found here were two perforated discs which resemble a form described by Mr. Bowers and Paul Schumake, and which Mr. Henshaw refers to as weights to digging sticks.

These two were made of the same material and in the same manner as the artificial stones and were too frail to be used in the way Mr. Henshaw mentions in "Perforated Stones from California," Bureau of Ethnology, 1887.

A stone digging tool was found which was chisel-shaped at one end, was about sixteen inches long and about two inches in diameter. It must have been very useful in digging the Tule potato *(Sagittaria)* which is now sometimes called "China potato," which grew and still grows in abundance along the sloughs and in the extensive tule marshes of the vicinity.

The obsidian spear and arrow-heads found here were fine examples of aboriginal skill. Two obsidian crescent-shaped knives or implements, which had probably been used in dressing fish, had their convex edges squarely notched or blocked. They are or were on exhibition in the Smithsonian building in 1882, and differ from anything I have seen elsewhere.

The burial ground appears to have once been the site of an Indian village, as bones of elk, deer, fish, ducks, geese, and other birds are plentiful. A circular, saucer-shaped excavation for a fandango or sweathouse, is additional evidence that a village once occupied the spot. Many of the skeletons which appear to have been buried last, and about the same time, were probably victims of small-pox or some other epidemic.

Waves from passing steamboats have washed away a considerable part of the ground, and a large levee has recently been built on and of the mound.

RECENT ADDITIONS TO THE NORTH AMERICAN LAND MAMMAL FAUNA.

BY WALTER E. BRYANT.

For several years I have been keeping a list of the new species of North American mammals as the descriptions appeared, with notes on the changes of nomenclature, for convenience of reference. Since 1884, when Mr. True published "A Provisional List of the Mammals of North and Central America, and the West Indian Islands" (Proc. U. S. Nat. Mus. 1884, Appendix), I believe nothing has appeared in that line. Certainly the nomenclature of the class is in need of revision, and I am informed that an authority has in preparation some work of the kind.

Nothing is attempted in the present article but to give the names, authority, citation of publication and habitat as far as known, except in a few instances when changes have been made in order to bring the names more into conformity to the latest authorities. The species here enumerated are mainly or entirely additions to Mr. True's list, the general order of which has been followed. Considerable shuffling of names has been done in the literature upon the subject during the past few years, necessitated by the acquired knowledge concerning the earlier writers and the species treated of by them and not resulting from the whims of authors or the disregard to generally accepted principles of nomenclature. A few of these changes are noticed here when they concern a given species.

The writings of Allen, Merriam and Mearns have supplied the greater portion of the present compilation, which it is hoped will be useful to workers in mammalogy, especially to those whose growing interest in this class of animals may result in the future in the organization of a union such as has done so much for the ornithology of North America.

The majority of the additions here given as will be seen were described in—

North	American	Fauna,	No.	1,	issued	October	25, 1889.
"	"	"	"	2,	"	October	30, 1889.
"	"	"	"	3,	"	September	11, 1890.
"	"	"	"	4,	"	October	8, 1890.
"	"	"	"	5,	"	July	30, 1891.

Bulletin of the American Museum of Natural History, vol. ii, 1887–90; vol. iii, 1890–91; vol. iv, in press.

Under North America I have included the species described from the country recognized by the American Ornithologists' Union.

To Mr. T. S. Palmer, First Assistant of the Division of Ornithology and Mammalogy of the U. S. Department of Agriculture, I am greatly indebted for substantial aid in the preparation of this paper. He has kindly read the proof sheets and supplied most of the added generic names with data and about fifteen of the added species and noted several important eliminations in the list.

Mr. Palmer has also made some changes in the spelling of geographical names, in which he has followed the rulings of the U. S. Board on Geographic Names. When a single definite locality is

given it is the type locality and not necessarily the entire habitat of the species.

While the appended list of eliminated species is by no means complete, it is given for whatever assistance it may be to students.

GENERIC AND SUBGENERIC ADDITIONS AND CHANGES.

1. APLODONTIA Richardson. [Andetates *Haplodon*] Richardson.

(Cf. Merriam, Science, vii, March 5, 1886, p. 219; Ann. N. Y. Acad. Sci. iii, May, 1886, p. 312.)

2. PHENACOMYS Merriam.

Merriam, N. Am. Fauna, No. 2, Oct. 30, 1889, p. 28.

Type, *Phenacomys intermedius* Merriam, from Kamloops, British Columbia.

3. SITOMYS Fitzinger. [*Hesperomys* Waterhouse, antedates *Vesperimus* Coues.]

Fitzinger, Sitzungsber, math. nat. classe, K, Acad. Wiss. Wien, lvi, 1867, p. 97.

Type *Cricetus myoides* Gapper, from Lake Simcoe, Ontario, Canada.

(Cf. Merriam, Proc. Biol. Soc. Wash. vii, April 13, 1892, p. 27, foot-note.)

4. ONYCHOMYS Baird. [Subgenus.]

Baird, Mamm. N. Am. 1857, p. 458. Raised to generic rank by Merriam N. Am. Fauna, No. 2, p. 3.

Type, *Hypudæus leucogaster* Max Wied from old Fort Clark, North Dakota.

5. REITHRODONTOMYS Giglioli. [Antedates *Ochetodon* Coues, 1874.]

Giglioli, Richerche intorno alla Distribuzione Geografica Generale, Roma, 1873, p. 160, foot-note.

(Cf. Merriam, Proc. Biol. Soc. Wash, vii, Apr. 13, 1892, p. 26, foot-note.)

6. CHÆTODIPUS Merriam. [Subgenus of *Perognathus.*]

Merriam, N. Am. Fauna, No. 1, p. 5.

Type, *Chætodipus spinatus* Merriam, from lower Colorado River, California.

7. PERODIPUS Fitzinger. [Antedates *Dipodops* Merriam, 1890.]

Fitzinger, Sitzungsber. math. nat. Classe, K. Akad. Wiss. Wien, lvi, 1867, p. 126.

Type, *Dipodomys agilis* Gambel, from Los Angeles, California. (Cf. Merriam, Proc. Biol. Soc. Wash. vii, April 13, 1892, p. 26, foot-note).

8. MICRODIPODOPS Merriam.

Merriam, N. Am. Fauna, No. 5, July 30, 1891, p. 115.

Type, *Microdipodops megacephalus* Merriam, from Halleck, Nevada.

9. EUDERMA H. Allen.

Allen, Proc. Acad. Nat. Sci. Phila. Jan. 1892, p. 467.

Type, *Histiotus maculatus* J. A. Allen, from Los Angeles County, California.

10. OTOPTERUS Lydekker.

Flower & Lydekker, Mammals Living and Extinct, London, 1891, p. 673, foot-note.

Replaces *Macrotus* Gray which is preoccupied.

11. NOTIOSOREX Baird MS.

Coues, Bull. U. S. Geol. Surv. Terr. iii, May 15, 1877, p. 646. (Subgenus.)

Type, *Sorex (Notiosorex) crawfordi*, from Fort Bliss, Doña Ana County, New Mexico.

(Cf. Flower & Lydekker, Mam. Living and Extinct, 1891, p. 624, raised to generic rank.)

12. BASSARISCUS Coues.

Science ix, May 27, 1887, 516.

Replaces *Bassaris* Wagler which is preoccupied.

13. LATAX Gloger.

Nova Acta Acad. Cæs. Leop. Car. xiii, pt. ii, 1827, p. 511.

Revived by Stejneger to replace *Enhydra* Fleming which is preoccupied. (Cf. Stejneger, Naturen, 1885, p. 172.)

14. SPILOGALE Gray.

Proc. Zool. Soc. London, 1865, p. 150.

Revived by Merriam, N. Am. Fauna No. 4, p. 1.

Type, *Mephitis interrupta* Rafinesque.

15. LUTREOLA Wagner. [Subgenus.]

Suppl. Schreb, Saügth. ii, 1841, 241.

Used as genus by Merriam, Ann. Rep. Dept. Agriculture, 1887, (1888), p. 433.

In a paper entitled "The Geographic Distribution of Life in North America with special reference to the Mammalia," by C. Hart Merriam, M. D. (Proc. Biol. Soc. Wash. vii, April 13, 1892, pp. 1-64), the following subgenera are revived or used for the first time:

Teonoma Gray (bushy tailed wood-rats).
Neosorex Baird (genus of shrews reduced to subgenus).
Atophyrax Merriam (genus of shrews reduced to subgenus).
Tamiasciurus Trouessart (containing the chickarees).
Neosciurus Trouessart (subgenus of *Sciurus*).
Parasciurus Trouessart (subgenus of *Sciurus.*)
Xerospermophilus (type, *Spermophilus mohavensis*).
Ammospermophilus (type, *Spermophilus leucurus*).
Neofiber True (reduced to subgenus of *Arvicola*).

SPECIFIC AND SUBSPECIFIC ADDITIONS AND CHANGES.

1. DIDELPHIS VIRGINIANA CALIFORNICA (Bennett) Allen. Texas Opossum.

Didelphys californica Bennett, Pr. Zool. Soc. i, 1833, 40.
Texas to City of Mexico.

2. CARIACUS MACROTIS CALIFORNICUS (Caton). Southern Mule Deer.

Cervus macrotis var. *californicus* Caton., Am. Nat. x, Aug. 1876, p. 464.
Southern California.

3. ARCTOMYS DACOTA Merr. Black Hills Marmot.
Merriam, N. Am. Fauna, No. 2, p. 8.
Black Hills, Dakota.

4. CYNOMYS ARIZONENSIS Mearns.
Mearns, Bull. Am. Mus. Nat. Hist. ii, 4, p. 305.
Southern Arizona.

5. CYNOMYS GUNNISONI Baird. Short-tailed Prairie Dog.
Revived by Merriam, N. Am. Fauna, No. 3, p. 58.
Arizona; Colorado.

6. CYNOMYS LEUCURUS Merr.
Merriam, *ibid*, No. 4, p. 33.
Fort Bridger, Wyoming.

7. TAMIAS STRIATUS LYSTERI Rich.
Cf. Merriam, Am. Nat. xx, 1886, p. 242.

Mountains of Pennsylvania; Adirondack region of New York; northern New England; eastern Canada north to the Gulf of St. Lawrence, and in the interior north to James's Bay, Hudson's Bay.

8. TAMIAS STRIATUS GRISEUS Mearns.
Mearns, Bull. Am. Mus. Nat. Hist. iii, 2, p. 231.
Upper Mississippi Valley west of the Great Lakes.

9. TAMIAS CASTANURUS Merr.
Merriam, N. Am. Fauna, No. 4, p. 19.
Wahsatch Mountains, Utah.

10. TAMIAS CHRYSODEIRUS Merr.
Merriam, *ibid*, p. 19.
Fort Klamath, Oregon, and southward in the Sierra Nevada.

11. TAMIAS CINERASCENS Merr. Gray Ground Squirrel.
Merriam, *ibid*, p. 20.
Helena, Montana; Idaho.

12. TAMIAS MACROHABDOTES Merr. Long-eared Chipmunk.
Merriam, Proc. Biol. Soc. Wash. iii, Jan. 27, 1886, 25.
Sierra Nevada Mountains, Placer County, California.

13. TAMIAS OBSCURUS Townsend, MS. Lower California Chipmunk.
Allen, Bull. Am. Mus. Nat. Hist. iii, 1, June, 1890, 70.
San Pedro Martir Mountain, Lower California.

14. TAMIAS TOWNSENDII HINDSII (Gray). Redwood Chipmunk.
Revived by Allen in Bull. Am. Mus. Nat. Hist. iii, 1, 75.
Coast region of California, from San Francisco northward. Restricted to the narrow coast belt west of the Coast Range.

15. TAMIAS QUADRIMACULATUS Gray. Sacramento Chipmunk.
Gray, Ann. & Mag. Nat. Hist. 3d ser. xx, 1867, p. 435.
Revived by Allen, *ibid*, p. 80.
Valley of the Sacramento River, California, north to Shasta County, California, and Fort Klamath, Oregon.

16. TAMIAS SENEX Allen.
Allen, *ibid*, p. 83.
Sierra Nevada Mountains, Placer County, California, north to Fort Klamath, Oregon.

17. TAMIAS MERRIAMI Allen.
Allen, *ibid*, p. 84.

Mountains of Southern California, from San Diego County north to Tulare and Monterey counties.

18. TAMIAS SPECIOSUS Merriam, MS. San Bernardino Chipmunk.

Allen, *ibid*, p. 86.

San Bernardino Mountains, California.

19. TAMIAS FRATER Allen. Sierra Nevada Chipmunk.

Allen, *ibid*, p. 88.

Sierra Nevada Mountains, Placer County, California.

20. TAMIAS AMŒNUS Allen. Klamath Chipmunk.

Allen, *ibid*, p. 90.

Fort Klamath, Oregon, and southward to Placer County, California, Idaho.

21. TAMIAS CINEREICOLLIS Allen. Arizona Chipmunk.

Allen, *ibid*, p. 94.

San Francisco Mountain and neighboring mountains of Central Arizona.

22. TAMIAS UMBRINUS Allen. Uinta Chipmunk.

Allen, *ibid*, p. 96.

Mountains of Northern and Central Utah (Wahsatch and Uinta Ranges.)

23. TAMIAS QUADRIVITTATUS GRACILIS Allen. San Pedro Chipmunk.

Allen, *ibid*, p. 99.

Socorro County, New Mexico, and Apache County, Arizona.

24. TAMIAS QUADRIVITTATUS LUTEIVENTRIS Allen. Buff-bellied Chipmunk.

Allen, *ibid*, p. 101.

Main chain of the Rocky Mountains in Montana, from Helena northward, probably into British America.

25. TAMIAS QUADRIVITTATUS AFFINIS Allen. Columbian Chipmunk.

Allen, *ibid*, p. 103.

Interior of British Columbia, east of the Cascade Mountains.

26. TAMIAS QUADRIVITTATUS NEGLECTUS Allen. Lake Superior Chipmunk.

Allen, *ibid*, p. 106.

Northeastern Minnesota, Northern Wisconsin, northern peninsula of Michigan, and northern shore of Lake Superior.

27. TAMIAS MINIMUS Bach. Pale Chipmunk.
Revived by Allen, *ibid*, p. 110.
"Bad lands" and plains of Dakota, Montana, and Wyoming.

28. TAMIAS MINIMUS CONSOBRINUS Allen. Wahsatch Chipmunk.
Allen, *ibid*, p. 112.
Eastern border of the Great Basin (Eastern Utah, Western and Southern Colorado, and Northwestern New Mexico).

29. TAMIAS MINIMUS PICTUS Allen. Desert Chipmunk.
Allen, *ibid*, p. 115.
The Great Basin, from western border of Great Salt Lake westward, and from Southern Utah and Southern Nevada to the Snake Plains of Eastern Washington.

30. SPERMOPHILUS LEUCURUS Merr. Antelope Squirrel.
Tamias leucurus Merriam, N. Am. Fauna, No. 2, p. 20.
Southern Utah, northern Arizona, southern Nevada, southern California, and the peninsula of Lower California.

31. SPERMOPHILUS LEUCURUS CINNAMOMEUS Merr. White-tailed Chipmunk.
Tamias leucurus cinnamomeus Merriam, *ibid*, No. 3, p. 51.
Grand Cañon of the Colorado and Painted Desert, Arizona.

32. SPERMOPHILUS INTERPRES Merr.
Tamias interpres Merriam, *ibid*, No. 4, p. 21.
El Paso, Texas.

33. SPERMOPHILUS GRAMMURUS ATRICAPILLUS Bryant. Black-capped Ground Squirrel.
Bryant, Proc. Cal. Acad. Sci. 2d ser. ii, p. 26.
Peninsula of Lower California, from latitude 25° northward in mountainous region.

34. SPERMOPHILUS BELDINGI Merr. Sierra Nevada Spermophile.
Merriam, Ann. N. Y. Acad. Sci., iv, Dec. 28, 1888, p. 317.
Sierra Nevada Mountains, California.

35. SPERMOPHILUS ARMATUS Kennicott. Mountain Spermophile.
Revived by Merriam, N. Am. Fauna, No. 5, p. 38.

Uinta Mountains, Utah, to Blackfoot Mountains, Idaho.

36. SPERMOPHILUS ELEGANS Kennicott. Kennicott's Spermophile.

Revived by Merriam, *ibid*, p. 39.

Fort Bridger, Wyoming and northwestward to Lemhi Valley, Idaho.

37. SPERMOPHILUS COLUMBIANUS (Ord). Burrowing Squirrel.

Arctomys columbianus Ord, "Guthrie's Geog. 2d Am. Ed., ii, 1815, 292–303."

Revived by Merriam, *ibid*, p. 39.

Idaho.

38. SPERMOPHILUS MOHAVENSIS Merr. Mohave Desert Spermophile.

Merriam, *ibid*, No. 2, p. 15.

Mohave Desert, California.

39. SPERMOPHILUS NEGLECTUS Merr.

Merriam, *ibid*, p. 17.

Dolan Spring, Arizona.

40. SPERMOPHILUS SPILOSOMA PRATENSIS Merr.

Merriam, *ibid*, No. 3, p. 55.

San Francisco Mountain, Arizona.

41. SPERMOPHILUS SPILOSOMA OBSIDIANUS Merr. Dusky Spotted Spermophile.

Merriam, *ibid*, p. 56.

San Francisco Mountain, Arizona.

42. SPERMOPHILUS CRYPTOSPILOTUS Merr. Desert Spermophile.

Merriam, *ibid*, p. 57.

Painted Desert, Arizona.

43. SPERMOPHILUS CANESCENS Merr.

Merriam, *ibid.*, No. 4, p. 38.

Cochise County, Arizona.

44. SPERMOPHILUS SPILOSOMA MACROSPILOTUS Merr.

Merriam, *ibid*, p. 38.

Pinal County, Arizona.

45. SPERMOPHILUS SPILOSOMA MAJOR Merr.

Merriam, *ibid*, p. 39.

Albuquerque, New Mexico.

46. SCIURUS FREMONTI MOGOLLONENSIS Mearns. Mogollon Chickaree.

Sciurus hudsonius mogollonensis Mearns, Bull. Am. Mus. Nat. Hist. ii, 4, p. 277.

47. SCIURUS HUDSONIUS VANCOUVERENSIS Allen. Vancouver Chickaree.

Allen, *ibid*, iii, 1, Nov. 14, 1890, p. 165.
Vancouver Island.

48. SCIURUS HUDSONIUS CALIFORNICUS Allen. California Chickaree.

Allen, *ibid*, p. 165.
Sierra Nevada Mountains, Placer County, California.

49. SCIURUS CAROLINENSIS HYPOPHÆUS Merr.

Merriam, Science, vii, No. 167, April 16, 1886, p. 351.
Minnesota.

50. SCIURUS FOSSOR NIGRIPES Bryant. Black-footed Gray Squirrel.

Bryant, Proc. Cal. Acad. Sci. 2d ser. ii, p. 25.
Coast region of California, southward from San Francisco.

51. SCIUROPTERUS VOLANS SABRINUS (Shaw). Hudsonian Flying Squirrel.

Sciurus sabrinus Shaw, Gen. Zoology, Mammalia, ii, pt. 1, 1801, 157.

Revived by Merriam in N. Am. Fauna, No. 5, p. 51.
Idaho.

52. APLODONTIA MAJOR Merr.

Merriam, Science, vii, Mar. 5, 1886, p. 219; Ann. N. Y. Acad. Sci. iii, 10, May, 1886, p. 312.
California.

53. FIBER ZIBETHICUS PALLIDUS Mearns. Pale Muskrat.

Mearns, Bull. Am. Mus. Nat. Hist. ii, 4, p. 280.
Arizona.

54. EVOTOMYS CAROLINENSIS Merr.

Merriam, Am. Journ. Sci. xxxvi, Dec. 1888, p. 460.
Mountains of North Carolina.

55. EVOTOMYS GALEI Merr. Gale's Red-backed Mouse.

Merriam, N. Am. Fauna, No. 4, p. 23.
Boulder County, Colorado.

56. EVOTOMYS OCCIDENTALIS Merr. Western Red-backed Mouse.
Merriam, *ibid*, p. 25.
Chehalis County, Washington.

57. EVOTOMYS CALIFORNICUS Merr. California Red-backed Mouse.
Merriam, *ibid*, p. 26.
Humboldt County, California.

58. EVOTOMYS IDAHOENSIS Merr. Idaho Red-backed Mouse.
Merriam, *ibid*, No. 5, p. 66.
Idaho.

59. EVOTOMYS GAPPERI BREVICAUDUS Merr.
Merriam, *ibid*, p. 119.
Black Hills, South Dakota.

60. EVOTOMYS DAWSONI Merr. Dawson's Red-backed Mouse.
Merriam, Am. Nat. xxii, July, 1888, 649.
Finlayson River, Northwest Territory.

61. PHENACOMYS INTERMEDIUS Merr.
Merriam, N. Am. Fauna, No. 2, p. 32.
Kamloops, British Columbia.

62. PHENACOMYS CELATUS Merr.
Merriam, *ibid*, p. 33.
Godbout, P. Q., Canada.

63. PHENACOMYS LATIMANUS Merr.
Merriam, *ibid*, p. 34.
Fort Chimo, Ungava, Hudson Bay Territory.

64. PHENACOMYS UNGAVA Merr.
Merriam, *ibid*, p. 35.
Fort Chimo, Ungava, Hudson Bay Territory.

65. PHENACOMYS LONGICAUDUS True.
True, Proc. U. S. Nat. Mus. xiii, 826, Nov. 15, 1890, p. 303.
Marshfield, Coos County, Oregon

66. PHENACOMYS OROPHILUS Merr. Mountain Lemming Mouse.
Merriam, N. Am. Fauna, No. 5, p. 65.
Idaho.

67. ARVICOLA DRUMMONDII Aud. & Bach.
Audubon & Bachman, N. Am. Quad. iii, 1854, 166.

Revived by Merriam, Proc. Biol. Soc. Wash. vii, Apr. 13, 1892, p, 25.

Rocky Mountains, Western Alberta.

68. ARVICOLA MOGOLLONENSIS Mearns. Mogollon Mountain Vole.

Mearns, Bull. Am. Mus. Nat. Hist. ii, 4, p. 283.

Mogollon Mountains, Central Arizona.

69. ARVICOLA (MYNOMES) ALTICOLUS Merr. Mountain Vole.

Merriam, N. Am. Fauna, No. 3, p. 67.

San Francisco Mountain, Arizona.

70. ARVICOLA (MYNOMES) MACROPUS Merr. Big-footed Arvicola.

Merriam, *ibid*, No. 5, p. 59.

Salmon River, Saw Tooth and Pahsimeroi Mountains, Idaho.

71. ARVICOLA (MYNOMES) MORDAX Merr. Cantankerous Arvicola.

Merriam, *ibid*, p. 61.

Idaho.

72. ARVICOLA (MYNOMES) NANUS Merr. Dwarf Arvicola.

Merriam, *ibid*, p. 62.

Idaho.

73. ARVICOLA (MYNOMES) LONGICAUDUS Merr. Long-tailed Arvicola.

Merriam, Am. Nat. xxii, Oct. 1888, 934.

Black Hills, South Dakota.

74. ARVICOLA AUSTERUS MINOR Merr. Northern Prairie Meadow Mouse.

Merriam, Am. Nat. xxii, July, 1888, 598.

Turtle Mountain, North Dakota.

75. ARVICOLA PALLIDUS Merr,

Merriam, Am. Nat. xxii, August, 1888, 702.

Fort Buford, North Dakota.

76. ARVICOLA PAUPERRIMUS Cooper. Pallid Lemming Mouse.

Revived by Merriam, *ibid*, p. 64.

Idaho, Washington, Nevada. (?)

77. SITOMYS TRUEI (Shufeldt).

Hesperomys truei Shufeldt, Proc. U. S. Nat. Museum, viii, Sept. 14, 1885, p. 403.

Fort Wingate, New Mexico.

78. SITOMYS ANTHONYI (Merr.)
Hesperomys (Vesperimus) anthonyi Merriam, Proc. Biol. Soc. Wash. iv, April 15, 1887, 5.
Grant County, New Mexico.

79. SITOMYS FLORIDANUS (Chapman).
Hesperomys floridanus Chapman, Bull. Am. Mus. Nat. Hist. ii, 3, 117.
Gainesville, Florida.

80. SITOMYS NIVEIVENTRIS (Chapman).
Hesperomys niveiventris Chapman, *ibid*, p. 117.
Florida.

81. SITOMYS AMERICANUS ARCTICUS Mearns. Arctic Deer Mouse.
Hesperomys leucopus arcticus Mearns, Bull. Am. Mus. Nat. Hist. ii, 4, p. 285.
Hudson Bay Territory.

82. SITOMYS AMERICANUS NEBRACENSIS (Baird). Black-eared Deer Mouse.
Hesperomys leucopus nebracensis (Baird) Mearns, *ibid*, p. 285.
Montana; northwestern part of Indian Territory.

83. SITOMYS AMERICANUS TEXANUS (Woodhouse). Texan Deer Mouse.
Hesperomys leucopus texanus (Woodhouse) Mearns, *ibid*, p. 285
Northwestern Texas; Indian Territory.

84. SITOMYS MEGALOTIS (Merr.) Leaf-eared Cliff Mouse.
Hesperomys megalotis Merriam, N. A. Fauna, No. 3, p. 63.
Grand Cañon of the Colorado and Desert of the Little Colorado, Arizona.

85. SITOMYS AMERICANUS RUFINUS (Merr.) White-footed Mouse.
Hesperomys leucopus rufinus Merriam, *ibid*, p. 65.
San Francisco Mountain, Arizona.

86. SITOMYS FRATERCULUS (Miller).
Vesperimus fraterculus Miller, Am. Nat. xxvi, March, 1892, 261.
Dulzura, San Diego County, California.

87. SITOMYS BOYLII (Baird.)
Hesperomys boylii Baird, Proc. Acad. Nat. Sci. Phila. 1855, 335.

Revived by Merriam, Proc. Biol. Soc. Wash. vii, April 13, 1892, p. 32.
Middle Fork of the American River, California.

88. SITOMYS MACROPUS Merr.
Merriam, Proc. Biol. Soc. Wash. vii, April 13, 1892, p. 34.
Hesperomys macropus Merriam, N. Am. Fauna, No. 4, p. 53.
Lake Worth, Florida.

89. SITOMYS NASUTUS (Allen).
Vesperimus nasutus Allen, Bull. Am. Mus. Nat. Hist. iii, 2, June 30, 1891, p. 299.
Larimer County, Colorado.

90. SITOMYS MEARNSII (Allen).
Vesperimus mearnsii Allen, *ibid*, p. 300.
Brownsville, Texas; Fort Verde, Arizona.

91. SITOMYS CRINITUS (Merr.) Cañon Mouse.
Hesperomys crinitus Merriam, N. Am. Fauna, No. 5, p. 53.
Snake River, Idaho.

92. SITOMYS TAYLORI (Thomas).
Hesperomys (Vesperimus) taylori Thomas, Ann. & Mag. Nat. Hist. 5th ser. xix, 1887, p. 66.
San Diego, Duval County, Texas.

93. ORYZOMYS AQUATICUS Allen.
Allen, Bull. Am. Mus. Nat. Hist. iii, 2, June 30, 1891, p. 289.
Brownsville, Texas.

94. ONYCHOMYS LONGIPES Merr. Texas Grasshopper Mouse.
Merriam, N. Am. Fauna, No. 2, p. 1.
Concho County, Texas.

95. ONYCHOMYS LONGICAUDUS Merr. Long-tailed Grasshopper Mouse.
Merriam, *ibid*, p. 2.
St. George, Utah.

96. ONYCHOMYS MELANOPHRYS Merr. Black-eyed Grasshopper Mouse.
Merriam, *ibid*, p. 2.
Kanab, Utah.

97. ONYCHOMYS MELANOPHRYS PALLESCENS Merr. Desert Scorpion Mouse.
Merriam, *ibid*, No. 3, p. 61.
Apache County, Arizona.

98. ONYCHOMYS LEUCOGASTER BREVICAUDUS Merr. Idaho Grasshopper Mouse.

Merriam, *ibid*, No. 5, p. 52.

Idaho.

99. ONYCHOMYS FULIGINOSUS Merr. Dusky Scorpion Mouse.

Merriam, *ibid*, No. 3, p. 59.

Between San Francisco Mountain and Desert of the Little Colorado, Arizona.

100. SIGMODON HISPIDUS LITTORALIS Chapman.

Chapman, Bull. Am. Mus. Nat. Hist. ii, 3, p. 118.

"Probably confined to the coasts of Southern Florida."

101. SIGMODON HISPIDUS ARIZONÆ Mearns. Arizona Cotton Rat.

Mearns, *ibid*, ii, 4, p. 287.

Fort Verde, Arizona.

102. SIGMODON HISPIDUS TEXIANUS (Aud. & Bach.)

Arvicola texiana Aud. & Bach. Quad. N. Am. iii, 1853, p. 229.

Revived by Allen, *ibid*, iii, 2, June 30, 1891, p. 287.

Texas.

103. NEOTOMA CINEREA OCCIDENTALIS (Baird). Dusky Wood Rat.

Revived by Allen, *ibid*, p. 287.

Idaho; Shoalwater Bay, Washington.

104. NEOTOMA CINEREA DRUMMONDII (Richardson).

Myoxus drummondii Richardson, Zool. Journ. iii, 1828, 517.

Revived by Merriam, Proc. Biol. Soc. Wash. 7, April 13, 1892, p. 25.

Rocky Mountains, British Columbia.

105. NEOTOMA BRYANTI Merr. Bryant's Wood Rat.

Merriam, Am. Nat. xxi, Feb. 1887, p. 191.

Cerros Island, Lower California.

106. NEOTOMA MICROPUS Baird. Texan Wood Rat.

Revived by Allen, Bull. Am. Mus. Nat. Hist. iii, 2, June 30, 1891, p. 282.

San Fernando River, Tamaulipas, Mexico, northward to Brownsville, Texas.

107. NEOTOMA MICROPUS CANESCENS Allen. Pallid Wood Rat.

Allen, *ibid*, p. 285.

Oklahoma Territory.

108. THOMOMYS PERPALLIDUS Merr. Desert Pocket Gopher.
Thomomys talpoides perpallidus Merriam, Science viii, 203, Dec. 24, 1886, p. 588.
Colorado Desert, California; Painted Desert, Arizona.

109. THOMOMYS CLUSIUS FUSCUS Merr. Mountain Pocket Gopher.
Merriam, N. Am. Fauna, No. 5, p. 69.
Idaho, in mountains.

110. THOMOMYS FULVUS (Woodhouse).
Geomys fulvus Woodhouse, Proc. Acad. Nat. Sci. Phila. vi, 1852, 201.
Revived by Merriam, N. Am. Fauna, No. 3, p. 71.
San Francisco Mountain, Arizona.

111. GEOMYS PERSONATUS True.
True, Proc. U. S. Nat. Mus. xi, Jan. 5, 1889, p. 159.
Padre Island, Texas.

112. GEOMYS BURSARIUS LUTESCENS Merr.
Merriam, N. Am. Fauna, No. 4, p. 51.
Lincoln County, Nebraska.

113. PEROGNATHUS FASCIATUS FLAVESCENS Merr.
Merriam, N. Am. Fauna, No. 1, p. 11.
Kennedy, Nebraska.

114. PEROGNATHUS BIMACULATUS Merr.
Merriam, *ibid*, p. 12.
Fort Whipple, Arizona.

115. PEROGNATHUS LONGIMEMBRIS (Coues).
Merriam, *ibid*, p. 13.
Fort Tejon; San Bernardino, California.

116. PEROGNATHUS APACHE Merr.
Merriam, *ibid*, p. 14.
Apache County, Arizona.

117. PEROGNATHUS INORNATUS Merr.
Merriam, *ibid*, p. 15.
Fresno County, California.

118. PEROGNATHUS OLIVACEUS Merr.
Merriam, *ibid*, p. 15.
Kelton, Utah.

119. PEROGNATHUS OLIVACEUS AMŒNUS Merr.
Merriam, *ibid*, p. 16.
Nephi, Utah.

120. PEROGNATHUS FORMOSUS Merr.
Merriam, *ibid*, p. 17.
St. George, Utah.

121. PEROGNATHUS INTERMEDIUS Merr.
Merriam, *ibid*, p. 18.
Mud Spring, Arizona.

122. PEROGNATHUS FALLAX Merr.
Merriam, *ibid*, p. 19.
San Bernardino, California.

123. PEROGNATHUS OBSCURUS.
Merriam, *ibid*, p. 20.
Camp Apache, Grant County, New Mexico.

124. PEROGNATHUS SPINATUS Merr.
Merriam, *ibid*, p. 21.
Lower Colorado River, California.

125. PEROGNATHUS PARADOXUS Merr.
Merriam, *ibid*, p. 24.
Trego County, Kansas.

126. PEROGNATHUS PARADOXUS SPILOTUS Merr.
Merriam, *ibid*, p. 25.
Gainesville, Cook County, Texas.

127. PEROGNATHUS CALIFORNICUS Merr.
Merriam, *ibid*, p. 26.
Berkeley, California.

128. PEROGNATHUS ARMATUS Merr.
Merriam, *ibid*, p. 27.
Mount Diablo, California.

129. PEROGNATHUS LORDI (Gray).
Merriam, *ibid*, p. 28.
British Columbia.

130. PEROGNATHUS MOLLIPILOSUS Coues.
Merriam, *ibid*, p. 29.
Fort Crook, California.

131. PEROGNATHUS FULIGINOSUS Merr. Dusky Pocket Mouse.

Merriam, *ibid*, No. 3, p. 74.
San Francisco Mountain, Arizona.

132. PEROGNATHUS FEMORALIS Allen.
Allen, Bull. Am. Mus. Nat. Hist. iii, 2, June 30, 1891, p. 281.
Dulzura, San Diego County, California.

133. PEROGNATHUS MERRIAMI Allen.
Allen, *ibid*, iv, 1, March 25, 1892, p. 45.
Southeastern Texas.

134. DIPODOMYS DESERTI Stephens.
Stephens, Am. Nat. xxi, Jan. 1887, p. 42, pl. v.
Mohave and Colorado Desert regions of southeastern California.

135. DIPODOMYS MERRIAMI Mearns.
Mearns, Bull. Am. Mus. Nat. Hist. ii, 4, p. 290.
New River, Arizona.

136. DIPODOMYS AMBIGUUS Merr.
Merriam, N. Am. Fauna, No. 4, p. 42.
El Paso, Texas.

137. DIPODOMYS SPECTABILIS Merr.
Merriam, *ibid*, p. 46.
Dos Cabezos, Cochise County, Arizona.

138. DIPODOMYS CALIFORNICUS Merr.
Merriam, *ibid*, p. 49.
Mendocino County, California.

139. PERODIPUS COMPACTUS (True).
Dipodomys compactus True, Proc. U. S. Nat. Mus. xi, Jan. 5, 1889, p. 160.
Padre Island, Texas.

140. PERODIPUS CHAPMANI (Mearns).
Dipodomys chapmani Mearns, *ibid*, p. 291.
Fort Verde, Arizona.

141. PERODIPUS LONGIPES Merr.
Dipodops longipes Merriam, N. Am. Fauna, No. 3, p. 71.
Painted Desert, Arizona.

142. PERODIPUS SENNETTI (Allen).
Dipodops sennetti Allen, Bull. Am. Mus. Nat. Hist. iii, 2, April 29, 1891, p. 226.
Near Brownsville, Cameron County, Texas.

143. PERODIPUS RICHARDSONI Allen.
Allen, Bull. Am. Mus. Nat. Hist. iii, 2. June 30, 1891, p. 277.
"Northern Texas to southern Wyoming and westward to the Rocky Mountains."

144. MICRODIPODOPS MEGACEPHALUS Merr.
Merriam, N. Am. Fauna, No. 5, p. 115.
Halleck, Nevada.

145. ZAPUS INSIGNIS Miller.
Miller, Am. Nat. xxv, Aug. 1891, p. 742.
Nova Scotia and New Brunswick.

146. LAGOMYS SCHISTICEPS Merr.
Merriam, N. Am. Fauna, No. 2, p. 11.
Sierra Nevada Mountains, California.

147. LEPUS CINERASCENS Allen.
Allen, Bull. Am. Mus. Nat. Hist. iii, 1, Oct. 1890, p. 159.
Los Angeles County, California.

148. LEPUS SYLVATICUS FLORIDANUS Allen.
Allen, *ibid*, p. 160.
Brevard County, Florida.

149. LEPUS IDAHOENSIS Merr. Idaho Pygmy Rabbit.
Merriam, N. Am. Fauna, No. 5, p. 75.
Idaho; northern Nevada; (Eastern Oregon and Washington?).

150. LEPUS INSULARIS Bryant.
Bryant, Proc. Cal. Acad. Sci. 2d, ser., iii, p. 92.
Espiritu Santo Island, Lower California.

151. LEPUS ALLENI Mearns. Allen's Hare,
Mearns, Bull. Am. Mus. Nat. Hist. ii, 4, p. 294.
Arizona.

152. LEPUS MELANOTIS Mearns. Eastern Jackass Hare.
Mearns, *ibid*, p. 297.
Kansas; Western Texas and Indian Territory.

153. ATALAPHA TELIOTIS H. Allen.
H. Allen, Proc. Am. Phil. Soc. xxix, Feb. 11, 1891, p. 5.
Southern California?

154. VESPERTILIO CILIOLABRUM Merr.
Merriam, Proc. Biol. Soc. Wash. iv, Dec. 17, 1886, p. 1–4.
Kansas and New Mexico.

155. VESPERTILIO LONGICRUS True.
True, Science, viii, Dec. 24, 1886, p. 528.
Puget Sound, Washington.

156. VESPERTILIO MELANORHINUS Merr. Black-nosed Bat.
Merriam, N. Am. Fauna, No. 3, p. 46.
San Francisco Mountain, Arizona.

157. MOLOSSUS CALIFORNICUS Merr.
Merriam, *ibid*, No. 4, p. 31.
Alhambra, Los Angeles County, California.

158. NYCTINOMUS FEMOROSACCUS Merr.
Merriam, *ibid*, No. 2, p. 23.
Colorado Desert, California.

159. NYCTINOMUS MOHAVENSIS Merr.
Merriam, *ibid*, p. 25.
Fort Mojave, Arizona.

160. EUDERMA MACULATUM (J. A. Allen).
Histiotus maculatus Allen, Bull. Am. Mus. Nat. Hist. iii, 2, Feb. 20, 1891, p. 195.
Los Angeles County, California.

161. SOREX PERSONATUS Geoffroy.
Geoffroy, Mém. du Muséum, xv, 1827, 122–125.
Labrador to Massachusetts, Ohio to Nebraska.

162. SOREX RICHARDSONII Bachman.
Bachman, Journ. Acad. Nat. Sci. Phila. vii, 1837, p. 383.
Revived by Merriam, Ann. Rept. Dept. Agr. 1887 (1888), p. 435.
Canada.

163. SOREX MONTICOLUS Merr. Mountain Shrew.
Merriam, N. Am. Fauna, No. 3, p. 43.
San Francisco Mountain, Arizona.

164. SOREX IDAHOENSIS Merr. Idaho Shrew.
Merriam, *ibid*, No. 5, p. 32.
Salmon River and Saw Tooth Mountains, Idaho.

165. SORREX MERRIAMI Dobson.
Dobson, Mon. Insectivora, part iii, fasc. 1, May, 1890, pl. xxiii.
Fort Custer, Montana.

166. SOREX DOBSONI Merr. Dobson's Shrew.
Merriam, *ibid*, p. 33.
Saw Tooth Mountains, Idaho.

167. SOREX VAGRANS SIMILIS Merr.
Merriam, *ibid*, p. 34.
Salmon River and Pahsimeroi Mountains, Idaho.

168. SOREX HYDRODROMUS Dobson.
Dobson, Ann. & Mag. Nat. Hist., 6th ser. iv, 1889, p. 372.
Unalaska Island, Aleutian Islands.

169. SOREX ALBIBARBIS (Cope).
Neosorex albibarbis Cope, Proc. Acad. Nat. Sci. Phila., 1862, p. 188.
Revived by Merriam, Proc. Biol. Soc. Wash. vii, Apr. 13, 1892, p. 25.
Franconia Mountains, New Hampshire.

170. BLARINA BREVICAUDA CAROLINENSIS (Bach.)
Sorex carolinensis Bachman, Journ. Acad. Nat. Sci. Phila. vii, pt. 2, 1837, p. 366.
Type from South Carolina.

171. SCALOPS ARGENTATUS TEXANUS Allen.
Allen, Bull. Am. Mus. Nat. Hist. iii, 2, April 29, 1891, p. 221.
Presidio County, Texas.

172. MEPHITIS ESTOR Merr.
Merriam, N. Am. Fauna, No. 3, p. 81.
San Francisco Mountain, Arizona.

173. SPILOGALE GRACILIS Merr.
Merriam, *ibid*, p. 83.
Grand Cañon of the Colorado, Arizona.

174. SPILOGALE INTERRUPTA (Raf.)
Revived by Merriam, *ibid*, No. 4, p. 8.
Kansas.

175. SPILOGALE RINGENS Merr.
Merriam, *ibid*, p. 9.
Hale County, Alabama.

176. SPILOGALE INDIANOLA Merr.
Merriam, *ibid*, p. 10.
Gulf Coast of Texas (?).

177. SPILOGALE LUCASANA Merr.
Merriam, *ibid*, p. 11.
Cape St. Lucas, Lower California.

178. SPILOGALE LEUCOPARIA Merr.
Merriam, *ibid*, p. 11.
Mason County, Texas.

179. SPILOGALE SAXATILIS Merr.
Merriam, *ibid*, p. 13.
Provo, Utah.

180. SPILOGALE PHENAX Merr.
Merriam, *ibid*, p. 13.
Marin County, California.

181. SPILOGALE PHENAX LATIFRONS Merr.
Merriam, *ibid*, p. 15.
Oregon and Washington, west of Cascade Mountains.

182. SPILOGALE PHENAX ARIZONÆ Mearns. Arizona Striped Skunk.
Mearns, Bull. Am. Mus. Nat. Hist. iii, 2, p. 231.
Fort Verde, Arizona,

183. TAXIDEA AMERICANA NEGLECTA Mearns.
Mearns, *ibid*, p. 250.
Northern California.

184. PUTORIUS CULBERTSONI Baird MS.
Coues, Fur-bearing Animals, 1877, p. 136.
Revived by Merriam, Proc. Biol. Soc. Wash. vii, April 13, 1892, p. 25.
Fort Laramie, Wyoming; Fort Union, Montana.

185. PUTORIUS ARIZONENSIS Mearns. Arizona Weazel.
Mearns, *ibid*, p. 234.
Mountains and high plateau region of Arizona, down to the lower limit of the forest zone of *Pinus ponderosa.*

186. MUSTELA CAURINA Merr.
Merriam, N. Am. Fauna, No. 4, p. 27.
Chehalis County, Washington.

187. CANIS NUBILUS Say. Timber Wolf.
Revived by Merriam, *ibid*, No. 5, p. 82.

188. UROCYON VIRGINIANUS SCOTTII Mearns. Scott's Fox.
Mearns, Bull. Am. Mus. Nat. Hist. iii, 2, p. 236.
Southern California; Arizona and western New Mexico.

189. VULPES MACROTIS Merr.
Merriam, Proc. Biol. Soc. Wash. iv, 1886–88, p. 135.
Southern California.

190. LYNX BAILEYI Merr.
Merriam, N. Am. Fauna, No. 3. p. 79.
Arizona.

ELIMINATED.

TAMIAS MINIMUS MELANURUS Merr.
Merriam, N. Am. Fauna, No. 4, p. 22.
Proves to be a phase of the molt of *T. m. pictus*. (Cf. Merriam, N. Am. Fauna, No. 5. p. 46, foot-note.)

TAMIAS ASIATICUS PALLIDUS Allen.
A synonym of *T. minimus* (Cf. Allen, Bull. Am. Mus. Nat. Hist. ii, 1 ,1890, p. 113).

SITOMYS AMERICANUS DESERTICOLUS (Mearns). Desert Deer Mouse.
Hesperomys leucopus deserticolus Mearns, Bull. Am. Mus. Nat. Hist. ii, 4, p. 285.
Identical with *Sitomys a. sonoriensis*.

VESPERUGO MERRIAMI Dobson.
Dobson, Mon. Insectivora, pt. iii, fasc. 1, May, 1890, pl. xxiii.
Identical with *Vesperugo hesperus* (Cf. True, Proc. U. S. Nat. Mus. x, Aug. 6, 1888, p. 515).

RANGIFER TARANDUS (Linn.)

THE DISTRIBUTION OF THE FLORA OF THE CAPE REGION OF BAJA CALIFORNIA.*

BY T. S. BRANDEGEE.

The Cape Region of Lower California is a mountainous extent of country, about 80 miles long and 30 wide, situated mostly between the twenty-third and twenty-fourth degrees of north latitude. At one time, it may have been an island, and have been separated from the northern portion of the peninsula by a wide sheet of water then connecting the Pacific Ocean with the Gulf of California, now a sandy plain and upland hardly rising more than one hundred and fifty feet above the level of the sea. The northern direction taken by the main mountain ranges of the region is followed by the islands Espiritu Santo, San José and Santa Catalina out into the Gulf of

* A list of plants of the Cape Region of Baja California is published in Proc. Cal. Acad. Ser. 2, vol. iii, 108, and a number of additions will soon appear in the publications of the same society.

California, and Ceralbo Island, east of La Paz, perhaps represents the continuation of the Coast Range in the same direction.

Lower California is a Mexican Territory; divided into two departments, and the Cape Region forms a portion of the Department of the South, which has for its capital La Paz.

This region, although small, on account of its position with respect to the peninsula and its distance from the main land of Mexico, possesses a flora in part endemic, in part common, to that of other countries, which by its distribution and peculiarities seems to be worthy of the publication of the following notes and table.

The mountains, according to the maps of the Coast Survey, reach nearly to a height of 6,000 feet above the level of the sea; their summits in winter are cool and pleasant, with occasional frosts at night and sometimes ice a quarter of an inch thick is formed on standing water. Clouds envelope the highest portion from June to September, and then thunder storms are frequent. In the lower altitudes, frosts are unknown and the heat is what would be expected in a region situated about the Tropic of Cancer and in the northern limit of growth of the cocoanut, the guava and the aguacate.* The winds from the ocean and gulf blowing over this narrow strip of land serve somewhat to reduce the heat of the sun's rays during the day and render the nights not unpleasant during the hottest time of the year.

The year is divided into the wet and dry seasons. The rains of the wet season are expected between June and September; they come mostly in the form of showers and seem to be unequally distributed over the region. During one of my visits, the vegetation about San José del Cabo was green and growing as the result of many showers, while about La Paz every plant was dry and withered. The lower elevations, excepting at the time of rains, are dry, and running water is rarely found except in the San José River, about Todos Santos, San Bartolomè and a few other places; but near the tops of the mountains, some small streams run throughout the year some distance downward, but are soon lost amongst the rocks and sand. Some years no rains fall except on the mountain tops,

*The fruit of this plant, which is too sparingly found in our markets, is commonly known as "alligator pear," a rather unlovely corruption of its Spanish name.

and one time of drought, when none fell upon the low lands during more than thirty months, made a lasting impression on the inhabitants.

During the dry season most of the vegetation is in a state of rest, many of the bushes or small trees are leafless, the annuals have disappeared and the dry stalks of herbaceous perennials mark the place from which a new growth will rapidly appear after the first summer rain. This region is usually spoken of by travelers who have sailed along its Pacific Coast and rounded the rocky promontory of Cabo San Lucas, as a forbidding and barren country, and so it is until the summer rains bring life to the vegetation. Residents of a temperate climate, where the change from winter to summer is gradual and the fullness of vegetable life is not reached until the first warmth of spring has become the heat of summer, cannot realize the sudden change that comes over a tropical region, when at the hottest time of the year heavy rains cause immediately every leaf to appear and every bud to grow.

The Cape Region is quite thickly covered with large bushes and small trees with an abundance of climbing and twining plants using them for supports. These altogether sometimes become so dense that it is impossible to ride or walk between them, and to go through them is usually not to be thought of on account of the spines and thorns.

The most conspicuous plants of the lower elevations on account of their abundance, their size and the showiness of their flowers are: *Fouquieria spinosa*, *Sida Xanti*, *Abutilon Xanti*, *Hibiscus ribifolius*, *Esenbeckia flava*, *Cardiospermum Halicacabum*, *Mimosa Xanti*, *Lysiloma candida*, *Calliandra Californica*, *Acacia filicina*, *Cereus Pringlei*, *pecten-aboriginum*, *gummosus* & *Thurberi*, *Dysodia speciosa*, *Viguiera deltoidea* & *tomentosa*, *Bebbia atriplicifolia*, *Plumiera acutifolia*, *Ipomœa aurea*, *Calophanes peninsularis*, *Beloperone Californica*, *Justicia Palmeri*, *Hyptis tephrodes* & *lanifolia*, *Antigonum leptopus*, *Yucca baccata*, and others that perhaps deserve mention. The Burseras are very abundant and well distributed throughout the region, but their flowers are insignificant although the fruit is somewhat conspicuous; and equally deserving of notice, for similar reasons are Karwinskia, Cyrtocarpa, *Pithecolobium flexicaule*, Albizzia, and *Ipomœa bracteata*. Other plants are extremely abundant in certain localities, and some are confined to small areas where they

form a large part of the vegetation. The sands of the sea shore from Todos Santos to San José abound in *Euphorbia leucophylla*, and *Ipomœa Pes-capræ;* Rhachidospermum and Martynia are usually in company with them; the fences and hedges about the fields and gardens are the home of the tall climbing Asclepiads; the lagoons near La Paz are filled with mangrove *(Rhizophora Mangle)*, and the saline flats of their vicinity produce most of the chenopods of the flora. The high mountain flora consists mostly of one species of pine *(Pinus cembroides)*, oaks, madroño and Nolina, with some cottonwoods and willows along the streams, and with smaller plants, such as Lopezia, Heterotoma, Lobelia, Dysodia, Eupatorium, Sphacele, Gilia, ferns, etc., growing amongst them.

Although most of the vegetation, especially that of the lower elevations, blooms during the rainy season, there are some notable exceptions. Some plants are in flower during the whole year, but produce a greater abundance either in spring or the "rainy season." The scarlet flowers of Justicia, Beloperone and Calliandra, can be found at any time, but are most common in March and April. Rubus, Heterotoma, Sphacele, of the high mountains, and Eucnide, most of the Daleas, Tephrosia, Fouquieria, Viguiera, *Perityle crassifolia* of the lower elevations, are examples of plants that are in flower the whole year, but their blossoms are most abundant during the rainy season.

The following plants belonging to the flora of the mountain tops blossom only during the first months of the year, in the "dry season:" Thalictrum, Ranunculus, Stellaria, Sagina, Hypericum, Nasturtium, Geranium, Trifolium, Hosackia, Prunus, Fragaria, Heteromeles, Ribes, Epilobium, Rumfordia, Perezia, Lobelia, Arbutus, Gilia, Erythræa, Mimulus, Sibthorpia, Brunella, Polygonum, Populus, Salix, Epipactis, Sisyrinchium, Juncus, Carex, Tripsacum, Festuca. All these genera, with two or three exceptions, belong to a temperate climate and are found within the tropics only on high mountains. The fact that they retain the habit of blooming in the spring contrary to that of the mass of vegetation of the region is a most interesting one. With the advent of the rains comes a great crowd of flowers such as Desmodiums, Œnothera, Lopezia, Cyclanthera, Begonia, Mitracarpus, Valeriana, Stevia, Viguiera, Carminatia, Baccharis, Verbesina, Heterospermum, Bidens, Dysodia, Tagetes, Buchnera, Clevelandia, Dicliptera, Mirabilis, and most of

the orchids and ferns, etc., belonging in general to a more southern flora than those of the spring.

Amongst the plants growing at lower elevation are the following that flower in the springtime: *Sisymbriun crenatum*, Atamisquea, *Abutilon Californicum*, Vitis, Sapindus, Lupinus, Erythrina, *Cæsalpinia placida*, Prosopis, *Acacia Farnesiana* and *Wrightii*, Lysiloma, *Pithecolobium Mexicanum*, Cotyledon, Lythrum, Mamillaria, *Cereus pecten-aboriginum*, *Pringlei*, *Schottii* and *Thurberi*, *Diodia crassifolia*, Eryngium, Hofmeisteria, *Pluchea odorata*, *Buddleia crotonoides*, *Samolus ebracteatus*, Phacelia, Nama, *Euphorbia Xanti* and two or three Agaves. This collection of names, unlike that of the mountain spring-blooming plants, does not remind one of a northern flora. It might be expected that Lupinus, Lythrum, Samolus, Phacelia, and Nama, would blossom in the spring, but that habit does not seem fit for such semi-tropical genera as Lysiloma, Erythrina, Albizzia, Pithecolobium, etc.

It is often impossible to decide with certainty whether a plant is native, or whether it should be considered an immigrant recently introduced by the agency of man. Conocarpus, for instance, is a rare bush of the southern shores and belongs to the maritime flora of tropical climates, a flora represented along the coast by several species of plants but, though probably derived from the south, does not belong to the class generally meant by "introduced plants."

The weeds of the fields and trails, certainly derived from other regions, are: *Malva borealis*, *Brassica nigra*, *Melilotus parviflora*, *Momordica charantia*, *Xanthium strumarium*, *Sonchus oleraceus*, *Polygonum acre*, *Desmodium scorpiurus*, and there are others more common; the universally distributed weeds of towns and cultivated grounds, that are not so evidently introduced, these are: *Portulaca oleracea*, *Sida rhombifolia*, *Cassia Absus & Tora*, *Mollugo verticillata & cerviana*, Richardia, Amarantus, and Euphorbia.

Only four of the genera of the Cape Region are supposed to be endemic, and three of them are certainly not very distinct from their nearest relatives. The most distinct, Coulterella, has been found only along the gulf shore, east from La Paz, but as it is strictly a maritime plant it is to be expected from neighboring coasts.

The annexed table, showing in a condensed form the geographical distribution of the flowering plants and ferns and

their relation to the floras of neighboring regions, especially the Mexican main land, is based upon 732 species. These are the result of collections made by Dr. Hinds of H.M.S. Sulphur in 1839, at Cabo San Lucas; by L. J. Xantus de Vesey in 1859–1860, about the same place; by Dr. Edward Palmer at La Paz in 1890, and by the writer at various localities during three trips in 1890 and 1892. Seventy-two species or nearly ten per cent. of the whole number seem to be endemic and future exploration together with the identification of unnamed specimens may increase this proportion, although a more complete knowledge of the botany of Sinaloa and Sonora will probably show that some plants now considered peculiar to the Cape Region only appear so on account of our ignorance concerning their distribution. Three hundred and sixty-two of the Cape Region species are found growing on the peninsula from Magdalena Bay and Comondu northward, and nearly one-half of this number extend into Alta California; sixty-four of them are peculiar to the peninsula.

Mr. Hemsley in Biologia Centrali-Americana, iv, 139, considers Mazatlan the southern limit of the North Mexican flora upon the west coast; assuming this to be correct, nearly five hundred of the species belong to that flora, and with few exceptions they all belong to the flora of Sonora.

The adjacent mainland, Sinaloa, has not been as well explored botanically as Sonora, but judging from our scanty data the Mexican part of the Cape Region flora bears much less resemblance to it than to the more northern Sonora, and the flora as a whole is decidedly that of Sonora and not an extension of that of Alta California southward as has usually been supposed. The few plants that probably belong to a more southern flora are found along the shore or in the southeast about San José and Miraflores.

Some of these semi-tropical maritime and brackish-water plants are found also on the southern end of the Peninsula of Florida. Rhizophora, Conocarpus, Avicennia, Laguncularia, *Ipomœa Pes-capræ* and *acetosæfolia* and *Scævola Plumieri* are common to American tropical shores, and reach their northern limit at about the same latitude on the Peninsula of Baja California as on that of Florida. The number common to this region and Florida, however, is not large, and of about twenty-five having such wide spread distribution, some like *Samolus ebracteatus* and *Centunculus mini-*

mus are found across the continent, while others may by future exploration have their now apparently widely separated habitats connected along a more southern route.

The number of genera in the ninety-nine orders found in the region is three hundred and ninety, and two hundred and thirty of them are represented by a single species, the flora being essentially insular the proportion of genera to species is large as in island floras. The largest genera are: Euphorbia with about twenty species, Cereus with nine, Acacia nine, Desmodium eleven, Cassia seven, Dalea seven, Ipomæa fourteen, etc. Leguminosæ, the largest order, has ninety-five species that are in most cases widely distributed throughout the region and abundant, so that this class of plants is the predominating one of the region. The second largest is Compositæ of eighty species; some of them are very common and some such as Franseria, Eupatorium, Brickellia, become almost arborescent. Euphorbiaceæ has forty-eight, many of them small prostrate species of the genus Euphorbia, but one species of Phyllanthus is a small tree. Malvaceæ has twenty-two, Graminæ fifty-two, Filices twenty-two, Convolvulaceæ twenty-five, Acanthaceæ seventeen. The relative positions of Leguminosæ and Compositæ in the flora of the world and that of Mexico are reversed and other large orders occupy different positions in the scale, but the region considered is so small that such comparisons have little value.

By the term "Mountain Flora" is meant those plants growing only upon or very near to the top of the highest ridges and summits of the mountains. Some plants of the lower elevations, such as Heterospermum, Behria, Centunculus, grow also up the mountains to their highest elevations, and others of the mountains are washed down the streams to the lower elevations, especially by the waters of the San José River; so that such strictly mountain plants as Clevelandia, Heterotoma and others can sometimes be found in damp stream beds, but the great mass of the mountain flora is peculiar to the high elevations. The hundred and forty-eight species belong to a hundred and seventeen genera; the orders containing the greatest number of species are: Filices with sixteen, Rosaceæ six, Leguminosæ fourteen, Compositæ twenty-one, Caryophyllaceæ six, Orchidaceæ nine. The largest genera are: Desmodium with three species, Notholæna of three; several others have two, but most of them are represented by but a single species. Forty-two of the hundred and forty-eight grow also in Alta California and ninety-five

are found in Sonora, while seventeen are considered endemic to these mountain tops. These figures, when compared with the flora of the lower elevations, show a slightly larger proportion of endemic species.

	Number of Species.	Peculiar to the Cape Region.	Also in Northern Baja California.	Found in Mexico.	High Elevation.	Lower Elevation.
Ranunculaceæ	3	.....	1	2	2	1
Papaveraceæ	1	.....	1	1	.....	1
Cruciferæ	6	1	5	3	3	3
Capparidaceæ	4	1	3	3	.....	4
Cistaceæ	2	.....	.....	2	2	.....
Violaceæ	2	1	1	1	.....	2
Bixineæ	1	.....	.....	1	.....	1
Polygalaceæ	6	1	4	4	2	4
Caryophyllaceæ	11	4	4	7	6	5
Portulacaceæ	7	.....	2	7	.....	7
Tamariscineæ	1	.....	1	1	.....	1
Hypericaceæ	2	.....	.....	2	2	.....
Malvaceæ	22	2	17	13	1	21
Sterculiaceæ	6	1	3	5	.....	6
Tiliaceæ	1	.....	1	1	.....	1
Malpighiaceæ	2	.....	.....	2	.....	2
Zygophyllaceæ	7	.....	6	5	.....	7
Geraniaceæ	2	.....	2	2	2	.....
Rutaceæ	3	1	.....	2	.....	3
Simarubeæ	1	.....	.....	1	.....	1
Burseraceæ	5	1	3	3	.....	5
Olacineæ	1	.....	1	.....	.....	1
Celastraceæ	1	.....	1	1	.....	1
Rhamnaceæ	4	.....	2	4	.....	4
Vitaceæ	3	.....	1	2	1	2
Sapindaceæ	8	.....	2	.....	1	7
Anacardiaceæ	3	.....	1	2	2	1
Leguminosæ	95	9	34	67	14	81
Rosaceæ	5	.....	1	5	5	.....
Saxifragaceæ	1	.....	.....	.....	1	.....
Crassulaceæ	2	1	1	.....	.....	2
Rhizophoraceæ	1	.....	1	1	.....	1
Combretaceæ	2	.....	1	1	.....	2
Lythraceæ	3	.....	1	3	1	2
Onagraceæ	8	.....	6	5	3	5
Loasaceæ	3	.....	2	2	.....	3
Turneraceæ	2	.....	.....	2	.....	2
Passifloraceæ	1	.....	1	1	.....	1
Cucurbitaceæ	9	2	2	4	1	8
Begoniaceæ	1	1	.....	.....	1	.....
Cactaceæ	16	3	8	11	1	15
Ficoideæ	4	.....	4	4	.....	4
Umbelliferæ	3	.....	2	1	1	2
Cornaceæ	1	.....	.....	1	1	.....
Rubiaceæ	15	5	3	9	2	15
Valerianaceæ	1	.....	.....	1	1	.....
Compositæ	80	14	45	43	21	59

	Number of Species.	Peculiar to the Cape Region.	Also in Northern Baja California.	Found in Mexico.	High Elevation.	Lower Elevation.
Goodeniaceæ	1	.....	.....	1	.....	1
Lobeliaceæ	2	1	.....	1	2	.....
Ericaceæ	1	.....	1	1	1	.....
Primulaceæ	3	.....	2	2	1	2
Ebenaceæ	1	1	.....	.....	.....	1
Oleaceæ	1	.....	?	.....	.....	1
Apocynaceæ	2	.....	1	1	.....	2
Asclepiadaceæ	10	.....	7	8	.....	10
Loganiaceæ	2	1	.....	1	.....	2
Gentianaceæ	3	.....	1	2	2	1
Polemoniaceæ	2	.....	1	1	1	1
Boraginaceæ	14	.....	9	10	.....	14
Hydrophyllaceæ	2	.....	2	1	.....	2
Convolvulaceæ	25	.....	12	21	1	24
Solanaceæ	19	1	14	14	1	18
Scrophulariaceæ	14	1	8	10	1	13
Bignoniaceæ	2	.....	1	2	.....	2
Orobanchaceæ	1	.....	1	.....	1	.....
Pedaliaceæ	1	.....	1	1	.....	1
Acanthaceæ	17	4	9	8	1	16
Verbenaceæ	8	2	4	3	.....	8
Labiatæ	13	1	7	8	4	9
Plantaginaceæ	2	.....	2	2	2	.....
Nyctaginaceæ	9	1	5	6	1	8
Polygonaceæ	4	.....	4	3	1	3
Amarantaceæ	10	.....	6	7	1	9
Chenopodiaceæ	7	.....	7	6	.....	7
Batideæ	1	.....	1	.....	.....	1
Phytolaccaceæ	4	.....	3	4	.....	4
Aristolochiaceæ	2	.....	.....	2	.....	2
Piperaceæ	2	.....	1	2	1	1
Loranthaceæ	2	.....	2	1	.....	2
Euphorbiaceæ	48	4	26	30	.....	48
Urticaceæ	2	.....	2	1	.....	2
Cupuliferæ	3	.....	?	?	2	1
Salicaceæ	4	1	3	3	2	2
Coniferæ	1	.....	.....	1	1	.....
Orchidaceæ	9	.....	1	9?	9	.....
Bromeliaceæ	1	.....	.....	1	.....	1
Iridaceæ	2	.....	1	1	1	1
Amaryllidaceæ	6	.....	2	6 (?)	.....	6
Liliaceæ	4	2	1	3	1	3
Commelinaceæ	5	1	.....	4 (?)	.....	5
Palmaceæ	2	.....	1	1	1	1
Aroideæ	1	.....	.....	1	.....	1
Lemnaceæ	1	.....	1	1	1	.....
Alismaceæ	1	.....	1	1	.....	1
Naidaceæ	2	.....	2	2	1	1
Juncaceæ	1	.....	1	1	1	.....
Cyperaceæ	10	.....	?	?	2	8
Gramineæ	52	2	29	43	8	44
Filices	22	1	5	21	16	6
	732	72	362	494	146	586

FOOD OF THE GROUSE AND MOUNTAIN QUAIL OF CENTRAL CALIFORNIA.

BY L. BELDING.

In autumn the grouse *(Dendragapus obscurus fuliginosus)*, of the Sierra Nevada at about seven thousand feet altitude, has a great variety of food as I have ascertained by dissecting many of them. The thimbleberry *(Rubus Nutkanus)*, appears to be its favorite article of diet, and next to this, the service berry *(Amelanchier alnifolia)*. Several kinds of wild currants and gooseberries, including *Ribes sanguineum* and *R. Menziesii* and red elderberries *(Sambucus racemosa)* are hardly less acceptable. Berries of manzanita *(Arctostaphylos pungens* and *A. Nevadensis)* and the mountain twin berry *(Lonicera conjugialis)*, the huckleberry *(Vaccinium occidentale)* and of the mountain ash *(Pyrus sambucifolia)*, are also eaten. The seeds of lupines, of *Polygonum polymorphum*, of the very abundant false sun-flower *(Wyethia mollis)*, of caraway *(Glycosma)*, and acorns of the dwarf oak *(Quercus chrysolepis* var. *vacciniifolia)*, add to the variety. The last two named are also eaten by deer and Indians. I have seen Washoe Indians have a pile of not less than thirty bushels, of nicely cleaned seeds of *Glycosma occidentale*. After the young grouse are hatched the mother bird takes them to alder and willow thickets where they find seclusion and water. Here they also find some insect food (which seems to be very necessary to young birds of most species), and a species of native red clover, the green leaves and heads of which supply them, for a time, with nearly all the food they require.

Old as well as young birds appear to be very fond of the mitre-wort *(Mitella Breweri)*, which grows in these damp, shady situations. About the middle of August the females, with their broods, begin to change their haunts and range higher in the mountains, and then feed partly upon the foliage of fir trees *(Abies concolor* and *magnifica)*, and hemlock spruce *(Tsuga Pattoniana)*, the latter being apparently preferred. The old males feed upon the foliage of these conifers nearly all the year and during the winter when everything is covered with snow all grouse must subsist upon it.

Some years, late summer frosts destroy the berry and seed crops and then the grouse are limited to a diet of a few kinds of vegetable food, grasshoppers and other insects. One such year, during Sep-

tember, I found them feeding almost exclusively on the fallen dried male flowers of the yellow pine *(Pinus ponderosa)*.

After, about the first of October, these grouse go into the fir trees of the high peaks and are seldom seen. The game law which prohibits their being shot prior to this time is almost equivalent to prohibiting shooting them at all. The open season should begin about the middle of August, when young birds are about two-thirds grown, at which time they are a great luxury, whereas an old bird is no better than an old hen, if as good. Sportsmen, who are familiar with grouse, avoid shooting the adults.

The mountain quail *(Oreortyx pictus plumiferus)*, which are so plentiful in the high mountains in summer, are only summer residents there. They usually spend the winter below the snow line, but as it is not possible to tell just where that is, or rather where it is going to be, they are sometimes caught in snow storms, but I have been astonished at the correctness of their apparent forecast of different winters. A few birds winter high in the mountains, but I think they are parts of flocks which were nearly annihilated, or young birds which got scattered and lost, and a few that were wounded and survived.

They begin their journey on foot from the summit and east slope to the foothills, a little after the first of September, and by the first of October, when the game law allows them to be shot, they have nearly all escaped from the mountain hunters to run the gauntlet of those lower down, on the west slope. In some respects they are very stupid birds, in others, quite the reverse. When they are going from their summer to their winter resorts, birds of a flock can all, or nearly all, be shot if the flock can be turned from its course and scattered. They soon begin to call together and will nearly always respond to a hunter's imitation of their call. The loud pleasing call of the male in breeding season is not easily imitated nor described, though apparently consisting of a single note, which is sometimes varied a little. The service berry is the staple article of their food in fall, but they eat more or less of the different kinds of berries which the grouse eat. I suppose they, as well as the grouse, eat berries of the wild coffee *(Rhamnus Californica)*, but I have no data for a positive opinion. They also eat the acorn of the dwarf oak and seeds of the snow bush *(Ceanothus cordulatus)*, and seeds of many small plants. I do not know that they eat any of the

foliage mentioned as the food of the grouse, but they probably eat leaves of clover early in summer, just as valley quail do in winter. The juveniles eat a great many ants.

Some seasons, when there are no berries and very few seeds, they live almost entirely upon the bulb of a species of grass, apparently *Melica bulbosa*, which grows at the head of springs and rivulets. The birds get the bulb by scratching. Such seasons they start for the foothills sooner than when food is abundant.

ON A LEAF-MINER OF POPULUS FREMONTI.

BY C. H. TYLER TOWNSEND.

Almost every spring the cottonwoods in the town of Las Cruces, New Mexico, and its vicinity, are badly infested with a leaf-miner, which up to the present time has baffled all attempts at breeding. The cottonwood is our only native shade tree in the Mesilla Valley, there being only the one species, *Populus fremonti;* and as this insect has proven a serious pest to it, the following notes on the larva will probably be of interest, although the imago is unknown. A very brief notice of this miner was published in Insect Life, vol. 4, pp. 26–27.

It was found on April 30, 1891, that nearly every tree in the valley was most thoroughly infested, the majority of trees having almost every leaf mined out and blistered. The larvæ eat out the entire inner portion or parenchyma of the leaf, leaving the two skins whitened and inflated like blisters. They entirely and irrecoverably ruin the foliage of the tree, giving it a most desolate and dying appearance. The trees, however, gradually put forth a new set of leaves, and though they apparently soon recover their normal healthy appearance it is clearly evident that this process must be a great tax on their vitality. I have even been told that in some previous years the second crop of leaves has been likewise destroyed, but I cannot vouch for the accuracy of this statement. On the above date the larvæ were of several sizes, the largest being about seven-sixteenths of an inch in length. In general color they are nearly white, with some black dots on the anterior segments below and on the segments next the head above. Two larvæ were often found in one leaf, their mines beginning in separate parts of the leaf and gradually approaching until they coalesced.

Leaves containing larvæ were collected on May 4 of the same year, and put in a jar with earth to breed, but the larvæ all seemingly shriveled up and became hard and dried. At this date more than two-thirds of the larvæ had left the leaves.

The spring of the present year the leaves of the cottonwood had been out not more than one week when it was found, April 21, 1892, that they contained good-sized larvæ of this miner. It would therefore seem that the eggs must be deposited in the leaf-buds before the leaves appear, perhaps about the time the buds begin to swell.

On April 25 of this year, most of the larvæ were apparently full-grown, and accordingly a good number of small branches bearing leaves filled with healthy larvæ were put in a breeding cage, the branches being inserted in a receptacle which was kept filled with water. The leaves remained green and healthy for days, until all the larvæ had disappeared. The next day, April 26, a large number of the larvæ had already left the leaves, and were crawling on the earth in the bottom of the cage. They seemed to manifest a migratory instinct, and did not appear inclined to bury themselves at once in the soil. The migratory larva seems to lose the blackish dots on the anterior segments both above and below, and is entirely of a whitish color and somewhat shorter than before. Two or three of them were noticed going into the earth, but they were subsequently found perfectly hard and dried, and this was likewise the fate of all the others, which shriveled up and died on top of the earth within a day or two. They would not crawl under chips which were placed within the cage. All natural conditions had been carefully studied and provided, but to no avail. On April 29, the larvæ had all left the leaves in the breeding cage. Some very small larvæ were at work on April 25, along with the apparently full-grown ones.

Five of these miners were often found in one leaf this season, but the leaves of the trees were not so totally destroyed as in 1891. In one case even seven larvæ were found in the same leaf. They all begin separately, and work till their mines meet. The two skins of the leaves then become filled with the very fine black frass or excrement of the larvæ. They feed by day, and so far as observed always with the venter toward the upper surface of the leaf. They leave the leaf by making an incision in the upper skin just in the

edge of the blistered portion from which the parenchyma has been eaten, and next the latter.

A remedy for these miners is rather hard to suggest. Perhaps an arsenical spray about the time the leaf-buds begin to swell would kill the newly-hatched larvæ when they begin to enter the leaves.

Birds and chickens seem to destroy many of them after they have left the leaves and descended to the ground. On May 4, what were supposed to be pupæ were found in the earth under a cottonwood tree, and blackbirds were reported digging them out and eating them.

It is quite certain that this miner is lepidopterous, and it will probably be found to belong to the *Tineidæ*. It seems also that there is usually but one brood annually, and perhaps the pupæ remains in the earth until the following spring.

Below is given a description of the larva:

Full-grown larva of leaf-miner on *Populus fremonti:* Elongate, creamy whitish, with six pale brownish true legs. Twelve segments beside the head, legs 5-jointed, terminal joint small, conical. Head pale tawny brownish or testaceous, with a median posterior ventral brownish marking; mouth parts darker distally. First segment (next head) with a large oblong brownish marking situated in the middle, which covers about one-half of the dorsum of segment and is divided in the middle longitudinally by a faint median whitish line or suture, and also transversely through the middle by a suture which, however, does not show as a whitish line. A median pair of brown dots on dorsum of second segment. Venter of first segment with a large brown marking in middle, venter of second and third segments with a much smaller brown spot, and venter of fourth with a still smaller brown dot. Fifth to eleventh segments each with rudiments of a pair of pro-legs, appearing as very small buds on ventral surface defined anteriorly by a pale brownish usually semilunar marking. Anal tubercle brown or blackish, except terminal and dorsal surfaces which are whitish. Head fully three-fourths width of first (next) segment; second and third segments widest and also shorter than the other segments which are all of a nearly uniform length, except sometimes the fourth which is not quite so long. Segments four to twelve often exhibit (in alcoholic specimens) a continuous longitudinal median furrow on the dorsal surface.

In some specimens the dorsal markings of the first and second segments have disappeared, or are absent, and the legs have nearly lost their pale brownish color.

Length, about 9 mm.; width of second and third segments, 2 mm.; average width of following segments, 1.5 mm.

Described from alcoholic specimens.

NOTES ON SOME OF THE BUTTERFLIES OF THE YOSEMITE VALLEY AND ADJACENT REGION.

BY EDWIN C. VAN DYKE.

In the summer vacation of this year, I had the good fortune to be one of a camping party, traveling through the Yosemite Valley and adjacent regions in the National Park. During odd moments around camp or on the march, I found time to do a little entomological work, chiefly upon beetles and butterflies. It is of the latter that I wish to speak here, supplementing to some extent the article of Dr. Behr in Zoe, Vol. I, as well as that of Mr. Harrison G. Dyar in Entomological News, Vol. III, No. 2. In the region traversed, I had the opportunity of observing between forty and fifty species of butterflies, and concerning most of these I will here give the result of my observations.

Papilio rutulus Bdv.—Quite common in the lower valleys and meadows of the region, where it may be seen skirting the willow thickets or sporting around the flowers in the immediate neighborhood. Found in the Yosemite and Hetch Hetchy valleys and around Lake Eleanor. Never seen at a higher altitude than five or six thousand feet.

Papilio eurymedon Bdv.—Very plentiful also throughout the region, but prefers the open spaces on the hillsides to the valleys. Also often found flying at higher altitudes than the above. Most of the specimens caught were in a more or less tattered condition, which indicates that August is their last month in the mountains, at least for that brood.

Papilio daunus Bdv.—Several splendid specimens caught from July 23 to 26, in the Hetch Hetchy Valley, and several later on at Lake Eleanor. In both places they were caught while in the act of drinking.

Papilio zolicaon Bdv.—Often noticed on the ridges and tops of mountains, at altitudes not greater than eight or nine thousand feet. One was taken at the top of Sentinel Dome, July 11.

Papilio indra Reak.—Only one specimen seen. This crossed the Tioga road just ahead of us, when we were at an altitude of over eight thousand feet. The species is probably found at much higher altitudes than any of our Papilios, save in a few instances that of *P. zolicaon*.

Parnassius clarius Eversmann.—Quite common around the bogs and wet places, between Lake Tenieya and Tuolumne Meadows. The average altitude here is about nine thousand feet. In manner of flight they much resemble the species of Satyrus.

Pieris sisymbri Bdv.—Several of these were caught on the top of Sentinel Dome, July 11. They fly around while it is quiet, but seek shelter as soon as it begins to blow at all hard.

Neophasia menapia Feld.—Of this species I saw only about three specimens. They were in a yellow-pine forest on the south side of Lake Eleanor.

Anthocharis ausonides Bdv.—Several specimens of these, in a very fresh condition, were caught. They were found around the meadows in the lower altitudes.

Colias eurytheme Bdv.—Found about every meadow in the region, even up to ten thousand feet altitude. The albino female was also quite common.

Colias behrii Edw. — Only one specimen of this scarce butterfly was seen. This was disturbed from its resting place in the grass, while our party was crossing a small meadow on the side of Mt. Lyell. It is found on several of the high peaks around Tuolumne Meadows, as well as occasionally in the meadows themselves, but nowhere is it a common butterfly.

Danais archippus Fab.—Quite common up to an altitude of about six thousand feet, and is commonly seen sailing across small cañons or hovering over the milkweed. Several larvæ of it in different stages of development were also observed on the milkweed. The habits of the butterfly in the mountains do not seem to me different from those I have observed in the valleys.

Heterochroa Californica Butl. — Quite common in the valleys throughout the region. These butterflies have a curious habit of coursing up and down the roads and paths, much in the manner of large dragonflies.

Limenitis lorquini Bdv. — This species was found in about the same localities as the preceding. Neither of them were observed at higher elevations than six thousand feet.

Argynnis monticola Behr; *Argynnis zerene* Bdv. — These two species were always found together, the former being the most numerous generally. Very common through the mountains at altitudes below nine thousand feet. They delight in sunshine, and are

always to be found on open hillsides or other such warm spots. In view of the fact that I have found these two butterflies together here, as well as in Shasta county two years ago, it seems to me hardly possible that they are more than mere color varieties of the same species.

Argynnis leto Behr.—This handsome Argynnid was found quite often. It is a strong and rapid flyer, and is quite hard to capture, partly from the above cause and partly from its habit of flying around the wet places of the meadows. No females were observed by me on the entire trip.

Argynnis egleis Bdv.—Only three specimens of this high mountain form were captured. One was caught on the upper Tioga road, and the other two on the Lyell fork of the Tuolumne river. It strongly resembles *monticola* and *zerene* in its habits, though it is a weaker butterfly, flying slower and closer to the ground.

Argynnis epithoræ Bdv. — This, the smallest of the Argynnidæ found in that region, is quite common in the open regions of the high altitudes. In manner of flight this species much resembles a Melitæa or even some of the species of Satyrus.

Melitæa palla Bdv.—Found throughout the region traveled, up to moderate altitudes.

Melitæa leanira Bdv.; *Melitæa quino* Behr.—Only one specimen of each of these was captured. They were found July 9 on the north edge of the Yosemite Valley.

Phyciodes mylitta Edw. — Several specimens from different parts of the region traveled.

Vanessa antiopa Linn. — Several specimens observed. Most of them were at medium altitudes, though one was seen at the foot of Mt. Lyell at an altitude of about ten thousand feet. It ranges still higher, probably.

Pyrameis cardui Linn.—Very common, even up to high altitudes. This is one of our hardiest species, being often seen on some of the coldest and windiest ridges in the mountains.

Pyrameis carye Hbn. — Quite common, but not found at such high altitudes as the preceding.

Pyrameis huntera Fabr.—Several of these were seen around water courses in the lower valleys of the mountains. This does not appear to be quite as hardy a butterfly as either of the two preceding, though it is found quite late in the autumn, around the bay here.

Junonia cœnia Hbn.—Very common everywhere at low altitudes.

Chionobas ivallda Mead. — This butterfly probably reaches a higher altitude than any other butterfly found in the locality. I only captured one and that was at the base of Mt. Lyell, at an altitude of about ten thousand feet; but I have received some battered specimens taken from the Mt. Dana glacier, at a much higher altitude. This butterfly is a rapid flyer, being in this respect quite a contrast to the rest of the family of Satyrs.

Chrysophanus helloides Bdv.; *Chrysophanus arota* Bdv.—Several of both species seen several times in the Tuolumne Meadows and often in company with the following:

Chrysophanus cupreus Edw. — This beautiful little butterfly is quite common in the Tuolumne Meadows, especially in the bare and sunny spots on the hillsides.

Thecla melinus Hbn. — Only one specimen captured, at Lake Eleanor, July 27.

Thecla grunus Bdv. — Quite common on the Eagle Peak trail, coming out of the Yosemite Valley. Found about the oak (*Quercus chrysolepis*).

Thecla cryphon Bdv.—Quite common along the shores of Lake Eleanor.

Lycæna acmon Db.-Hew. — Very common in the lower altitudes of the district.

Lycæna battoides Behr.—Only one specimen captured here.

Lycæna sæpiolus Bdv.; *Lycæna rustica* Edw.—Very common in the Tuolumne Meadows, especially the former. Found congregated in great numbers along the margins of streams and ponds.

Eudamus tityrus Fabr. — Two specimens captured in the Tuolumne Meadows.

Nisoniades propertius Lint. — Several found in the same region as the preceding.

Besides the butterflies given above, I saw many other species which I did not get near enough to identify. The region as a whole is, however, a very rich one for a lepidopterist, and is particularly interesting to one interested in geographical distribution. Looking at the Yosemite region from this standpoint, one can see how similar it is to the rest of the Sierra region north of it. The only one of the above butterflies peculiar to this one district is *Colias behrii*, the remainder being either mountain forms peculiar to the

Sierra region in general or else cosmopolitan forms and those found everywhere in the State.

To the collector from the valley and coast regions of the State this region is a new world. Here he first comes in contact with large numbers of that family of Argynnidæ which makes the mountains seem so full of insect life. This is by far the best represented of any family in the mountains of this region, with reference both to numbers and to species. *Vanessa californica* slightly outnumbers it farther north, but is not seen in this locality. The genus Papilio is also better represented here than in the lower regions. The species of Thecla, Lycæna, Chrysophanus, Pieris and Colias are represented here as well as in the valleys. Parnassius and Chionobas are of course mountain genera, seldom found at low altitudes.

This short paper, with what has been done before by others, I hope will induce more collectors to explore the above district and try to clear up some of the difficult points. Very little has yet been done, but until this region is well explored our knowledge of what the Sierras contain will necessarily be limited.*

*Most of these butterflies were named for me by Mr. J. J. Rivers.

A NEW RUMFORDIA FROM LOWER CALIFORNIA.

With Plate xxiii.

BY T. S. BRANDEGEE.

RUMFORDIA CONNATA. Perennial, herbaceous 1–2 m. high; stems clustered, much branched near the top, glandular-pubescent: leaves ⅓–1½ dm. long, ovate, acuminate, serrate, decurrent on the petioles as a broad margin and connate into a cup often 1–2 cm. in depth, more or less filled by the hirsute pubescence; nodes as long or longer than the leaves: panicle compound: heads long-pedunculate; peduncles slender, naked: heads 4–5 cm. broad; outer involucre foliaceous, deeply 5–8 lobed, its segments nearly equalling the rays, two of them usually much broader than the others and 2-toothed at apex; inner conduplicate about ¼ the length of the outer, green and glandular on the back, acute, and three times the length of the akene; receptacle convex, the paleæ membranaceous, obliquely obtuse, somewhat boat-shaped, loosely enclosing and twice longer than the akenes: rays ♀, numerous 15–18 mm. long,

equally 3-toothed at apex, and usually with two strap-like lobes at base, the slender glandular tube nearly half as long as the limb; disk flowers long-tubular 5-toothed: stamens long-exserted minutely sagittate at base: akenes glabrous, compressed, striate, oblique at apex, somewhat clavate, curved on the back and straight on the inner edge, crowned by a thickened ring; pappus none.

Highest elevations of the mountains of the Cape region of Lower California. Not very abundant, but conspicuous, making masses of bloom a yard or more in diameter.

The oblique compressed akenes, broader at the back, remind of Madia. The description is rather fully given because the plant does not entirely agree with that of the hitherto monotypic Rumfordia. It is, however, a fault which will readily be pardoned by any one who has had to delve among the brief and vague descriptions of too many of the Mexican Compositæ.

The figure in the plate is drawn one-half natural size.

A NEW EPILOBIUM.

With Plate xxiv.

BY T. S. BRANDEGEE.

EPILOBIUM NIVIUM. Perennial, pubescent, stems in tufts from a strong woody base: leaves oblong- or elliptic-lanceolate, pubescent on both sides 8–15 mm. long, narrowed to a short stout petiole, somewhat fascicled in the axils, the lower opposite, the upper usually alternate, all abruptly tipped with a stout subulate gland ½–1 mm. long: flowers racemose in the upper axils; pedicels shorter than the ovary: calyx tube red or reddish, abruptly enlarged above the ovary, nearly linear 5–7 mm. long, ⅔ the length of the petals; lobes spreading, at length deflexed, about 3 mm. long above the obconical throat: petals violet-purple, obcordate, 7–10 mm. long, twice the length of the longer stamens which are opposite the sepals and inserted a little higher in the tube; anthers apiculate: ovary few-about 8-ovuled; style equalling the corolla, the stigma with 4 short ultimately reflexed lobes: capsule somewhat fusiform, the few seeds being developed near the center; seeds immature, apparently smooth; coma dingy.

Collected September 25, 1892, at an altitude of 5,500 feet, on the

red shales of Snow Mountain, Lake County, in flower and young fruit.

In habit this species is strikingly like the narrower-leaved forms of the monotypic genus Zauschneria, and in conjunction with such species as *E. paniculatum* and *E. obcordatum*, make that genus untenable, there being no longer any definable and constant difference, however trivial, which can be used to separate them.

THE HABITS AND NESTING OF PALMER'S THRASHER.

(Harporhynchus curvirostris palmeri.)

BY HERBERT BROWN.

In offering these notes on the habits and nesting of Palmer's and Bendire's thrashers, I question much if I can say anything new in regard to the former, inasmuch as it has long been under the observation of experienced naturalists. The bird is a common resident of this portion of the Territory, and a notable feature of feathered life in every cactus belt in Southern Arizona. Some years since, I purchased a partial albino.* I first saw it as a fledgling at a ranch about forty-five miles west of Tucson, to which place the writer had gone as one of a rescuing party; the sheriff of the county, while endeavoring to arrest an Indian horsethief, had fallen into ambush and was himself a captive. The bird had been taken from its nest under the impression that it was a young mocking-bird. When I again saw it some six months later, it was fully grown, and appar-

*In general appearance it resembled *H. c. palmeri*. Poise and shape of head, length and curve of mandibles, bold, bright yellowish gray eye and movements those of *palmeri*, but the white markings gave it somewhat of a resemblance to *M. polyglottos*. If approached by a stranger when caged, it would ruffle its feathers, open its tail like a fan and peck viciously at the hand, but to its owner, a young fellow, whose both arms had been broken by an Apache bullet, it was all love and affection. The first, fifth and ninth primary in the left wing were white, sixth, seventh and eighth brownish gray, secondaries ashy gray, tertiaries white, stems of all white feathers black. Right wing, first and fifth primaries white, sixth brownish gray, secondaries first two white, the next four brownish gray, tertiaries first brown, second brown and white, third white, upper half of greater coverts white, eighth, nine and tenth all white. Tail—eleven rectrices entirely white, barred with faint waving lines of a darker color. Back, head and breast ashy gray, throat and abdomen white, upper mandible black, lower mandible from base to angle of gonys, white.

ently as domestic as the chickens with which it freely associated. Occasionally it would become too obtrusive and draw upon itself the belligerent attention of its more powerful companions, but when struck at, like the proverbial flea, it was never there. A dozen times an hour, and off and on I watched it for nearly half a day. I expected to see it killed, but its remarkable quickness always stood its friend. One pestiferous old hen would run up to within striking distance, then slowly crane her neck in the direction of the impudent little intruder, which also as suddenly assumed a like position, and for a moment they would stand defiantly eyeing each other, when, almost too quick to be seen, the hen would deliver her blow, but only to find the enemy two feet away with its head cocked first on one side and then on the other, apparently enjoying the dangerous sport. It answered readily to the name of Dick, and was particularly fond of a mixture of chili and corn meal, and when its attention was called to a cup containing some, it would be up in an instant, and if the vessel was covered with the hand would attempt to force its mandibles between the fingers. Failing in this, it would watch eagerly for any opening it could take advantage of. It had a penchant for digging holes in the ground; the harder the earth the greater its apparent delight. This odd feature, however, is common to the *palmeri* family at all seasons of the year, but more particularly, I think, while breeding. They press their tails firmly against the ground, after the matter of the woodpecker; if the earth be dry and sandy, a perfect fusilade of dirt is kept up. The force of the blow is downward and towards the body, but occasionally to clean the sand out they strike several sideward blows, and dirt flies for a foot in all directions. In the early spring they are commonly seen with a hard lump about the size of a pea, attached firmly underneath the point of the lower mandible, and as the lump is of adobe, which at times is found a considerable distance from their resting places, it is evident that this digging is done for a purpose. During the winter months they leave the mesas for the more sheltered bottoms where they frequent the brush fences, pomgranate and willow hedge rows bordering the ploughed fields, and then, literally, they are in mud to their eyes.

Palmer's thrasher may never be classed as a musical prodigy, but nevertheless among Arizona birds he is rivalled only by that king of American songsters, *Mimus polyglottos*. Morning, noon and

evening, perched on the topmost branch of a cholla, he is always in tune, and while his notes may perhaps be less varied than his more favored kinsman, it is none the less bold and commanding, and but for the ubiquity of his rival in song would be in demand as a cage bird.

Southern Arizona, notwithstanding its great mountain chains, if viewed from an elevated position, presents the appearance of a vast plain that ends only where the horizon seems to touch the earth, with here and there a mountain range small in comparison with the surrounding plain, set down upon it. Between the mountains lie immense mesas and valleys, as a whole, timberless and waterless, but covered with nutritious grasses, great cacti belts and other vegetation of curious growth. Here, then, is the home of the *palmeri*, and in the cholla, beset with countless spines, it builds its nest and rears its young. This class of cacti, of which the foregoing cut gives but a faint conception of its terrors, is virtually impenetrable to man and beast. Ten million of cambric needles, set on hundreds of loosely jointed spindles, woven so closely together as to apparently defy the penetration of a body however small, but the thrashers go in and out and up and through them with the ease of water running through a sieve. In some convenient fork, on a limb against the bole of the bush, or in a cavity formed by the pendent stems of the plant, the nest is most commonly built. All the spines in the vicinity of the nest are pulled off for the better protection of the young. This does not, however, always save them as I have found them once in a while, tangled and dead in the terrible burs.

The external nest of the Palmer's thrasher is made of thorn twigs averagaing in length about eight or nine inches, seldom shorter but frequently much longer. Almost invariably they are lined with a species of wire grass, but sometimes thay go astray and use other material. In external depth the nests vary according to the whims of the bird and the requirements of the site chosen, but generally they average from seven to ten inches. The inner cavity at its greatest width near the top measures from four to four and one-half inches, bottom one-half an inch to an inch narrower, rounded or flat, and from three to three and one-half inches deep. However sparsely the walls of the nest may be lined, the bottom is always thickly padded with dried grass into which the eggs frequently sink one-half their depth, and in this condition hatch. There are, of

course, many exceptional nests. Some remarkable for the oddity of their construction, others for their bulkiness and still others for the flimsy manner in which they are put together. Have many records of such; a few instances, however, will suffice to show the peculiar ideas of the birds when they depart from their usual seven by ten building. One nest was built on the ruins of three others and probably represented as many successive broods, and gave the interior of the cholla the appearance of having been solidly filled in with dead sticks. Exterior diameter of the nest 20 inches, depth 36 inches, cavity across the top 4½ inches, bottom 3 inches, depth 6 inches, but lined only about 4 inches up with baling rope, hog bristles and grass. A second had an external diameter of 14 inches, depth 12 inches, interior diameter top of cavity 5 inches, bottom 2 inches and depth 9 inches, but lined with grass and feathers for two inches only, the other seven inches being naked sticks. The peculiarity of another was that the bird in leaving the nest went through a well built piece of cribbing rather more than ten inches deep, which stood at an angle of about 70 degrees with the top of the nest. The sticks forming the cribbing were from six to eight inches long and straight, the aperture was about four and one-half inches in the clear, being rather longer one way than the other. One edge of the cribbing lay solidly on the nest, the opposite side being open sufficiently to admit the body of the bird, giving the cribbing the appearance of having at some time been tipped from the perpendicular. I broke sufficient of the cactus burs away to expose the open side of the nest, then secreted myself to watch events. Both birds soon returned to the nest, but becoming alarmed again left apparently for good, but in the course of half an hour one again came back and was presently followed by the other. After a general inspection of the premises the female went on the nest, going in under the open edge of the cribbing, but on being approached left the nest by going up through the cribbing as she did when first disturbed. For a third time I saw her make her entrance and exit as described. The nest contained three slightly incubated eggs. In the spring of 1889 I noted several nests made almost entirely of flowering weeds. This came from the nature of the vegetation in the immediate vicinity of the cholla belt in which the nests were placed.

There appears to be no fixed time for the opening of the nesting

season, which alternates between the latter part of February and the beginning of April. At first I was inclined to attribute this difference to climate causes, but subsequent events modified my opinion in that direction. A cold winter followed by a late nesting led to the former belief, but a still colder winter and an earlier nesting upset my theory on that proposition. March 1, 1889, the young were already in the nests. February 28, 1886, my notes show two nests of three eggs each. March 28, 1887, is my first record. Although I had watched diligently for weeks and found many finished nests. March 3 opened the season for 1888 and March 15 for 1889, although the season was not fairly under way till two weeks later. The season of 1887 was characterized by the smallness of the clutches, two eggs as a rule being the maximum number laid, that of 1889 being marked by the other extreme, the complement being seldom less than three but more generally four. Although the season of 1888 opened early in March it was not until March 12 that I visited the principal cactus belts within a radius of about twelve miles east and south of Tucson, and of the fifteen nests examined one contained two eggs; two, three eggs each; five, two young each, and two contained one young each. Three nests were apparently ready for eggs and two were in course of construction. The young in two nests were apparently ten days old and from that age they graduated down to the chipped shell. On the 18th I worked the cactus north of Tucson. I found one nest with two well developed young, one ready for eggs, one with one young fledged and sitting in the bush, two with three eggs each and one with one young, one about a week old. March 25 I partially covered the ground that I had been over on the 12th east of Fort Lowell, following down the Rillito a dry wash and a roaring torrent at different seasons of the year. The young had almost invariably left their nests and were sitting in the bush or running around with the old ones. The broods varied in size from one to three. The season of 1889 did not fairly open till the first week in April, when it opened with a rush, the birds being more numerous and clutches larger than on preceding years. April 3, I noted nine nests containing three eggs each; April 10, five of three; April 13, nine of four, twelve of three and two of two eggs each; April 14, two of four and eleven of three each; April 16, four of four; 17th, three of four and eleven of three; 27th, six of four and eight of three; 30th,

six of three and one of two. This practically closes the book for the year. It must be borne in mind, however, that the foregoing is given only to show the unusual size of the clutches and not as an actual representation of all the nests that came under my observation. The mesas and desert lands of Arizona are better than the macadamized road of the Eastern States for good driving, and, as they are generally level and everywhere accessible to a team, a large area of ground can be covered in one day. This fact partially accounts for the richness of the foregoing result for 1889.

NOTES ON SOME SPECIES OF THE GENUS ŒNOTHERA.

BY ALICE EASTWOOD.

Œnothera biennis L. The flowers of this common species expand about sunrise, not all at once as if they were opened by electricity, but one here, another there, and so on until all the fully developed buds are out. The style is shorter than the filaments, and fertilization takes place in the bud. On a cloudy morning they remain bright and fresh, but when the sun beats down with intense and undimmed rays, the petals are wilted long before noon. The var. *grandiflora* Lindl. has much larger flowers and stems less leafy. The style is larger than the filaments and before the bud opens is protruded from the expanding corolla, so fertilization in the bud is impossible. I have not observed insects flying around the open flowers or crawling within the corollas.

Œnothera pinnatifida Nutt. In the spring two classes of plants can be found; those that have evidently lived through the previous season and small plants that appear to be seedlings. The former soon become large with spreading habit, often forming a mat more than a foot in diameter. I have counted sixty-five large white blossoms on a single plant. They die when the seed ripens, unless growing near where the supply of water is permanent, when they appear to become perennial. They bloom in April and May, often lingering on through June and even occasionally into August. When there are rains in August, as there almost always are, a new crop of seedlings comes up which form simple-stemmed plants with a few flowers that remain until the frost. These plants are, in my opinion, the originals of the many stemmed plants of the next spring,

while the spring seedlings come from seeds that did not germinate the previous season, or perhaps from seeds ripened on the fall seedlings. These flowers open about sunset and are not fertilized in the bud, for the pistil greatly surpasses the stamens. I have examined hundreds of pods and have always found two rows of seeds in each cell, eight rows in all. The seeds are round and pitted.

Œnothera trichocalyx Nutt. Of this I have collected several forms that vary with reference to the bud, the appearance of which seems to be the chief difference between this and *Œ. albicaulis.* I cannot determine to which species several belong, though the Grand Junction *Œ. trichocalyx* and the Denver *Œ. albicaulis* seem quite distinct. They all have lance-linear seeds, grooved where they press against their companions, and often mottled with red. I found the mottled seeds on the Grand Junction form of *Œ. trichocalyx* and the Denver form of *Œ. albicaulis.* In both, the seeds of well developed pods have two rows in each cell. The plants from Grand Junction have buds that are conspicuously white villous and decidedly blunt; the tips are not in the least free This seems to be the typical form, as I said before, of *Œ. trichocalyx.*

The form from Thompson's Springs, a station on the Rio Grande Western in Utah, has villous buds that are acuminate but without free tips. I have the same from along McElmo Creek, in southwestern Colorado. The form from Moab in Utah has smooth buds, acuminate and with free tips. The form from Court House Wash, on the road to Moab, has buds slightly villous, with tips acuminate and partially free. These forms are all annuals or biennials.

The Denver form of *Œ. albicaulis* has sparingly villous pods, acuminate and with free tips It would appear that a specific difference between these two must be sought in some other organ. *Œnothera albicaulis* is distinctively a perennial, but that might arise from its situation. It is always found not far from water, while *Œ. trichocalyx* inhabits desert regions.

In comparing the Denver *Œ. albicaulis* with the forms of *Œ. trichocalyx* I find the leaves to be quite dissimilar, the former having leaves that are either sparingly or deeply toothed and canescent with appressed hairs; the latter having pinnately divided smooth leaves with the segments narrow and linear. However, in looking over Watson's Revision, I find that var. *runcinata* and var. *Californica* of *Œ. albicaulis* have pinnatifid leaves; so the difference in the

leaves ought to have no weight. They both have white shreddy stems, *Œ. trichocalyx* being more frequently red than white. The flowers and capsules do not differ sufficiently to be marked. From all these considerations I feel compelled to believe that there is but one species instead of two. I have not had opportunities to observe the habits of any of these forms, but all are white-flowered and of course open in the evening.

Œnothera coronopifolia Torr. & Gray. Next to *Œ. biennis*, this seems most widely distributed. The flowers have a strong, sickening odor, and open before sunset. The style which is at first erect and longer than the stamens becomes declined as in *Epilobium spicatum*. It is not fertilized in the bud. The flowers remain open until nearly noon the next day and seem to gradually wither, changing from white to rose color. They are not quite an inch in diameter, and often there are several in bloom at once on the low but erect stem. There are two rows of seeds in each cell as in those of *Œ. pinnatifida*.

Œnothera cæspitosa Nutt., is the most variable of all the species, especially in its manner of growth, seeming to change so as to adapt itself to different conditions, or rather those that became best adapted prevailed and transmitted their qualities to the new generations. The form from Steamboat Springs in Routt county, Colorado, has pods on peduncles from a half-inch to an inch long. It is cæspitose. I have not seen the flower. The Mancos form is cæspitose from running root-stocks, with slightly angled sessile pods. The petals are deeply obcordate. At Grand Junction there are three forms: first, the typical cæspitose form; second, that with simple erect stem, the flowers in the axils and the dry stem of winter thickly covered with large ridged-winged sessile pods; and third, the intermediate, with stems branching from the base above ground, instead of underground, as in the Mancos form. The first is the common mountain form, the second is found at Pueblo and near Colorado Springs in the same kind of adobe soil in which it lives at Grand Junction. The axis of the two last forms is succulent, and doubtless holds a supply of moisture to ripen the fruit during the dry season that always follows the spring rains. The capsules are strongly winged and sessile. The flowers of this species are not fertilized in the bud. I watched the Mancos form and found that the flowers expanded almost at sunset, quite gradually but notice-

ably. The pistil was erect and protruded its viscid stigmas from the opening bud without a grain of pollen to be seen. The stigma lobes which were folded in the bud expanded as the corolla unfolded. Humming bird moths frequented the patches and flew from flower to flower almost as soon as they were open. The flowers were withered before noon the next day. They have a fragrance sweet and strong, so much like a lily that they are often so called. I suppose that the color too has something to do with the incorrect name.

One morning in June, after a frost the preceding night, I perceived, as I was riding along, an open flower with the lobes of the stigma closed. I had never noticed such a phenomenon before, and it impressed me as singular. I wondered if the frost had closed them after expansion or if the cold had prevented their opening. Did the stigma lobes come together to protect the naked stigmatic surfaces, or was it merely an accident?

Œnothera scapoidea Nutt., has two distinct forms which are both found at Grand Junction, sometimes even growing side by side. The small-flowered form blooms earlier than the other. The difference in size is marked, one having flowers an inch in diameter with protruding stigmas, the other with corollas less than a quarter of an inch across and stigmas included and fertilized in the bud. The pods and seed differ only in size but to a less degree than the flowers. Both have the red spots at the base of the petals and both have variable leaves. Generally they are entire, sometimes they have a few short irregular lobes at the base of the blade, and rarely have I seen them with margins irregularly sinuate toothed.

Œnothera cardiophylla Torr. Approaches so near to *Œ. scapoidea* that it is impossible for me to discriminate among the several forms which I collected this spring. The Grand Junction form has stems leafy along the branches instead of at the base; the leaves are oblanceolate, sinuate, dentate or entire, often with small irregular lobes below the blade. The flowers are very small and reddish, orange when they first open. The Moab form has all the leaves, except the bract-like upper ones, clustered near the root; the upper leaves are small, ovate and remotely dentate, the lower have from one to five pairs of small irregular leaflets on the long petiole. The pedicels equal the pod, but they vary in length in almost every plant. Another Moab form has all the leaves clustered at the base

of the stem, very villous canescent and similar in shape to the preceding form. In its general appearance it comes very near to *Œ. scapoidea*, and I regard it as an intermediate form. In Montezuma Cañon I found a similar plant. The pods are long and slender, twice as long as the pedicels.

I cannot find a constant characteristic among all these forms, but yet the forms that seem typical are not alike. All of the varieties of the (two?) species have two rows of seeds in each cell of the ovary. The impress of the eight rows can be distinctly seen on the pods of all my specimens.

There is an interesting feature common to the two forms of *Œ. biennis* and the two of *Œ. scapoidea*. Each has a large and small flowered variety, the former fertilized after opening and the latter in the bud. It is a subject for future study, and observations have not yet been sufficiently close and extended for theories or hypotheses.

NOTES ON SOME CALIFORNIAN CISTELIDÆ.

BY F. E. BLAISDELL.

Stenochidus gracilis Lec. Sparsely distributed throughout San Diego County. Frequents the blossom of *Adenostoma fasciculatum;* taken in net while at rest from various species of plants. The insect is black in color with basal portions of femora red.

Stenochidus cyanescens Lec. One specimen taken in May at Mokelumne Hill, Calaveras County. The genus is not exclusively Californian (*vide* Classif. N. A. Coleop., p. 390), as supposed by Drs. LeConte and Horn—it also occurs in Nevada (Casey). A black species; frequently the elytra have a bluish tinge.

Hymenorus inquilinus Casey. One specimen which I refer to the present species was taken from an agricultural ants' nest Sept. 24th, at Mokelumne Hill. The elytra are without impressed striæ, although the sutural lines are partly discernible. Color rufo-testaceous, humeral areas paler. Eyes black, front strongly convex, sparsely punctate and shining, epistoma abruptly flat and rather closely punctured. Prothorax short and slightly wider than elytra, the latter with sides straight and nearly parallel.

Hymenorus fusculus Casey. A number of specimens of this species were taken from a pile of decaying sunflower blossoms at Coronado.

Hymenorus macer Casey. Common at Poway, San Diego County, under debris, beneath trees and about decaying vegetables.

Isomira variabilis Horn. Moderately common at Poway during June and July on the blossoms of *Adenostoma fasciculatum.*

Cistela Thevenetii Horn. Moderately rare at Poway. Frequents the blossoms of *Adenostoma fasciculatum.* Color piceous-black to black, femora red.

LETTER FROM M. ALPHONSE DE CANDOLLE TO M. ERNEST MALINVAUD.*

GENEVA, July 6, 1892.

Dear Sir and Fellow Member:

You wish to know my opinion regarding the propositions issued by a committee of very competent botanists in Berlin, on the subject of nomenclature. I have signed the four articles which they propose, and I will tell you why.

In 1867, when we revised the collection of laws of nomenclature, we made omissions and committed several errors, which the march of science has now made obvious. We then thought almost exclusively of the future, scarcely at all of the first epoch in binominal nomenclature. We particularly said that it should start from Linnæus, without explaining from which of his works. But between the first edition of the Systema Naturæ (1735) and the author's last dissertation, published in 1776, a period of forty-one years elapsed, and during this long time his principal works were spread abroad (Genera, Species, Mantissa, etc.). At the same time descriptions of genera and species were published which are or are not sound, according as the nomenclature is based on this or that work of the master.

It is sufficient to cast a glance at the first folio edition of the Systema, now very rare, to be convinced that it is intended to make known Linnæus' twenty-four classes and not at all to define genera. It was in 1737, in the first edition of the Genera, that the author named and characterized the genera which he admitted. In 1753, in the first edition of the Species, he enumerated species under the binominal form. Not long since I was disposed to determine gen-

* Translated by Mary F. McRoberts, from the Bulletin of the Botanical Society of France, Vol. 39, meeting of July 8, 1892.

era from 1737 and species from 1753, but on this point the members of the committee of Berlin make a remark which is, in my opinion, very just. The real merit of Linnæus is to have combined for all plants the generic name with the specific term, which he did in 1753. That is, therefore, the chief date of the new nomenclature. Linnæus did not invent the designating of a species by two words. That is found in many books before his time. But it was an exceptional case, the greater number of species being named by phrases. If this plan had been continued the science would not have changed; there would only have been phrases, more or less lengthy, according as new species were discovered. Happily, Linnæus struck a successful blow when he instituted the constant and general employment of the binominal method as a fixed rule. Thus he is virtually the creator of this method, just as Ant. L. de Jussieu is of naming families, although many before him named and characterized these groups. Taking everything into consideration, it is a happy conclusion, that of deciding upon the date 1753 as the origin of modern nomenclature. That resolves the difficulty regarding the change of names, which the law of priority would entail had an earlier date been fixed upon. Strictly taken, 1752 decides the genera and 1753 the species, but taking into consideration the page which precedes the definition of species in the first edition of Species Plantarum, we see that Linnæus made use of the fourth edition of Genera Plantarum for determination of the genera, which he published in 1752.

The second proposition of the Berlin committee is in part our Article 46 of the Laws of Nomenclature, with useful additions regarding seminuda names, also regarding plates unprovided with descriptions of new genera. The third proposition conforms to the principle of the desirability of fixity of names. Finally, proposition four is a learned and impartial application of exceptions which it is possible to admit in the law of priority. Botanists will be pleased to see the desire to preserve such names as Oxytropis, Desmodium, Statice, Protea, Banksia, Myristica, Dendrobium and others, which an ill-chosen date or irrational interpretation of the law of priority threatened to change. The idea of making exceptions to that rule is not precisely a new one. Our Laws of Nomenclature (Article 4, and Commentary, p. 33) allow this to be seen. Thus the most just and best drafted laws, even in the civil code, are sometimes submitted to alterations which it is true ought to be rare and only caused

by necessity. At the present moment M. Kuntze's much to be regretted work involves just such a necessity. The Berlin committee understand this, and in the list of names to be rejected and names to be preserved, in spite of the law of priority, it has accomplished a difficult task, for which gratitude is due to it. Its propositions are a development of our laws of nomenclature, such as should be made when abuses crop in or when negligence is discovered in the compilation of 1867. I have myself given utterance to ideas of that nature, from which I hope good results, although the action of an isolated individual must always be slower than that of a committee.

Accept, dear sir and fellow member, the assurance of my cordial esteem. ALPH. DE CANDOLLE.

NOTES ON TWO MEXICAN SPECIES OF CEROPLASTES, WITH A RECORD OF PARASITES REARED FROM ONE.

BY C. H. TYLER TOWNSEND.

The two scales below mentioned have been sent to me by Dr. Alfredo Dugès, from the vicinity of Guanajuato, Mexico. To Dr. Dugès also is due the credit for the information given regarding food-plants.

Ceroplastes dugesii J. Licht.—Found at Guanajuato "more commonly on *Malvaviscus arboreus* Cav. and *M. acerifolius* Presl., two shrubs of about 3 or 4 metres height; and *accidentally* on adjoining shrubs" This is a large species, nearly white, sub-hemispherical, showing no division into plates, the white waxy secretion being very susceptible to pressure and filled with a watery liquid. Specimens kept dry for months do not lose this liquid in the least degree. Those sent measure in length, 9 to 11 mm.; width, 7 to 9 mm.; height, 5 to 8 mm.

Ceroplastes sp.—Found "on *Bignonia (buccinatoria?)*, and *Chrysanthemum* at Guanajuato." This is quite a different species in appearance. It considerably resembles *C. cirripediformis*, but is more than twice as large. The waxy secretion is not so white as in *C. dugesii*, but more of a dirty gray in color, not so soft, dryer, and is very distinctly marked off into plates, much resembling in general form the carapace of the box-turtle *(Cistudo)*. There is a dorsal, central, rounded plate, with a central black navel-like

spot; around this are grouped six other plates, two on each side and one at each end, the anterior end plate being the widest and bearing in a transverse row three central navel-like spots, the other plates sub-equal and with a single navel-like spot approximated to lower lateral margin; all the plates are marked with numerous very slight ridges radiating from the navel-like spot, the radiations being perfect on all sides from the center of the dorsal plate, and mostly upward and laterally on the others, the anterior end plate most approaching the central one in this respect. The specimens sent measure in length, 6 to 8 mm.; width, 4½ to 5½ mm.; height, 4 to 6 mm.

The specimens of this species were received from Dr. Dugès, on Sept. 27. On opening them, there were found to be present numbers of live adult flies of some species of parasitic microhymenoptera. Probably a dozen or more of these parasites escaped at this time. These all belonged to the more numerous flavous species. More of the same issued up to Sept. 29. The scales were not again looked at until Oct. 15, when a careful examination showed four different forms among the parasites, some of which had been issuing up to date. These were counted, showing the following numbers that had issued from 10 scales: The more numerous were the first or common flavous form, distinguished by the scutum of thorax being of a rufous tinge, and of which there were 22 specimens. Of a smaller form, which was black above and pallid below, there were 6 specimens. There were 3 specimens of a form more slender than the first one, and perfectly black except the wings. And finally there was a single specimen of a beautiful trypetid-like variegated-winged species, having the wings white with fuscous reticulations and the body marked in very much the same way. The flavous form was the only one noticed for the first few days, and the others must have issued much later. One specimen of the black species was found alive Oct. 15.

These parasites were sent to Mr. L. O. Howard for determination, and the following letter was received in reply:

"I am glad to get the specimens which you send, and it is interesting to know that all are bred from *Ceroplastes*. The yellow species, which occurs in the greatest abundance, is a species of *Aphycus*. It differs, curiously enough, from my *Aphycus ceroplastis* described in Bulletin 5 of this Division, and which was bred from

a *Ceroplastes* received from Silver City, N. M. I fully expected that your form would prove identical with this. The beautiful species which resembles a *Trypeta* belongs to a new genus of *Encyrtinæ*. We have the same species in the National Collection from California. The other species—the small black one—belongs to the genus *Tebrastichus*, and is a parasite not of the scale-insect, but of the *Aphycus*. It is a tremendous genus and the species are not worked up."

A SUPPOSED NEW FEATHER STRUCTURE.

BY CHARLES A. KEELER.

In examining a specimen of the Arizona hooded oriole (*Icterus cucullatus nelsoni*), I observed what looked like fine black hairs sticking out among the feathers on the head and back of the neck. Upon extracting one of them, and examining it under the microscope it had every appearance of being a true hair. In reality it is probably a structure allied to the rictal bristles, but occurring in so unusual a place, and lying down upon the feathers instead of standing erect it has the appearance of being a different structure. Being unable to find any allusion to it I would propose, if it be indeed a new structure, that it be termed PSEUDOPILUM. They are present on the backs of the neck and heads of all the orioles I have been able to examine, and might prove to be a generic character. They also occur in both sexes and in the young, although most numerous in the adult male.

ON NUMENIUS BOREALIS IN CALIFORNIA

BY L. BELDING.

I think *Numenius borealis* published by Mr. Holterhoff in The Auk (vol. i, 4, 393), and referred to by Mr. Bryant (Zoe iii, 2, 165), was really *N. hudsonicus* and Mr. Holterhoff was mistaken in identifying his specimen. I was in San Diego not long after he published the note of its occurrence there and asked to see the specimen. He showed me a specimen of *N. hudsonicus* instead of *N. borealis*, and as there is no other known record of its capture in California, it is scarcely entitled yet to a place among Californian birds.

NOMENCLATURE OF PLANTS.

BY KATHARINE BRANDEGEE.

The Botanical Club of the American Association for the advancement of Science, which met this year on August 18, at Rochester, N. Y., appointed, on motion of N. L. Britton, a committee to consider the question of nomenclature and submit a set of recommendations to the club. The committee as appointed consisted of N. L. Britton, John M. Coulter, H. H. Rusby, W. A. Kellerman, F. V. Coville, L. M. Underwood and L. F. Ward; and on the following day submitted this report:

Resolved, That the Paris Code of 1867 be adopted, except where it conflicts with the following recommendations:

I. *The Law of Priority.*—Priority of publication is to be regarded as the fundamental principle of botanical nomenclature.

II. *Beginning of Botanical Nomenclature.*—The botanical nomenclature of both genera and species is to begin with the publication of the first edition of Linnæus' *Species Plantarum* in 1753.

III. *Stability of Specific Names.*—In the transfer of a species to a genus other than the one under which it was first published, the original specific name is to be retained, unless it is identical with the generic name or with a specific name previously used in that genus.

IV. *Homonyms.*—The publication of a generic name or a binomial invalidates the use of the same name for any subsequently published genus or species respectively.

V. *Publication of Genera.*—Publication of a genus consists* (1) in the distribution of a printed description of the genus named; (2) in the publication of the name of the genus and the citation of one or more previously published species as examples or types of the genus, with or without a diagnosis.

VI. *Publication of Species.*—Publication of a species consists* (1) in the distribution of a printed description of the species named; (2) in the publishing of a binomial, with reference to a previously published species as a type.

VII. *Similar Generic Names.*—Similar generic names are not to be rejected on account of slight differences, except in the spelling of the same word; for example, *Apios* and *Apium* are to be re-

* Amended Aug. 22, by inserting the word "only."

tained, but of *Epidendrum* and *Epidendron*, *Asterocarpus* and *Astrocarpus* the later is to be rejected.

VIII. *Citation of Authorities.*—In the case of a species which has been transferred from one genus to another, the original author must always be cited in parenthesis, followed by the author of the new binomial.

The main discussion upon this report was on Article VI, in regard to the acceptance of named exsiccati not accompanied by a description as valid publication of a species, which was discussed by Messrs. Beal, Coulter, Vasey, Swingle, Bailey, Kellerman, Barnes, Fernow, Cook, Dudley, Morong, Britton, Underwood and Johnson. The motion to amend by including exsiccati was lost.

Dr. Britton moved that a permanent committee be appointed to serve as a board of arbitration, and to prepare and print a list of the flowering plants within the area of the sixth edition of Gray's Manual in accordance with the recent report on nomenclature. It was subsequently agreed to to extend the range to include Canada, Nebraska and Kansas. On motion of Dr. Arthur the nomenclature committee was made the permanent committee for this purpose. A further motion was carried "that this committee be empowered to receive all suggestions and criticisms of this list, and to report upon them at the next year's meeting."

The action here taken is certain to have an important effect upon botanical nomenclature, in North America at least, as most botanists would be willing to make concessions in non-essentials for the sake of peace and uniformity. It is evident that such sacrifices were made in committee, as Art. IV of the principles set forth in the circular† sent out to American botanists did not appear in the report. This article, which received the signatures of four members of the committee, provided "That a varietal name be treated as equal in rank to a specific name, in its relations as a homonym and in the transfer of species and varieties from one genus to another."

The effect of this article would be to render the oldest specific name invalid in place of a still older varietal name. We have to thank the good sense of the committee for the shelving of this article, which would necessitate an absurdity in citation, and in view of the extreme looseness with which varieties are treated in bot-

† Zoe, iii, 170.

any—as equivalent to subspecies on one hand and to the slightest variation on the other—would lead to endless confusion.

Articles I, III, V, VI, VII, VIII will continue to be the practice, as they have been in the past, of most botanists.

Objections to Article II may readily be waived.

If Article V is rigidly enforced we shall be delivered from a lot of Rafinesquian trash—Agoseris for instance, where no type species is named.

The discussion on Article VI is somewhat surprising, as it is evident that some members of the club wished to make the issuance of exsiccati a valid publication. It might be endurable to so consider sets carefully prepared under competent superintendence and sufficiently numerous to allow at least one to each country, but a moment's reflection ought to convince anyone that sets as ordinarily distributed—in which only the sample, if any, has been submitted to authority—would be valueless for such a purpose, while the facilities for species-making, already too great, would be immensely increased.

And who should have authority to discriminate?

Article VIII, requiring the name of the original describer of a species to follow it in all cases, and in parenthesis when transferred to another genus, seems to us a great improvement over the old practice, which made no distinction between species described by an author and those merely, for any reason, written after another generic name—indeed offered a premium for as many changes as possible. The concluding clause, requiring the name of author of the last transference to be appended after the parenthesis, will probably be followed or neglected according to the fancy of the writer, as at present.

The rock ahead in these rules is the fourth article: the "Once a synonym always a synonym" provision. If this were intended as a rule for future guidance the objections might easily be overcome, though it would enable any mean-minded man—and some such have been known in botany—to prevent the commemoration of the name of anyone against whom he might have a grudge, by attaching his name to an invalid genus; but as a retroactive measure it will make chaos come again, unless—which it is idle to hope for—it could be left to the hands of careful monographers, It appears to us far better to let the matter of homonyms rest and devote the time spent

in discussions of them to a study of the organisms themselves, especially as such study may result in altering the bounds of genera and involving a new set of names, for perhaps few botanists, if they remember the mutations of genera in the last hundred years, largely due to our increasing knowledge, will consider that even their own efforts will be able to put nomenclature on a perfectly stable footing.

The annoyance arising from homonyms in synonymy is comparatively small, but as between zoology and botany they are a crying evil which overshadows all the others. Even so long ago as 1846, when Agassiz wrote the index to his Nomenclator Zoologicus he made the statement that the rectification of these names in zoology and as between zoology and botany would necessitate the sacrifice of almost half the generic names made in recent times, and it must be apparent to anyone that the inconvenience of writing concerning an insect feeding upon a plant of the same name is infinitely greater than that arising from the occasional revival of an old homonym, especially as by the recent tendency of science genera are more apt to be consolidated than divided.

The law of priority is apparently the only way of securing uniformity, yet it is repugnant to our sense of justice to reckon as of equal value in systematic science the work of careful and conscientious botanists and of the other far too numerous ones who, without herbaria or books of reference, record their vague descriptions, often identifiable only by the process of exclusion, in obscure journals or trade catalogues. There is no other branch of human knowledge which deliberately encourages incompetence.

We pay a dear price for uniformity when we have to accept such work as that of Necker and Rafinesque, and to dread the day when some Mexican may take it into his head to identify the plants of Hernandez' Historia Plantarum Novæ Hispaniæ, and give us some hundreds of names like *Tzonpilihuizpatli Tepuzculullæ*, for instance.

A CORRECTION.—I included in the additions to True's Check-list (in this issue) a reference to Am. Rept. Dept. Agr. 1887, p. 435, as the place where the name *Sorex richardsonii* was revived. This is a mistake as *S. richardsonii* was revived, so far as I know, in Merriam's Geog. Dist. of Life in N. Am. (Proc. Biol. Soc. Wash. vii, April 13, 1892, p. 25.) The species referred to in Annual Report for 1887 is *S. Forsteri*, which should not appear in the list of additions as it is given in True's list.

T.S.P.

INSECTS OF CATALINA ISLAND.

BY F. A. SEAVEY.

During the last week in August of the present year I spent part of the time in collecting insects on Catalina Island. As I know of no list of insects from this island having ever been published, I send one of my collection, incomplete as it is, trusting it might be of some interest in furnishing a new locality for the insects named:

HYMENOPTERA.

Apis mellifica Linn.
Emphor sp.?
Bombus Californicus Smith.
Bombus sp.?
Pompilus ferrugineus Say.
Pompilus tenebrosus Cresson.
Pompilus sp.?
Parapompilus sp.?
Augochlora pura Say.
Polistes aurifer Saussure.
Ceratina acantha Provancher.
Paratiphia albilabris Spinola.
Philanthus Californicus Cresson.
Vespa diabolica Saussure.
Bembex fasciata Fabricius.
Bembex nubilipennis Cresson.
Isodontia sp.?
Sphærophthalma sp.?
Sphærophthalma aureola Cresson.
Dipara sp.?

COLEOPTERA.

Balaninus obtusus Blanchard.
Anthonomus canus LeConte.
Pristoscelis quadricollis LeConte. From *Heteromeles arbutifolia*.
Carpophilus pallipennis Say.
Saprinus vitiosus LeConte.
Platynus brunneomarginatus Mannerheim.
Tropisternus Californicus LeConte.
Hyperaspis lateralis Mulsant. From *Artemisia Californica*.

Psyllobora tædata Leconte. From *Artemisia Californica.*
Chilocorus bivulnerus Mulsant.
Hippodamia ambigua LeConte.
Hippodamia convergens Guerin.
Coccinella sanguinea Linnæus.
Diabrotica soror LeConte.

HEMIPTERA.

Lygæus reclivatus Say.
Lygæus sp.? From *Verbena prostata.*
Orsillus scolopax Say. From *Verbena prostata.*
Nysius angustatus Uhler. From *Verbena prostata.*
Narnia femorata Stal.
Neathus vitripenne Stal.
Murgantia histrionica Hahn. From *Isomeris arborea.*
Platycotis sp.?
Kermes galliformis Riley.
Lecanium oleæ Bernard.
Lecanium sp.?
Aspidiotus convexus Comstock.

DIPTERA.

Volucella avida Osten Sacken.
Volucella esuriens Fabricius.
Volucella tau Bigot.
Copestylum marginatum Say.
Anthrax edititia Say.
Anthrax pretiosa Coquillett.
Anthrax sinuosa Wiedemann.
Lepidanthrax inaurata Coquillett.
Nerius sp.?
Ectyphus sp.?

ORTHOPTERA.

Scudderia Behrensii Bruner.
Œcanthus sp.?
Labia sp.?

NEUROPTERA.

Chrysopa sp.?

RECENT LITERATURE.

Reviews of Paleobotanical Literature.

BY THEO. HOLM.

A. G. Nathorst: *On the occurrence of fossil glacial-plants.**

It is nothing less than a mapping of the former distribution of the Arctic flora in Europe, that the author presents in these papers. They are principally based upon his own observations, and contain an invaluable account of the distribution of these plants. The accompanying map gives a comprehensive view of the former extent of the Ice-period in Europe, covering an area from 50° to 70° lat., besides Switzerland, a part of Hungary, Bavaria, Würtemberg, France and the Pyrenees.

The plants which especially indicate the presence of a former Arctic flora are: *Salix polaris*, *S. reticulata*, *Betula nana*, *Polygonum viviparum*, *Azalea procumbens*, *Saxifraga oppositifolia*, *Dryas octopetala*, besides some others, including mosses. The author presumes that several other species of *Salix* will be found by closer examination of the considerable material he has at hand, as there are some leaves which very much resemble *S. myrsinites*, *S. myrtilloides*, *S. retusa*, *S. Lapponum* and various others.

The fragments of these plants are not only leaves, but also branches, catkins and fruits. It will be interesting to know the conclusions which the author promises will soon appear from these investigations, concerning the former and present distribution of the Arctic plants. Some very interesting points have been given, however, in the present paper, concerning the distribution of *Dryas*. For the first time this has lately been discovered as fossil in Great Britain in a single locality near Edinburgh, while it is found in the living state among the mountains of Wales, Yorkshire and Scotland. *Polygonum viviparum* was found as fossil in Switzerland, but no fossil remains have ever been found of it in Sweden, although it is very common in the recent flora.

---

*"Ueber den gegenwärtigen Standpunkt unserer Kenntniss von dem Vorkommen fossiler Glacialpflanzen." (Bihang K. Sv. Vet. Akad. Hdlgr. vol. 17, 1892; Stockholm, pp. 1–32, with map.) and: "Den arktiska Florans forna Utbredning i Länderna öster och söder om Oestergön." (Ymer, Stockholm, 1891, pp. 115–147, with map.) Also, "Fresh Evidences Concerning the Distribution of Arctic Plant during the Glacial Epoch." (Nature, vol. 45, Jan., 1892.)

The accompanying map shows, also, the former and recent distribution of *Salix polaris*, which, in connection with the other facts mentioned above, may give us important hints as to the migration of plants. It is to be hoped that Professor Nathorst will soon give us the promised work upon the distribution of these plants. And similar researches are highly recommended to the paleobotanists of this country.

FRIDOLIN KRASSER: *The Rhetic flora of Persia.**

It was not until the year 1858 that the fossil flora of Persia was investigated, when Dr. Goebel, as a member of the Khanikow-expedition to Chorassan, had the opportunity of making some collections in that country. These were studied by Dr. Goeppert. While Dr. Goebel collected in the province Asterabad in eastern Persia, visited Tietze, several years later, Hif near Kaswin and the mountain Siodscher, and Dr. Wähner made extensive collections on the Polak-expedition, discovering plant-bearing deposits near Rudbar and Sapuhin.

The Persian fossils from these localities occurred in a formation consisting principally of a greenish or sometimes reddish sandstone, the age of which, judging from the flora, seems to be identical with the Rhetic formation.

The author gives a complete list of works, published upon this Persian flora, the most important having been written by Goeppert, Polak, Schenk, Sturr and Tietze. He also mentions the most interesting fossil plants that were collected by the above mentioned explorers, and gives, finally, a full account of a very large collection, made recently by Dr. Rodler near Sapuhin at Kaswin, and presented to the Vienna Museum by the late Dr. Polak, court-surgeon of the Shah. It is especially from this last collection, that the age of the formation has been ascertained, and the specimens seem to give a more complete illustration of that flora, than any of the other Persian collections. We find in the list a few *Archegoniata: Equisetaceæ* and *Filices*. Among the genera of these families are *Equisetum*, *Phyllotheca*, *Asplenium*, *Bernouillia*, *Clathropteris* and others. The *Cycadeæ* are represented by *Podozamites*, *Otozamites*—of which *O. Polakii* is described as new to the science—and such genera as

*"Ueber die fossile Flora der rhätischen Schichten Persiens." (Sitzungsberichte d. K. Akad. d. Wissenschaften, Wien. vol. 100, 1891, 20 p.)

Pterophyllum and *Anomozamites*. Among the *Coniferæ* are found *Palissya*, *Baiera* and *Ginkgo*.

H. ENGELHARDT: *Cretaceous plants from Saxony.**

Such authors as Brongniart, Sternberg, Brown, Geinitz and Goeppert have already described the cretaceous Ferns, Cycads and Conifers from the locality near Freiberg, in Saxony, and Ettingshausen has treated the oldest dicotyledonous plants of the region in his paper: "Die Kreideflora von Niederschöna in Sachsen."† But since the year 1867, nothing of importance has appeared upon this subject. There is, however, in the Museum of the "Freiberg Bergakademie" a considerable collection made by Reich, which has been left partly unnamed, and it is upon this valuable material that the author has based the present paper. It contains an enumeration of plants with several critical remarks, and following are figured and described as new species: *Pterophyllum Reichianum (Cycadeæ)*, *Salix Schoenæ*, *Triplaris cenomanica (Polygoneæ)*, *Sapotacites Stelzneri*, *Mimusops ballotæoides*, *Chrysophyllum Velenovskyi*, *Sapindus saxonicus*, *Sterculia Geinitzi*, *Simaba saxonica* and *Leguminositeş cretaceus*. The collection embraces, also, several very interesting types, and, although described before, we will note the presence of such characteristic forms as: *Delesseria Reichii*, *Didymosorus comptoniæfolius*, *Sequoia Reichenbachii* and *S. minor*, *Diospyros primæva* and *Liriodendron Meekii*.

C. T. BARTHOLIN: *Jurassic plants from Denmark.*‡

The present paper contains an enumeration of fossil plants, mostly collected by the author himself during his stay on the Danish island Bornholm. They all belong to the Jurassic flora, and represent the *Equisetaceæ*, *Marsiliaceæ* and *Filices*.

Sagenopteris Nathorsti is described and figured as new to the science. The author with some doubt has referred to this genus the fragments of some leaves which, if we consider the minute nervation, resemble somewhat the genus *Antrophyopsis*. There has, also,

---

*"Ueber Kreidepflanzen von Niederschöna." (Sitzungsberichte und Abhandlungen d. naturwiss. Gesellschaft Isis. Dresden, 1892, pp. 79–105. One plate.)

†Sitzungsberichte d. K. Akad. d. Wissensch. Wien. vol. 55.

‡"Nogle i den bornholmske Juraformation forekommende Planteforsteninger." (Botanisk Tidsskrift, Kjöbenhavn, 1892, vol. 18, pp. 12–28, plates 5–12.)

been described and figured a new species of *Laccopteris*, but the author has not ventured to name this supposed new species, since merely a very few specimens were discovered. This form seems to be related to *L. elegans*, but differs, however, by the considerably larger size of the leaves and the variation of nervation.

Hausmannia Forchhammeri apparently represents a distinct type. It has the appearance of *Jeanpaulia* very much in the shape of the frond, being stipitate and showing some divisions; but, the secondary nerves proceeding at right angles from the primary one, brings this form as to nervation closer to the genus *Clathropteris*.

The author calls attention to the fact that the leaves of *Hausmannia* show the same peculiar difference as does *Platycerium* of the recent. Concerning the arrangement of the sori, this new species agrees with *Clathropteris platyphylla*, in which they are scattered all over the dorsal face of the leaf.

The situation of the sori in relation to the nerves, was, unfortunately, not to be distinguished in the fossil. The plates contain several, well-drawn figures, with some details of all the species which were collected.

Third Annual Report of the Missouri Botanic Garden. The scientific papers are, first, A Revision of the American Species of Rumex occurring North of Mexico, by William Trelease. Twenty-three species are admitted and illustrated by as many plates, which though unecessarily reduced for the size of the page and deficient in detail will be found useful in dealing with this somewhat neglected group. In the second paper Dr. C. V. Riley brings together in accessible form papers previously published on "The Yucca Moth and Yucca Pollination," and describes six new species of Yucca moths *Pronuba synthetica*, *Prodoxus pulverulentus*, *P. y-inversus*, *P. reticulatus*, *P. coloradoensis* and *P. sordidus*. The ten appended plates are devoted to the different moths and details of oviposition and pollination. The paper is of much interest, but the author's argument that the Pronuba deliberately gathers the pollen from one flower and carries it to another with the view of fertilizing the flower and producing food for her young is somewhat of a draft on our capacity for belief.

The succeeding papers are: Notes and Observations on Yucca, with many good photographs and several detail drawings by Engel-

mann; a description of a new species of Agave (*A. Engelmanni* Trel.) and some notes with a plate on *Parmelia molliuscula.*

More than a third of the volume is occupied by reports of the annual banquets of the trustees and gardeners, and the annual flower sermon. Some of our English botannical friends are inclined to poke fun at this feature of the Report, and it must be confessed that a lot of bombastic after-dinner speeches do not combine well with scientific papers, but in fair justice it must be admitted that the authors of the scientific papers should not be held responsible.

K. B.

The North American Pyrenomycetes. By J. B. ELLIS and B. M. EVERHART. This book is an octavo of nearly 800 pages, with 41 excellent plates drawn by F. W. Anderson, whose early death we have had recently to deplore. Very little critical work has been done excepting in the Erysipheæ, which were elaborated by Prof. T. J. Burrill. Scarcely any attempt has been made to indicate the conidial and other stages of the species and the specific keys are of the slightest; as for instance in Sphærella, where the sections of the genus are given as:

A. Parasitic on leaves of dicotyledonous trees and shrubs.
B. On leaves and cones of coniferous trees.
C. On stems and leaves of dicotyledonous herbaceous plants.
D. On monocotyledonous plants.
E. On cryptogamous plants.

This may be as good a key as any, where the principal distinctions among the species appear to be the different plants on which they grow, with an occasional variation of a few micromillimetres in size, but this being the case the want of an index of hosts is especially remarkable. The volume on account of the large type and spacing is unduly large, and the plates though excellent are in many cases of species which have already been figured, and render the book too expensive for the masses, while to the specialist it is entirely unnecessary.

K. B.

Contributions from the U. S. Herbarium, vol. i, No. 5. This publication contains four papers. The first is a list of the plants collected by Dr. Palmer in 1890 on Carmen Island. *Drymaria diffusa*, *Desmanthus fruticosus*, *Passiflora Palmeri*, *Houstonia fruticosa*, *Brickellia brachiata* var. *glabrata* and *Euphorbia Carmenensis*,

the first three illustrated by excellent plates which I am glad to see are not folders, are described as new. The second paper—Plants Collected by the U.S.S. Albatross, 1887–91, along the Western Coast of America—is by various authors. J. N. Rose: Plants from Cocos and Galapagos Islands; D. C. Eaton: Ferns and Mosses from Southern Patagonia and Fuegia, with description of one new species *Bryum cælophyllum;* A. W. Evans: List of Liverworts from Southern Patagonia, with descriptions of two new species, *Lophocolea apiculata* (pl. xv) and *Schistochila quadrifida* (pl. xvi); and a short list of Lichens from the same place by Dr. J. W. Eckfeldt. The third paper is a revision of the North American species of Hoffmanseggia by E. M. Fisher, and though marred somewhat by careless proof-reading is a valuable contribution. The study includes 17 species, two of them, *H. Texensis* and *H. canescens*, described as new and 9 new varieties are also characterized. One species, *H. intricata*, has suffered change of name, the older var. *glabra* being substituted for it, it seems to me, without due consideration. The writer fully agrees with the proposition that varietal names should be retained when a named variety is raised to specific rank—with one important reservation—that in no case is a specific name to be disturbed. For a varietal name can only claim priority as a variety, its specific date being that on which it was described as a species, any other course would involve the nomenclature in a series of false assumptions and absurdities. The author, for instance, finds himself unable to attach Watson's name to a species which he never named, yet inferentially appends his own, which can only date from the publication of his paper. As a matter of fact the name *glabra* was passed over for what appeared to be two good reasons. In the first place it is a pure and simple "nomen nudum," and if it were specific instead of varietal could only hold by the courtesy of a subsequent describer. In the second place Hoffmanseggia belongs to the category of unstable genera, being regarded as too near Cæsalpinia by Bentham, and unhesitatingly reduced to that genus by Baillon, and there is at least one older valid species of Cæsalpinia bearing the specific name *glabra*.

Another instance where the author's nomenclature seems to be at fault, according to his own rule, is in using *demissa* as a varietal name under *H. falcaria*, though by the synonymy given under it *H. densiflora* is the prior name.

The Systematic and Alphabetic Index of New Species, published in 1891, of North American Phanerogams and Pteridophytes, by Josephine A. Clark, which is the last paper, is one that every systematic botanist will find extremely useful, and we hope the other promised publications from the card list of the Botanical Division will soon appear. T.S.B.

Life Histories of North American Birds with special reference to their Breeding Habits and Eggs, with Twelve Lithographic Plates. By. CHARLES BENDIRE, U. S. Army (Retired). Smithsonian Institution. U. S. Nat. Mus. Special Bulletin No. 1, 1892, pp. viii, 1–414. Since the publication in 1857 of a single volume of the series begun by Dr. Thomas Mayo Brewer on the nests and eggs of North American birds no similar work has been attempted, if we except Ernest Ingersoll's financially unsatisfactory venture. The need of material both for the text and for figuring typical eggs has been a serious obstacle now removed by the matchless collection of Captain Bendire and the assistance rendered by others by contributions of new and more complete data relating to nidification supplementing the author's own extensive field experience. Doubtless there is no one equally as competent to deal with this subject as Captain Bendire who has, from time to time, in the pages of the Auk, biographically treated of several species in a manner that leaves but little to be desired. The work contains a few typographical, but self-correcting errors of proper names. The style is simple and clear. The text is decidedly not a compilation but remarkable for the amount of new reading that it contains, and one feels a confidence in accepting the facts as facts. The present volume, the first of the series, treats of 146 species and subspecies including the gallinaceous birds, pigeons and birds of prey. The text is not confined to descriptions of nests and eggs, but treats also of the life histories of each species, their geographical range, migration and food habits. The colored lithographic plates representing full sized typical eggs and variations are excellent, having been reproduced by Ketterlinus from the water-color drawings by Mr. John L. Ridgway. W.E.B.

The *Auk* for October has two photogravure plates of nests of the fish hawk accompanying an article on the "Breeding Habits of the Fish Hawk on Plum Island, New York," by Charles Slover Allen.

R. H. Lawrence contributes "Further Notes on Birds of the Gray's Harbor Region, Washington," with annotation on about forty species. "Birds of Southwestern New Mexico," by A. W. Anthony, has brief notices of 127 species and subspecies.

In General Notes, *Ereunetes occidentalis* is recorded from Connecticut; *Coccyzus americanus occidentalis* from Clarke County, Washington; *Vireo olivaceus* inhabiting British Columbia and Washington. Mr. Lucas makes an interesting item concerning the raising of English sparrows by electric light. This pest having been seen catching insects at night about an electric light and carrying them to their young. "Raising vegetables," he says "by electric light may be a good thing, but raising English sparrows in this manner is of more than doubtful utility." W.E.B.

In the *Scientific Memoirs* of Medical Officers of the Army of India, edited by W. R. Rice, Calcutta, 1892, part vii, we find five different papers on intestinal worms infesting horses, sheep and man. The first paper is by G. M. F. Giles on Some Observations on the Life History of *Sclerostomum tetracanthum* Diessing. This intestinal parasite is a strongyloid nematode closely related to *Dochmius duodenalis*, which infests the human system. *Sclerostomum tetracanthum*, is a small worm about half an inch in length, but as it occurs in enormous quantities—several buckets full having been taken from a single horse—it causes grave disorders and generally death. The disease caused by this parasite is in India known as "Surra," in Europe as epizooty, and appears to be prevalent at times in almost every county in the world.

Sclerostomum infests only the upper half of the large intestine, the ova only being dropped with the dung. The eggs develop only under the influence of rain and moisture, producing a tiny, white and semi-stransparent worm, the Rhabdite-stage of the parasite in question. These Rhabdite worms feed and live in the dung until they become sexually fertile when they proceed to grass and weeds. This transition can only be accomplished under the influence of rain or abundent moisture under any form. The mature male Rhabditis attains a length of 1.7 mm., two-ninths of the length being occupied by the body proper, the remaining seven-ninths consisting of a long hair-like tail. The female Rhabditis attains a length of 2.25 mm., but is otherwise similar to the male. One or more generations are produced by this stage. Finally the ova of the Rhabdite

form gain access to the intestines of herbivorous animals, being swallowed with the green plants on which they feed. The embryos develop rapidly and finally encyst themselves in the walls of the stomach, cœcum and colon, and later on emerge as full grown Sclerostoma. *Dochmius duodenalis*, which is very similar to the Sclerostomes, causes the dreadful disease in man known as "Kala-azar" or "Beri-Beri." The best remedy to be administered are repeated doses of ½ oz. each of Thymol, 1½ oz. in all being sufficient to expel all the free worms, the treatment to be repeated when the cysts have developed.

In a subsequent paper in the same part Mr. Giles describes 3 species of Sclerostomes—*robustum*, *equinum* and *tetracanthum*, all infesting the horse.

Following this paper is one by the same author "On Nodular Disease of the Intestines in Sheep." In Assam and Burma the keeping of sheep is almost impossible on account of this nodular disease, the sheep dying off one by one in quick succession. This disease, also common in United States, is caused by a nematode worm, *Œsophagostoma columbianum* Curtice. The ova are carried away by the dung, hatch out in one or two days and become Rhabdites with short tails. They moult at least three times, and feed on green vegetation. Their eggs pass into the intestines of sheep, encyst there and later develop into Œsophagostomas. No successful treatment is possible and no prevention is likely to succeed. The Rhabdite forms exist continuously as free nemadotes and only await the opportunity to pass into the sheep. Stall feeding with steamed fodder appears to be the only prevention. G.E.

PROCEEDINGS OF SOCIETIES.

CALIFORNIA ACADEMY OF SCIENCES. *August 1, 1892.* President Harkness in the chair.

Donations to the museum were reported from S. Reubel, W. W. Price, A. W. Anthony, Dr. J. G. Cooper, John Carlsen, Frank H. Vaslit, W. O. L. Crandall, Agent S. P. Co., Indio, Cal., C. W. Knox, Frank H. Holmes, Charles Fuchs, Mr. Goebig, M. Braverman, E. D. Flint, J. W. Barry, Dr. Harkness, Charles A. Keeler, J. J. Kinrade.

The Librarian reported 187 additions to the library.

A paper by William W. Price on the Discovery of a New Grove of *Sequoia gigantea* was read by Walter E. Bryant.

A paper by Dr. J. G. Cooper on Land and Fresh-water Shells of Lower California was read by title.

The Secretary read a paper prepared by Melville Attwood on the advisibility of making an exhibition of Californian iron ores at the World's Columbian Exposition.

Dr. Harkness exhibited a living specimen of Amblystoma and made a few remarks concerning its metamorphosis.

Charles A. Keeler and Prof. W. E. Ritter discussed certain points in Romanes' theory of natural selection.

September 5, 1892. President Harkness in the chair.

Donations to the museum were reported from W. G. Blunt, Carlos Troyer, R. G. Stitt, Lieutenant Holcomb, E. W. Jones, Melville Attwood, R. C. McGregor, Miss Effie A. McIllriach, George B. Badger, Sidney M. Smith, Mrs. Nuttall, Mrs. Bush, A. W. Crawford, T. H. Hittell.

Twelve hundred and twenty-six additions to the library were reported.

E. W. Jones, by invitation, addressed the Academy on the subject of tin mining, explaining the methods used at the Temescal mine in working the ore.

Charles Fuchs made some remarks on *Phlœosinus dentatus* Say, which is ravaging the cypress trees.

September 19, 1892. President Harkness in the chair.

Donations to the museum were reported from C. H. and Dr. E. S. Clark, Henry Lorenzen, J. B. Haggin, James E. Requa, Carlos Troyer, G. P. Rixford, Mrs. A. E. Bush.

The Librarian reported 207 additions to the library.

Charles A. Keeler read a paper entitled Sexual Selection as a factor in the Beautiful in Nature.

October 3, 1892. President Harkness in the chair.

Anthony W. Vogdes and Oscar T. Baron were elected resident members.

Donations to the museum were reported from H. S. Nichols, Miss Effie A. McIllriach, Olaf Olsen, Dr. J. G. Cooper, Dr. L. D. Morse, M. Braverman.

Seventy-six additions to the library were reported.

Major J. W. Powell, Director of the United States Geological Survey, delivered a lecture on the Aboriginal Tribes of North America.

A vote of thanks was tendered to Major Powell.

October 17, 1892. President Harkness in the chair.

Additions to the museum were reported from F. A. Marriott, Jr., Mrs. C. A. Boland, Frank Miller, Dr. J. G. Cooper, Capt. Hultman, Geo. E. Twitchell and Thomas C. Johnston.

A vote of thanks was tendered to Mr. Thomas C. Johnston for his donation of a valuable ethnological collection from the South Sea Islands.

The Secretary read an announcement of the discovery by H. W. Fairbanks of *Proetus ellipticus* Meek, a trilobite from the Waverly Group, in Shasta County, California, identified by Captain A. W. Vogdes.

Lieutenant John P. Finley delivered a lecture on Phases of Pacific Coast Weather and Violent Local Storms, illustrated with stereopticon views.

A vote of thanks was tendered Lieutenant Finley.

CALIFORNIA BOTANICAL CLUB. *September 5, 1892.* Dr. Harkness in the chair.

The following were elected to membership: Miss Alice J. Merritt, Mrs. H. W. Hansen, Thomas Hatch, J. W. Blankinship, Dr. Ferdinand A. Hassler, Miss M. B. Harvey, Mrs. M. E. P. McCowen.

September 29, 1892. President Campbell in the chair.

Professor Douglas H. Campbell delivered a lecture on a Trip to the Hawaiian Islands, of which the following is a brief outline:

On first arriving in Honolulu one is struck by the great variety of tropical vegetation in the city. Of these tropical growths the palms are especially noticeable, the finest of all being the royal palm, *Oreodoxa regia.* Of the other showy plants the various leguminous trees with showy flowers were conspicuous, and of these the handsomest was *Poinciana regia.*

An examination of the shore region outside the city shows that practically none of the garden plants are indigenous, and that the vegetation native to the site of the city is very scanty. In the valleys back of the town, however, where the rainfall is very heavy, vegetation is abundant and varied.

The cane and rice plantations in the vicinity of the city, as well as elsewhere in the islands, are conspicuous features, and, with taro, constitute the staple crops. Cocoanuts are found everywhere near the sea, and banana and pineapple plantations are common.

Other fruits noted were oranges, mangoes, papayas, guavas and others less frequent.

Trips were made to Hawaii and Kauai, respectively the most southerly and most northerly islands of the group.

Attention was drawn to the great difference in the amount of rainfall upon different parts of the islands, especially upon the two sides of Hawaii. At Hilo the annual rainfall is 180 inches, and the vegetation in consequence extraordinarily luxuriant. Here the ferns reach wonderful development and the tree-ferns reach their full size and beauty. The ferns belong to much more diverse groups than in the United States, and all of the principal groups are represented.

On Hawaii the largest forests trees were met, but the variety is much less than on Kauai, which is much richer, especially in flowering plants.

The different geological age of the islands was referred to, Kauai being the oldest and Hawaii the youngest. Hawaii is, indeed, still in process of formation.

The islands being so isolated, and never having been connected with any other land have developed a most peculiar flora. Of the flowering plants and pteridophytes together almost 75 per cent. are strictly peculiar to the islands, while of dicotyledons the percentage is about 85, the highest known in any area of equal size.

October 17, 1892. The Vice-President, Mrs. S. W. Dennis, in the chair.

The following were elected to membership: Prof. W. R. Dudley, Mrs. R. F. Bingham, Mrs. R. M. Austin, J. H. Redfield, E. J. Buell, Prof. M. L. Seymour, Miss Emma Chismore, Mrs. Sophia E. Wilson, L. M. King, Christian Dahl, Dr. F. O. Jacobs, Miss Emma A. Shumway, W. A. Setchell, W. S. Lyon.

CALIFORNIA ZOOLOGICAL CLUB. *August 19, 1892.* The Vice-President, Walter E. Bryant, in the chair.

Mr. Bryant addressed the club on methods of preparing bird skins.

The charter roll was declared closed with this meeting.

October 1, 1892. Dr. Harkness in the chair.

Dr. O. P. Jenkins, of the Leland Stanford Jr. University, delivered an address on Recent Explorations in the Yellowstone National Park. The lecturer spoke in substance, as follows:

Despite the perpetual explorations of the Yellowstone Park by tourists, there is still much to be learned there from a zoological standpoint. Fish Commissioner McDonald has been especially interested in the Salmonidæ of the west, the trout, grayling and salmon, and much money has been spent in investigating the subject in this region. In 1889 Messrs. Jordan and Gilbert made a careful survey of the park for the purpose of determining the limits of the troutless area, which is situated in the Shoshone and Lewis Lake region, and includes the streams running from these two bodies of water. The explanation of this troutless area is not far to seek. The district in question is a greatly elevated volcanic region forming a high plateau, and the streams arising upon it invariably plunge down high falls. Accordingly, although trout are plentiful up to the falls they are unable to ascend to the plateau above. This elevated area is a beautifully timbered region, interspersed with grassy meadows affording ample feed for horses, and has now been well stocked with trout by the Fish Commission.

In 1891 I was sent with Prof. Evermann, of the Fish Commission, to this locality to see how the trout which had been left there were doing, and to see what other streams in the region might be stocked to advantage. A fine opportunity was also presented to work out an interesting problem in the geographical distribution of the trout of this district. We started from Two Ocean Hotel, with a pack train of eighteen horses and complete outfit, for Two Ocean Pass, a pretty meadow valley of high elevation, from which flow a number of streams, some ultimately reaching the Atlantic and some the Pacific system of water courses. The trout in the two water-courses had been considered as two species, but Dr. Jordan, after an examination of a large series, pronounced them to be the same. An examination showed that one Atlantic stream had piled up a gravelly bank and the water had been dammed up so that by the removal of a few stones a strong stream ran off towards the Pacific creek. Trout were found on both sides of the divide in this instance. Near at hand another stream was found, which could be made to flow in both directions from the divide by diverting its channel at a slight bend, and allowing the water to flow up one arm and down the other of a sort of Y.

The bull-head, blob, or miller's thumb, as it is variously called, is found in this troutless area above the falls, especially in the Gib-

bons River. Strangely enough no blob are found in Yellowstone Lake or River, which are alive with trout. Why it should go where it apparently could not get, and did not go where it might easily have been, is indeed a mystery. Geysers occur at various points near the shore of the Yellowstone Lake, where there is a sudden contrast from ice cold to boiling water. Trout may be caught and cooked in the same body of water, almost without stirring from one spot. In fact, not unfrequently they swim into a geyser unawares and are speedily killed. All these trout of the Yellowstone Lake and River are infested with a parasite—a cestode worm. It sometimes lodges in the abdominal cavity, sometimes in the pyloric cæca or intestines, but most frequently in the muscles. For some time we were unable to understand how it was that the trout of the Yellowstone Lake were thus infested, while those of Jackson Lake were not, but the explanation was at last found. The California gull and white pelican are hosts of the adult form of this parasite, which lives in their intestines. The eggs of the worm, when voided by the birds are eaten by the trout, and developing there into the larval stage burrow into the muscles of the fish.

In an interesting stream known as Crawfish Creek no fish were present, but an abundance of crawfish (*Cambarus ambellis*). Grayling were restricted to Firehole River and Gibbon River, which flow together. The temperature of the water makes a great difference in the size of trout, an extremely cold temperature retarding growth, and it is on this account that most of the Yellowstone trout are comparatively small in size.

MEMBERS OF THE CALIFORNIA ZOOLOGICAL CLUB.

Mrs. Kate D. Adams, 109 Montgomery St., San Francisco.
H. M. Anthony, 124 Oak St., San Francisco.
Mrs. A. L. Bancroft, 1605 Franklin St., San Francisco.
Frank W. Bancroft, Berkeley, Cal.
Oscar T. Baron, Fresno, Cal.
Dr. F. E. Blaisdell, Mokelumne Hill, Cal.
A. W. Bowman, Piedmont, Cal.
A. W. Bowman, Jr., Piedmont, Cal.
Mrs. Katharine Brandegee, 819 Market St., San Francisco.
Robert B. Brandegee, 253 W. 42d St., New York City.
Townshend S. Brandegee, 819 Market St., San Francisco.

Prof. John C. Branner, Palo Alto, Cal.
Walter Brett, Lakeport, Cal.
Walter E. Bryant, 819 Market St., San Francisco.
Miss Louise M. Bunnell, 2610 Pacific Ave., San Francisco.
Miss Mabel Campbell, Irving Institute, San Francisco.
Allen M. Carpenter, Berkeley, Cal.
Mrs. John Vance Cheney, 900 O'Farrell St., San Francisco.
Dr. Edward S. Clark, 16 Geary St., San Francisco.
Miss Josephine Cohn, 1452 O'Farrell St., San Francisco.
Prof. John H. Comstock, Ithaca, N. Y.
Miss E. R. Congdon, Berkeley, Cal.
Dr. J. G. Cooper, East Oakland, Cal.
D. W. Coquillett, Los Angeles, Cal.
Miss A. T. Croughwell, 10 Middle St., San Francisco.
John L. Curtis, 1513 Curtis St., Oakland, Cal.
H. E. Davis, 2323 Devisadero St., San Francisco.
Dr. Fred W. D'Evelyn, 219 Geary St., San Francisco.
Miss Daisy Doud, 2211 Steiner St., San Francisco.
George W. Dunn, 321 Sansome St., San Francisco.
Miss Alice Eastwood, 819 Market St., San Francisco.
Dr. Gustav Eisen, 819 Market St., San Francisco.
Miss Florence Emerson, 1030 24th St., San Francisco.
Mrs. L. D. Emerson, 1030 24th St., San Francisco.
Mrs. E. C. B. Fassett, 2622 Sacramento St., San Francisco.
Miss Ethel Fountain, 528 11th St., Oakland, Cal.
Miss T. M. Franklin, 514 Hermann St., San Francisco.
Charles Fuchs, 212 Kearny St., San Francisco.
Dr. C. H. Gilbert, Menlo Park, Cal.
S. Glucksman, 538 3d St., San Francisco.
Dr. H. W. Gould, 1422 C St., San Diego, Cal.
William F. Greany, 827 Brannan St., San Francisco.
William H. Hall, East Oakland, Cal.
Mrs. A. Hall-Jones, 1514 Pine St., San Francisco.
Miss Katharine V. D. Harker, 1909 Pine St., San Francisco.
Dr. H. W. Harkness, Pacific-Union Club, San Francisco.
Miss Laura J. F. Hecox, Santa Cruz, Cal.
Henry Hemphill, San Diego, Cal.
J. W. Hendrie, Sound Beach, Conn.
Miss Frances Hodgkinson, 1513 Pierce St., San Francisco.

Miss Caroline L. Hunt, 1520½ Vallejo St., San Francisco.
A. M. Ingersoll, 873 Fifth St., San Diego, Cal.
Dr. O. P. Jenkins, Menlo Park, Cal.
Ira C. Jenks, Lakeport, Cal.
F. O. Johnson, Berkeley, Cal.
Dr. David S. Jordan, Menlo Park, Cal.
Charles A. Keeler, Berkeley, Cal.
W. D. Kingsbury, 2530 Mission St., San Francisco.
Albert Koebele, Alameda, Cal.
A. Krause, Calistoga, Cal.
Miss Eugenia C. Landström, Berkeley, Cal.
John D. Locke, Haverhill, N. H.
James L. Lockwood, Chicago, Ill.
P. MacEwen, 819 Market St., San Francisco.
Miss L. J. Martin, 711 Jones St., San Francisco.
Miss Effie A. McIllriach, 1030 24th St., San Francisco.
F. H. McLean, Berkeley, Cal.
James D. Meeker, Box G, Berkeley, Cal.
Dr. C. Hart Merriam, Washington, D. C.
Edward C. Merwin, 1262 Franklin St., Oakland, Cal.
Dr. H. N. Miner, Berkeley, Cal.
H. E. Parker, cor. Broadway and Taylor Sts., San Francisco.
F. S. Plimpton, San Diego, Cal.
Miss F. Prag, Commercial High School, San Francisco.
William M. Price, Palo Alto, Cal.
A. P. Redington, 23 Second St., San Francisco.
Rev. F. Reiser, Marysville, Cal.
L. E. Ricksecker, Santa Rosa, Cal.
Prof. William E. Ritter, Berkeley, Cal.
J. J. Rivers, Berkeley, Cal.
Miss Inez L. Robinson, Berkeley, Cal.
W. T. Ross, 6 Eddy St., San Francisco.
Miss Sara W. Scruggs, 1036 Valencia St., San Francisco.
J. R. Scupham, 942 Myrtle St., Oakland, San Francisco.
Fred A. Seavey, The Palms, Cal.
T. E. Slevin, Jr., 2413 Sacramento St., San Francisco.
Norwood B. Smith, 1619 Washington St., San Francisco.
W. P. Steinbeck, Hollister, Cal.
F. Stephens, Santa Isabel, Cal.

Clark P. Streator, U. S. Dept. of Agriculture.
Mrs. W. J. Stringer, 2007 Taylor St., San Francisco.
Adolph Sutro, Sutro Heights, San Francisco.
Aurelius Todd, Eugene, Oregon.
F. C. Torrey, 108 Grant Ave., San Francisco.
Charles H. Townsend, U. S. Fish Commission.
Prof. C. H. Tyler Townsend, Las Cruces, N. M.
Carlos Troyer, 538 Turk St., San Francisco.
Edwin C. Van Dyke, Berkeley, Cal.
Frank H. Vaslit, 705 Sutter St., San Francisco.
Miss Emily I. Wade, 1819 Eddy St., San Francisco.
Miss Nettie Wade, 1819 Eddy St., San Francisco.
Mrs. N. A. Wood, 2211 Steiner St., San Francisco.
Allen C. Wright, 1814 Taylor St., San Francisco.

NOTES.

The Journal of Botany for July says: "British botanists, especially London ones, will regret to learn that the introduction of plants into localities where they may become established is being carried on with considerable energy by a member of a London Natural History Society. Hampstead Heath and Keston Bog are two of the places where this pernicious and unscientific action has occurred; and *Parnassia* and *Pinguicula vulgaris* were planted in the New Forest bogs by the same individual. In this case it was possible to nullify the attempt; but the precautions then taken may be easily evaded, and it is to be feared that in some cases the imposition may be successful. We trust that the society referred to will take steps to disassociate itself from so disreputable a proceeding."

Unless there is more in this note than meets the eye of a casual reader it is difficult to see why the writer objects with so much vigor. Nature aided by the peregrinations of man diffuses many of the unsightly and objectionable of her plants pretty widely, and if no attempt is made to deceive, why should not the ornamental ones go visiting also? We would hold that man a benefactor who would vary the prevailing yellow of our autumn fields by the beautiful New England Aster, make our swamps acquainted with the Osmunda and the Side-saddle Flower, or hide in our forests the Indian pipe.

Prof. W. R. Dudley of Cornell is expected in California in December to take charge of the department of Phanerogamic Botany at Stanford University.

Miss Faustina Butler, in charge of the World's Fair exhibit of California Wild Flowers, would be grateful for seeds, bulbs, etc., of our showy wild flowers. Address, care of World's Fair Commission, Flood Building, San Francisco.

Miss E. Cannon, 1402 Bush St., San Francisco, wishes to dispose of her herbarium of named Californian plants; some hundreds mounted on large-sized sheets, but the greater part unmounted.

Botaniska Notiser, 1891, Part 4, 174, has the following note upon *Cystopteris Bænitzii* Dörfler: "According to Botan. Centralblatt 1891, nr. 25, pp. 333–4, there is to be found in C. Bænitz's Herbarium Europæum under nr. 6,510 a new Cystopteris species distributed and described under the name of *C. Bænitzii* Dörfler. While the spores of *C. fragilis* Bernh. are closely covered with pointed teeth, the new species possesses spores which are perfectly smooth without signs of teeth, only here and there furnished with isolated irregular, folded ridges or 'combs.' The specimens were found on slate rocks in the vicinity of Kongswold Dovre in Norway. The species is besides only known by its namer from San Bernardino in South California. Among the many specimens in the herbarium of the Lund University no one agrees with the above description except one with the following: '*C. fragilis* lobulato-dentata Wilde. Elstad, in crevices close to a small brook 3/7, 1865, A. Falck.' Elstad is situated in Gudbransdalen. The value of this new species must be decided by future investigations."

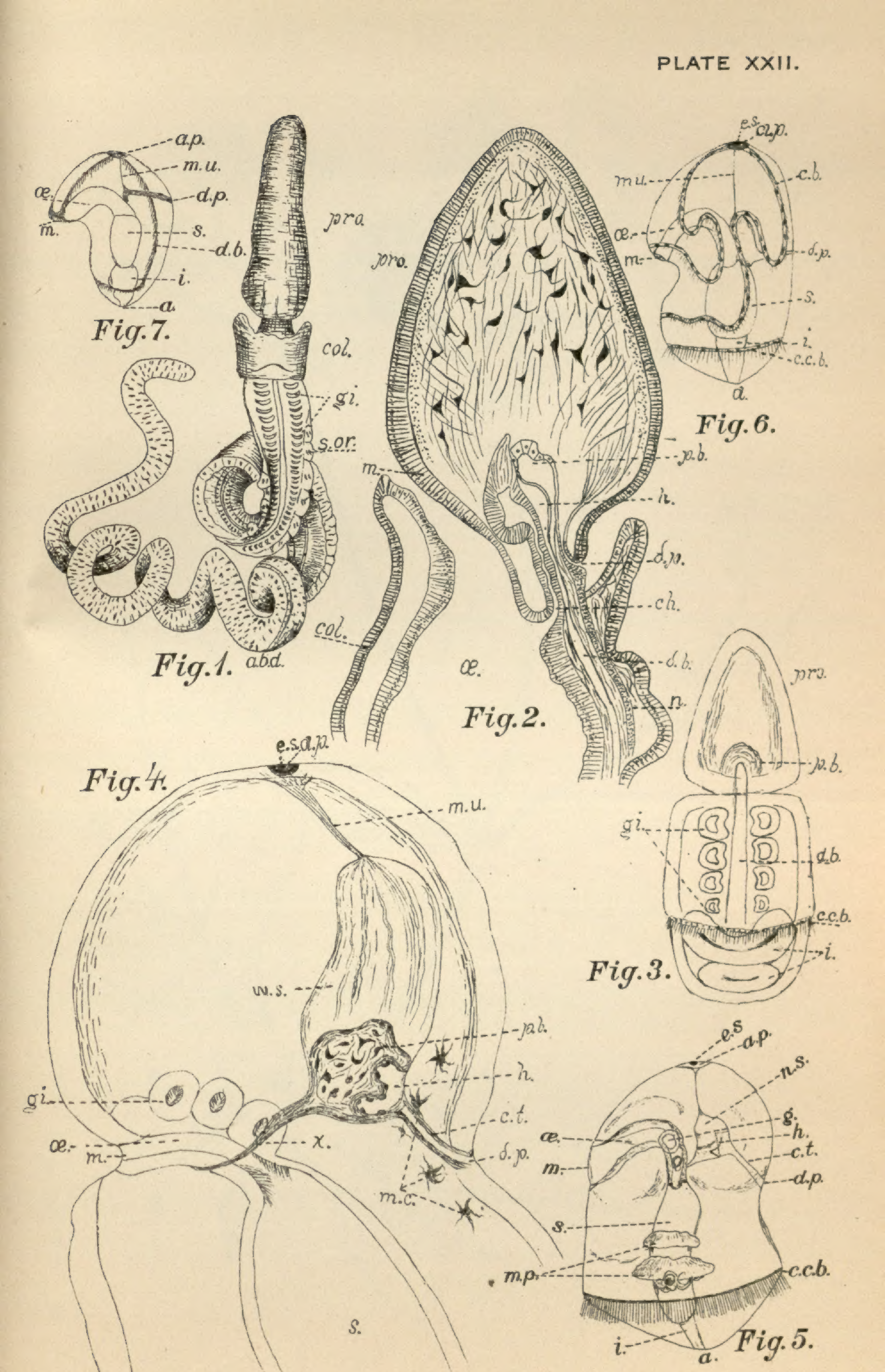
If species of ferns are to be founded upon markings of the surface of the spores a fertile field is prepared for the species maker. The numerous specimens of *C. fragilis* in the herbarium of the California Academy of Sciences show every gradation of spore markings, from mere irregular reticulations to the ordinary echinate form. One example from Santa Clara County is covered with irregular warty projections. Specimens from Rhode Island and from Hawaii agree exactly with the description of *C. Bænitzii*, and others from Sierra Mojada, Colorado, are both reticulated and echinate.

The Harvard Herbarium has been reorganized under the name of the "Gray Herbarium of Harvard University," in charge of Dr. B.

L. Robinson, Curator; Henry E. Seaton, Asst. Curator; Merritt L. Fernald and J. A. Allen, Assistants. Much good work may be expected from this group of young and active men, succeeding to the richest herbarium and best botanical library in America, and inheriting from their great predecessors traditions of moderation which may influence the too violent tendencies of nomenclatural reform.

Mr. William T. Davis, writing in Bull. Torrey Club, xix, 301, about a patch of oaks on Staten Island, names one which he considers a hybrid, *Quercus Brittoni.* It will be interesting to observe how persons who act in such wise, propose to distinguish these names from those of valid species. Gardeners, of course, give names to the multitude of hybrids and sports which they produce for trade purposes, but such names are usually of a fanciful form, and botanical science takes little cognizance of them. Our friends, the zoologists, are evidently neglecting their opportunities. How long the army mule, for instance, has led a miserable existence for want of a specific name, yet it is too be feared that if some fervent "disciple" of any eminent zoologist testifies admiration by attaching his name to the long neglected quadruped, the well meant effort will hardly receive the thanks of the complimented.

ERRATA.—In article on Balanoglossus, Ritter:
Page 190, line 21, for "flow" read "flows."
Page 197, line 34, for "sink" read "sinks."
Page 200, for "Fig. 6" read "Fig. 7;" and for "Fig. 7" read "Fig. 6."
In "List of Abbreviations," for "*v. b.* Ventral blood vessel" read "*w. s.* Water vesicle."
On Plate xxii, Fig. 5, for "*n. s.*" read "*w. s.*"



BALANOGLOSSUS.

RUMFORDIA CONNATA

EPILOBIUM NIVIUM