EXPERIMENT STATION

OF THE

KANSAS STATE AGRICULTURAL COLLEGE,

MANHATTAN.

BULLETIN No. 98—MAY 1900.

HORTICULTURAL AND ENTOMOLOGICAL DEPARTMENT.

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SCALE=INSECTS UPON KANSAS GRASSES.

To THE student of other groups of injurious insects it may appear that the scale-insects have lately occupied more than a due proportion of the public interest. The unheralded advent of the San José scale, its unsuspected distribution over a wide territory, its rapid though insidious increase in a locality where it has once gained foothold, and its somewhat overrated though still very important position as an injurious species have combined to call the scales generally into greater prominence than they have hitherto enjoyed in any extra-tropical country.

These insects, belonging to the family Coccidæ, constitute a group of Homoptera of characters unusual in many respects when compared with insects in general. They differ not only in remarkable ways from other insects, but different species of the group vary within wide degrees among themselves, or even between the two sexes of the same species. In habits they are sedentary, in the most important forms the adult females especially being wholly without the power of locomotion. In the adult males alone are wings present, making possible the approach of this sex to the other at pairing time. All are small insects, and with most of them their systematic study can be carried

on only by the exercise of special skill in manipulation, and by the use of the best appliances.

The group thus presents many attractive features to the student of pure entomology. Their obscure structural characters, their hidden life-histories, and the abundance of new forms, heretofore unsuspected, offer inducements to their study of a kind most inviting to the entomological enthusiast; and that these facts have been appreciated is made evident by the recent considerable increase in the literature on the family.

To the student of economic entomology their study also appeals with especial force, as the members of this group throughout constitute destructive plant pests, of a character all the more dangerous in that they are individually insignificant, and so inconspicuous even in the mass that it requires expert eyes to distinguish them as insects as well as to identify the species. Along with this, their extreme fecundity, their uniformly unfavorable influence on all plants subject to their attacks, and the difficulty of their extermination by any of the customary methods employed in the case of better-known insects of this region, demand, from the strictly practical standpoint, the most assiduous and painstaking pursuit of methods for their destruction.

The scale-insects that have chiefly attracted the attention of students, at least in temperate regions and outside of conservatories, are parasites of the woody plants, mainly occupying the stems, branches, leaves or fruits of these plants above ground. Root-inhabiting forms exist, but it is not commonly the case that these inhabit the perennial herbaceous plants in the open ground in our country.

The object of the present paper is to call attention to the occurrence in Kansas, on common perennial prairie grasses, of certain species of the Coccidæ, in one group at least, of unexpected relationships. The genus *Antonina,* of which several new species are here described, has not hitherto been reported elsewhere from the United States, and this fact gives these forms additional interest.

It is undoubtedly true of the grass-inhabiting forms of the scale insects that they are like the others of the family in their power for injury to the infested plants, but it is fortunate that their occurrence is less common than that of their host-plants. However, the species occur, as will be noted in the following account, upon plants of great agricultural value, the grasses that they inhabit being well known and widely distributed species of the great grazing lands of the state.

The scales upon the grasses, like other Coccidæ are in appearance quite different from insects of more familiar types, but with a little careful observation one may learn to detect them in spite of their deceptive forms. The most common and widely distributed of these

belong to the hitherto unreported genus *Antonina*, and are to be recognized at the base of the stems and the crown of uprooted grasses by the little cottony clusters, which, though smaller in size, present an appearance not unlike that of the common mealy-bug occurring on greenhouse plants, or of the woolly excretion of the well-known aphids or plant-lice upon the bark of the roots and trunks of apple trees. By removing this protective covering, a small, naked, stationary, cream-colored body, which is the adult female, is often exposed. Closely allied to the above are the *Eriococcus* forms, which differ in that the covering is more compact and felt-like, so that the insects in size and appearance resemble large swollen grains of rice. They are arranged longitudinally in irregular groups along the stems above the surface of the ground, or sometimes hidden between the stem and the leaf. By removing the sheathing leaves at the base of the stem, there are often found small brown bodies, somewhat irregular in shape and not unlike the bud-scales of a tree. These are scales belonging to the genus *Pseudolecanium*. Associated with these, there are present at certain seasons young white forms which resemble the beginnings of new shoots. The true nature of these forms can at once be detected by the fact that the insect may be readily scraped from the plant by a knife or the finger. Clustered at the base of the roots are the *Gymnococcus* forms, which are somewhat pear-shaped, and in appearance resemble the larvæ of the potato beetle. In the fall the specimens are naked, while in the spring they are often covered with a heavy mass of cottony threads. In either case they are easily detected, and when crushed stain the hands with their secretions.

The following table will be of assistance in classifying the various groups of scales upon the grasses, so far as they are considered in this paper:

Insects at the lower parts of the stems inclosed in a dense cottony covering, or felted sac, about one-eighth inch in length, which when fresh somewhat resemble swollen grains of rice. . . . . **Eriococcus**

Insects dull terra-cotta red in color, plainly showing the division of the body into segments, and loosely attached to the base of the stems and roots. In the spring specimens are covered with a cottony covering which contains a number of pink-colored eggs. . . . . **Gymnococcus**

Insects oval, hemispherical, quite frequently flattened, and of a dark brown color. They are to be found at the bases of stems protected by the blades.. . . . . **Pseudolecanium**

Insects with a white body, which is stationary and covered with a cottony mass somewhat like the mealy-bugs. They are usually present at the base of the stems.. . . . . **Antonina**

Insects at the base of the stems, living beneath a small circular, dark brown, film-like covering about 0.1 inch in diameter, which if raised with a pin or any sharp point is seen to protect a soft, stationary, cream-colored body, the insect itself, beneath.. . . . **Aspidiotus marlatti**

Grass Coccids Recorded from the United States.

There is little definite knowledge of the extent of this group, particularly the native forms, references to the grass scales being scattered and meager, and quite often incomplete in important particulars. In the following list it has been the endeavor, so far as the limited literature at command has permitted, to bring together published records, from the United States, of this class of scales, with their host-plants. It will not be surprising if a number of species have been omitted.

Rhizococcus quercus Comstock; upon unnamed species of grass, Rept. U. S. Dept. Agric., p. 340, 1880.

Aspidiotus hederæ Vall., var. *nerii* Bouche; upon grass, name not given, Comstock, 2d Cornell Report, p. 63, 1883.

Chionaspis spartinæ Comstock; on *Spartina stricta,* 2d Cornell Report, p. 106, 1883.

Ripersia maritima Ckll.; on *Spartina,* sp., Insect Life, vol. VII, p. 43, 1894.

Orthezia graminis Tinsley; on culms and blades of grass, Can. Ent., p. 12, 1898.

Dactylopius sorghiellus Forbes; on roots of June-grass and timothy, King, in Can. Ent., p. 111, May, 1899.

Pseudolecanium californicum Ehrhorn; on bunch-grass, Can. Ent., p. 103, May, 1899.

Ripersia arizonensis Ehrhorn: in ants' nests on roots of grass, Can. Ent., p. 5. Jan. 1899.

Aspidiotus marlatti Parrott; on *Andropogon scoparius* and *Andropogon furcatus,* Can. Ent., p. 282, 1899.

Antonina nortoni Parrott and Ckll.; on *Bouteloua racemosa,* Can. Ent., p. 280, 1899.

Aspidiotus hederæ Vall.; on grass, King, in Can. Ent., p. 225, 1899.

Dactylopius citri Boisd.; on *Bouteloua eriopoda* in greenhouse, Parrott, MS.

List of Kansas Specimens, with Host=plants.

In the course of the field-work of the past summer, the Department of Entomology of this Station gave attention to the collection of scale insects from the prairie-grasses of the state, recording a number of new species and host-plants. These, together with the species already published for the state, are here appended, thus making the list of coccids upon Kansas grasses complete to date.

Species.	Host-plants.
Antonina bouteloua	**Bouteloua hirsuta.**
	Bouteloua havardii.
Antonina nortoni	**Bouteloua racemosa.**
Antonina graminis	**Eragrostis trichodes.**
	Eragrostis pectinacea.
	Bulbilis dactyloides.
	Paspalum ciliatifolium.

Species.	Host-plant.
Gymnococcus nativus	**Sporobolus cryptandrus.**
Aspidiotus marlatti	**Andropogon furcatus.**
	Andropogon scoparius.
	Panicum virgatum.
	Chrysopogon avenaceus.
Eriococcus kemptoni	**Androgogon scoparius.**
Pseudolecanium obscurum	**Andropogon scoparius.**
	Sporobolus longifolius.
Pseudolecanium californicum	**Andropogon furcatus.**

For the convenience of the general entomologist as well as the specialist, it seems well to reproduce in full the descriptions of *Antonina purpurea,* as well as that of *Gymnococcus agavium,* with the corrections and additional points of value as suggested by Douglas, the publications containing them being inaccessible to many entomologists. Their incorporation in this publication is further desirable as making the present account of these genera quite complete.

In the preparation of this paper we desire to express our appreciation of the assistance rendered by Messrs. J. B. Norton and H. B. Kempton in their careful work in collecting, and by the former more particularly in the determination of the grasses. We are especially under obligations to Prof. Theo. D. A. Cockerell for many valuable suggestions and for the gift of a number of closely allied species, for the loan of mounts of types, and for the description of *Antonina purpurea,* translated by his wife. We are also indebted to Mr. C. L. Marlatt for a copy of Lichtenstein's description of *Antonina brachypodii,* and to Mr. E. M. Ehrhorn for topotype specimens of *Pseudolecanium californicum.*

Studies of Grass Coccids, with Description of New Species, by P. J. Parrott.

ANTONINA.

Antonina Signoret, Annales de la Société Entomologique de France, vol. v, 1875, pp. 25—27.

Adult females inclosed in a cottony sac; apodous, with or without antennæ, excreting from the abdomen a very long cottony appendage; anal ring with six hairs. Larva with six-jointed antennæ.

TABLE OF SPECIES.

1. Anal orifice deeply invaginated, protected on ventral surface by a chitinous plate. . . . . boutelouæ
   Anal orifice not so 2
2. Antenna short, aborted, with not more than three segments. . . . 3
   Antenna with five segments, occasionally four. . . . graminis
3. Derm, exclusive of anal segment, with a large number of hairs. . . purpurea
   Derm not so . . . . nortoni

Antonina bouteloueæ, n. sp. (Plate I, figs. 2, 3, 4, 5, 6; plate V, fig. 3.)

Sac white, cottony, 3 mm. long, 2 mm. wide. Living female oval in form and cream-colored. Specimens boiled in KOH clear easily, with the exception of the spiracles, mouth-parts, antennæ, and more especially the ultimate segment, which remains strongly chitinous, and of a dark yellowish-brown color. Small round glands in all parts of the body, more numerous in the caudal region. About anal area, a number of small sharp spines and many slender hairs. Antenna short, thick, composed of three segments. Spiracles strongly chitinous, surrounded on the outer margin by a crescentic group of rather large round glands. Anal orifice large, deeply invaginated, and protected on the under side by a large chitinous plate.

Larva about .5 mm. long by .2 mm. in width, oval in form. In KOH, is yellowish, with the legs and mouth-parts darker. Anal ring of medium size, with six stout bristles. Lateral of anal opening, one long slender hair, with several small sharp spines at its base. On the transverse middle of each segment, a row of short conical spines. Legs stout, chitinous, with tarsus and tibia subequal; tarsal digitules long, filiform. Antenna six-segmented, measuring as follows, in micromillimeters, respectively: (1) 17, (2) 14, (3) 13, (4) 8, (5) 10, (6) 49.

Habitat.— Collected by H. B. Kempton, May, 1899, at the base of stems of *Bouteloua hirsuta,* growing on the sand-hills south of Manhattan, Kan.

A specimen closely resembling this species was found by J. B. Norton in the collections of the Botanical Department upon *Bouteloua havardii,* "Limpia canyon, Texas, G. C. Neally, '89." It resembles *bouteloueæ* in the peculiar structure of the anal orifice, but differs in the small disc-like spiracles. More specimens are needed to insure a correct determination of the species.

Antonina purpurea.

Antonina purpurea Sign., Annales de la Société Entomologique de France, vol. v., 1875, pp. 25—27.

*Laboulbenia brachypodii** Licht., Mittheilungen der Schweizerischen entomologischen Gesellschaft, Nov. 1877, Band V, Nr. 5.

Antonina brachypodii Ckll., Check-list of the Coccidæ, Bull. III. State Lab., vol. IV, art. XI.

This species, of the length of 2 to 3 mm., by 1 mm. in width, is enclosed, in the most advanced state, in a padded sac, like *Eriopeltis festucæ,* but forming a smaller heap, and being found either above the neck of the plant in the open air, or on the root.

*Lichtenstein, in a postscript to his mention of *Laboulbenia brachypodii,* expresses an opinion that his species is identical with *Antonina Purpurea.* I have therefore made *brachypodii* a synonym. His description of the species is of itself not sufficient for any satisfactory determmation.

In the first case, one notices that from the superior point of this sac the insect emits a long silky conduit, which is secreted by the abdominal extremity which corresponds to this point. The insect is then head downwards. If one opens the sac, it appears as a mass, of an elongated cylindrical form, blackish, which, crushed, tints the fingers with dark red. In this stage it sufficiently resembles a dipterous pupa, all the more that on examination it is quite impossible to see the legs, which have disappeared.

The superior extremity is rounded and allows to be seen the vertices of the antennæ, which present a few visible articulations, the last with five or six hairs, almost spinous; the inferior is a little less wide, narrower than the body, and offers a considerable thickening of the derm, which, besides, is more colored and strongly punctuate with rugose points. A little before the edge a wide genito-anal ring, with six very long hairs, but which do not exceed the abdomen; on each side we can distinguish two lobes with some hairs, which are prolonged even on the segment; amidst the punctuation are seen a few short hairs. On the derm after it has been decolored by potassium one sees above a great number of spinnerets in the form of hairs, and with a rounded punctuation. Below it seemed to us that these were only hairs. On each side one easily sees the stigmata, which are colored, and accompanied by an abundant punctuation. The rostrum offers a pretty long insertion, with the rostral filaments very long—the curve attaining almost the last abdominal segment; these are not very visible, except the last ones of which the suture presents some rugose-colored points. The lower lip or chin we found difficult to isolate, and we could not say if it is multiarticulate in the adult insect advanced in age; but with the embryonic larva we were quite well able to isolate and draw it, and it is formed of two articulations, which helped us to class this species with the coccids and not with the lecaniids. In this stage we found the antennæ of six joints, of which the sixth is the longest, the others short and nearly equal. The legs are thick, slightly pubescent; the tarsus equals the tibia as to length, the claw is long, with the four usual filiform digitules. What struck us most in this larva was the extraordinary length of the rostral filaments, which unfolded would exceed three to four times, or even more, the length of the body.

Habitat.— It is found on the stubble and at the root of certain of the Gramineæ, principally *Milium* and *Agropyrum*, and by its position and habitat gives cause for the idea that it might be C. *radicum-graminis* of Geoffroy or Fonscolombe.

Antonina nortoni. (Plate I, fig. 5: plate V, fig. 4.)

Antonina nortoni Parrott & Ckll., Can. Ent., Oct. 1897.

Sac white, cotton-like, completely enveloping female. Female oval, plump, cream colored, with slight tinge of brown on margin. There are many single glands, especially in the caudal region, but they are less numerous anteriorly. On outer side of each spiracle there is a crescentic group of rather large circular glands, placed very close together. Antennæ short, thick, composed of three segments, measuring respectively 18—25, 13—16, 27—28 micromillimeters. Spiracles chitinous, large and extended. Anal orifice circular, situated in a slight depression, surrounded by a strong chitinous ring. Around anal area are many slender hairs, very much smaller than bristles of the anal ring.

Habitat.— Found at the bases of the stems of *Bouteloua racemosa,* on Bluemont, Manhattan, by J. B. Norton, April 25, 1899.

Antonina graminis, n. sp. (Plate I, fig. 6; plate IV, fig. 1.)

Sac of female globular, dirty white, 3 mm. in diameter. Female oval in form, of a light brown color, slightly pollinose, 2.6 mm. in length, 1.4 mm, in width. Specimens are rather difficult to clear in KOH, almost invariably retaining a yellowish coloration. Derm is heavily punctuated with many small round glands, especially in the caudal region. A few short slender bristles are present in all parts of the body, but are more numerous on the posterior segment. Anal orifice quite large, with six stout bristles, surrounded by a strong chitinous ring. In the caudal area are a small number of bristles, more slender, and a little shorter than those in the anal orifice. Spiracles large, chitinous, surrounded on the outer margin by small oval and round glands, about forty in number, situated closely together in a crescentic group. Antennæ rather short and thick, consisting of four or five segments, measuring, respectively, in micromillimeters: (1) 21, (2) 23, (3) 21, (4) 27, and (1) 14, (2) 21, (3) 12, (4) 7, (5) 25. The three basal segments are usually broad, of about the same width, while the last two segments taper sharply. In some specimens the anterior legs were present; these were thick and not very chitinous; femur longer than tibia, and tibia longer than tarsus.

Habitat.— Collected at the base of stems of *Eragrostis trichodes* by J. B. Norton, May 30, 1899, at St. George; upon *Bulbilis dactyloides* on sand-hills south of Manhattan; upon *Eragrostis trichodes, E. pectinacea, Paspalum ciliatifolium* on sand-hills south of Hutchinson; and upon *Eragrostis trichodes,* Nickerson, Kan., by H. B. Kempton, August, 1899.

This species resembles *nortoni,* but is distinguished at once from it by the peculiar antennæ. For the reason that legs appear in a number of specimens, I hesitated at first in placing it in this genus, but prefer to do this temporarily rather than construct a new genus, which seems to be my only alternative.

GYMNOCOCCUS.

Gymnococcus Newstead, Ent. Mo. Mag., 2d series, vol. VIII.

Female adult forming a cottony sac; body soft, naked. Legs highly chitinized, tarsus generally longer than the tibia; anal ring with six short bristles placed in two groups on its anterior lateral margins. Anal lobes absent.

TABLE OF SPECIES.

1. Derm of female with numerous short conical spines.. . . . . **.agavium**
   Derm of female smooth, without spines.. . . . . **2**
2. Glands around spiracles in a crescentic group.. . . . . **nativus**
   Glands around spiracles forming a circle.. . . . . **ruber**

Gymnococcus agavium. (Plate II, fig. 4.)

Coccus agavium Douglas, Ent. Mo. Mag., Dec. 1888.
Gymnococcus agavium Newstead, Ent. Mo. Mag., 2d series, vol. VIII.

Female adult: Short rounded oval, a little narrower in front, smooth, without mealy or cottony covering, very convex and firm on upper side, pinky-yellowish, with some light brown specks on the back, somewhat in two longitudinal rows, beneath soft and very tumid; segmentation visible above and beneath; anal ring of six hairs, the chitinous portions in three equal parts, each separated from the other; the orifice never circular, but crescent-shaped as in the genus *Coccus*. Legs short, chitinous, and scarcely longer than the antennæ; tarsi longer than tibiæ. Antennæ short, stout, tapering, of seven joints, highly chitinous, with wide articulations; 1st joint longest; 2d, 3d and 4th nearly as long, subequal; 5th, 6th and 7th each consecutively shorter and smaller, and having a few hairs; 5th joint with a spine. Mentum biarticulate. Derm above, with numerous short conical spines. Anal lobes obsolete, in their place a long hair. Larva clearly dactylopid. Anal lobes obsolete. Anal ring as in the adult, but all the parts proportionally smaller. Dorsum with six rows of short conical spines, not truncate as in *Coccus*.

Male adult: Blackish brown, shining; head broadly produced anteriorly; antennæ long, slender, piceous, with projecting simple hairs, of ten joints; the first two thick, 1st longest of all, narrow at base; 2d

oval, twice as long as the first; the 3d to 5th thinnest, 3d longest of all; 4th and 5th one-fourth shorter, subequal; 6th to 10th stouter; 6th as long as 2d; 7th shorter; 8th and 9th still shorter, subequal; 10th shorter than 9th, conical. Eyes simple, an ocellus vertical and close to the margin of each. Thorax broad, convex, sides divergent to an angle, posterior angles prominent; posterior depression large. Wings very long, ample, clear white, halteres short, white. Terminal filaments of the body long, white. Legs long, slender, piceous, with short, projecting, simple hairs; tibiæ very long; tarsi one-fourth as long as the tibiæ, claws very short. Pupa in a close-fitting sac made by the larva. Length, 1 mm.

Habitat.— From the under side of leaves of a species of agave from the Royal Gardens. Kew.

Gymnococcus ruber. (Plate II, figs. 2, 3, 6; plate IV, fig. 2.)

Gymnococcus ruber Parrott & Ckll., Industrialist, March, 1899.

Female more or less pyriform, 6 mm. long, and about 4 broad, soft, naked, slightly pruinose, with a very little white secretion on the under side; color dull terra-cotta red, very much the color of the larvæ of *Doryphora* 10 *-lineata* or of red modeler's wax. Surface somewhat shining. Segmentation obscure in adults, but very distinct in younger forms (3 mm. long), which are flattened, nearly circular in outline, and look like Maskell's figure of the adult female of *Dactylopius poæ*.

Boiled in KOH, the insect gives a fine crimson color and becomes quite transparent, except that the legs, antennæ, anal ring and mouth-parts remain brown. Skin with rather numerous small round glands, especially in the caudal region; these glands, focused up and down, sometimes look like short spines. In the cephalic region there are a very few true spines, small and slender. Anal ring very small, subcircular or oblong, strongly chitinous, with six very short bristles, in two sets of three, confined to the anterolateral parts of the ring; mouth-parts small, the so-called mentum distinctly dimerous; legs and antennæ strongly chitinized; antennæ short and rather stout, seven-segmented; segments 1, 2, 3, 4 and 7 subequal, each about 33 micromillimeters long; 5 and 6 subequal, each about 25 micromillimeters long.

Egg oval, yellow to pinkish red, depending upon the development of the embryo, slightly pollinose, about 340 micromillimeters in length by 216 in width. The eggs are deposited in a cottony mass, secreted by the female. Often one-half to three-quarters of the insect is covered by a loose mass of cottony threads. One ovisac examined

contained over 400 eggs, besides a large number of larvæ. On January 27 specimens were commencing to form ovisacs, from which larvæ were seen to emerge March 12.

Larva purplish; legs and antennæ light yellow. Caudal tubercles prominent, with one long filament each, of a length not exceeding one-half that of the body. On each side of the base of the filament one short stout spine. On each segment a transverse row of short stout spines. Antennæ six-segmented, gently tapering, measuring in micromillimeters as follows: (1) 9, (2) 14, (3) 21, (4) 10, (5) 13, (6) 24. Legs stout; femur 70 micromillimeters in length, tibia 47, tarsus 56.

Habitat.— In clumps of *Bouteloua eriopoda,* hidden at the bases of the stems, at Mesilla Park, New Mexico.

Gymnococcus nativus, n. sp. (Plate II, figs. 5, 6; pl. VI, fig. 6).

Female adult 3 mm. long, 2 wide, soft, naked, varying from short rounded oval to pyriform in shape; color dull terra-cotta red, resembling *ruber*. Segmentation quite distinct above and below. Boiled in KOH, the female gives a bright crimson color, and becomes quite transparent, with the exception of the antennæ, legs, mouth-parts, and anal ring, which remain brown. Derm with many small round glands in the caudal region, but with fewer numbers in anterior segments; large oval glands, often elongated oval, few in number, in all parts of the body. A few small slender spines are to be seen, especially around the anal ring and mouth-parts. Exterior portion of spiracle circular, disk-like, surrounded on its outer margin by small round glands, from twelve to twenty in number, placed close together in a crescentic group. Anal ring small and circular, strongly chitinous, and containing six very short stout bristles, arranged in two groups on its anterior lateral margins. Legs stout; tarsi longer than tibiæ. Antennæ seven-segmented; segments 1, 2, 3, 4, 7 subequal, measuring from 17 to 35 micromillimeters in length; 5 and 6 subequal, considerably shorter than the former.

Habitat.— Collected at the base of stems of *Sporobolus cryptandrus* by H. B. Kempton, August, 1899, at Nickerson, Kan.

Aspidiotus marlatti. (Plate II, fig. 1.)

Aspidiotus marlatti Parrott, Can. Ent., Oct. 1899.

Found upon the bases of stems of *Andropogon furcatus, A. scoparius, Panicum virgatum,* and *Chrysopogon avenaceus* (J. B. Norton).

Eriococcus kemptoni, n. sp. (Plate I, fig. 1; plate V, fig. 5.)

Sac of female about 3 mm. long and 1.5 mm. wide, varying from white to yellowish in color, firm and closely felted. Female oval in form, about twice as long as broad, dark yellow to almost orange in color, segmentation complete. Boiled in KOH, female turns to a crimson, and clears quite readily. In the space between the antennæ and the mouth-parts, four to six stout spines placed in a transverse row. Along the margin, extending from the anal ring and not reaching the point of attachment of the posterior legs, from seven to ten stoutspines. Derm when transparent reveals a number of small round glands, especially about the mouth-parts and the caudal region; in these parts small spines are also present. Posterior tubercles with one long hair. Anal ring quite large, with eight bristles. Legs large and stout; femur quite swollen, measuring with trochanter from 130 to 140 micromillimeter; tibia generally shorter than tarsus, measuring from 81 to 98; tarsus, from 84 to 105. There is one stout bristle on inner margin of the tibia near distal end, and several smaller ones on distal end of tarsus. Antennæ seven-segmented, with the segments quite variable. A number of formulæ were as follows: 13 (47) 265, 4 (317) 256, 3 (147) 256, and 7 (321) 456.

Habitat.— Collected by J. B. Norton on *Andropogon scoparius* in Moehlman Bottom, June 1, 1899, Riley county, and also by R. H. Kempton on, *Andropogon scoparius,* August, 1899, at Dundee, Kan.

Pseudolecanium obscurum, n. sp. (Plate III, figs. 1, 2; plate VI, fig. 7.)

Females irregular in size, varying from 2 to 7 mm. long, 1.5 to 3 mm. wide, some globular, others extremely flat; young forms from cream to pink in color, shining, the posterior segment darker colored, often black. Not infrequently the dorsum is longitudinally striated by the veins of the leaves of the host-plant.

Boiled in KOH, female becomes transparent, with the exception of the mouth-parts, spiracles, and the posterior segment; mouth-parts small, complete; spiracles, two pairs, large, somewhat resembling the shape of a dumb-bell with flattened ends, the exterior portion disk-like, the margin composed of a strong chitinous ring, the inner surface composed of many circular glands. Parallel to the margin, on the outer side of the mouth-parts and spiracles, but contiguous to the latter, are a large number of glands varying in size, with a chitinous margin, and forming a band around the body, which is at its greatest width in the region of the spiracles, where there are four or five rows of glands; while about the mouth-parts there are only one or two rows of glands; on the posterior segment the glands are closer

together, and when viewed sidewise appear like small blunt spines. This is best seen when the band of glands comes in contact with the margin of the segment.

Posterior segment very chitinous, with a rather large number of circular glands; margin neither plicate nor crenate, quite even, with the exception of the deep cleft at the middle. The tips of the anal lobes have four or five small bristles each. Anal ring with a number of slender hairs.

Habitat.— At the bases of the stems of *Andropogon scoparius* from Lost Springs, Parsons, Fredonia, and upon *A. scoparius* and *Sporobolus longifolius,* Green Mound, Oct. 28, 1899 (Parrott).

This species is distinguished from *californicum* by the absence of the row of thick blunt spines on margin and by the presence of very chitinous spine-like glands on the margin of the posterior segment.

Pseudolecanium californicum Ehrhorn. (Plate III, figs. 3, 4, 5.)

Nidularia (?) californica Ehrhorn, Can. Ent., May, 1899.
Pseudolecanium californicum Ehrhorn, MS.

Female adult dark brown, 2 to 5 mm. long, 1.5 to 3 mm. wide, with the ultimate segment darker and more chitinous. Specimens vary much in size and shape. Young forms cream to pinkish in color, with the anal segment from dark brown to black; derm smooth, shining, with slight traces of whitish secretion. All stages rest upon a thin white secretion, which in old specimens is quite brittle. No antennæ visible, but in one specimen the anterior pair of legs was present. These were slender, not very chitinous, measuring as follows, in micromillimeters: Femur, 98; tibia, 56; tarsus, 48. Along the margin of body there are several rows of glands. Interspersed among these glands are a number of blunt spines, some of which resemble a spear-head set in a socket, and others little acorns. Few short sharp spines are to be seen here and there in all parts of the body. Margin of posterior segment very chitinous, plicated, and deeply cleft in the middle.

Habitat.— At the base of the stems of *Andropogon furcatus* upon sand-hills south of Manhattan (Parrott), and near St. George (J. B. Norton).

The Kansas specimens vary from the typical *californicum* in the arrangement of the blunt spines along the margin. In our mounts of specimens of *californicum,* kindly sent us by Mr. Edw. Ehrhorn, the row of spines is quite constant; but in the local specimens the spines are not confined to a row, but are distributed among the rows of glands, and, as shown in the drawing, the spines often exceed the cir-

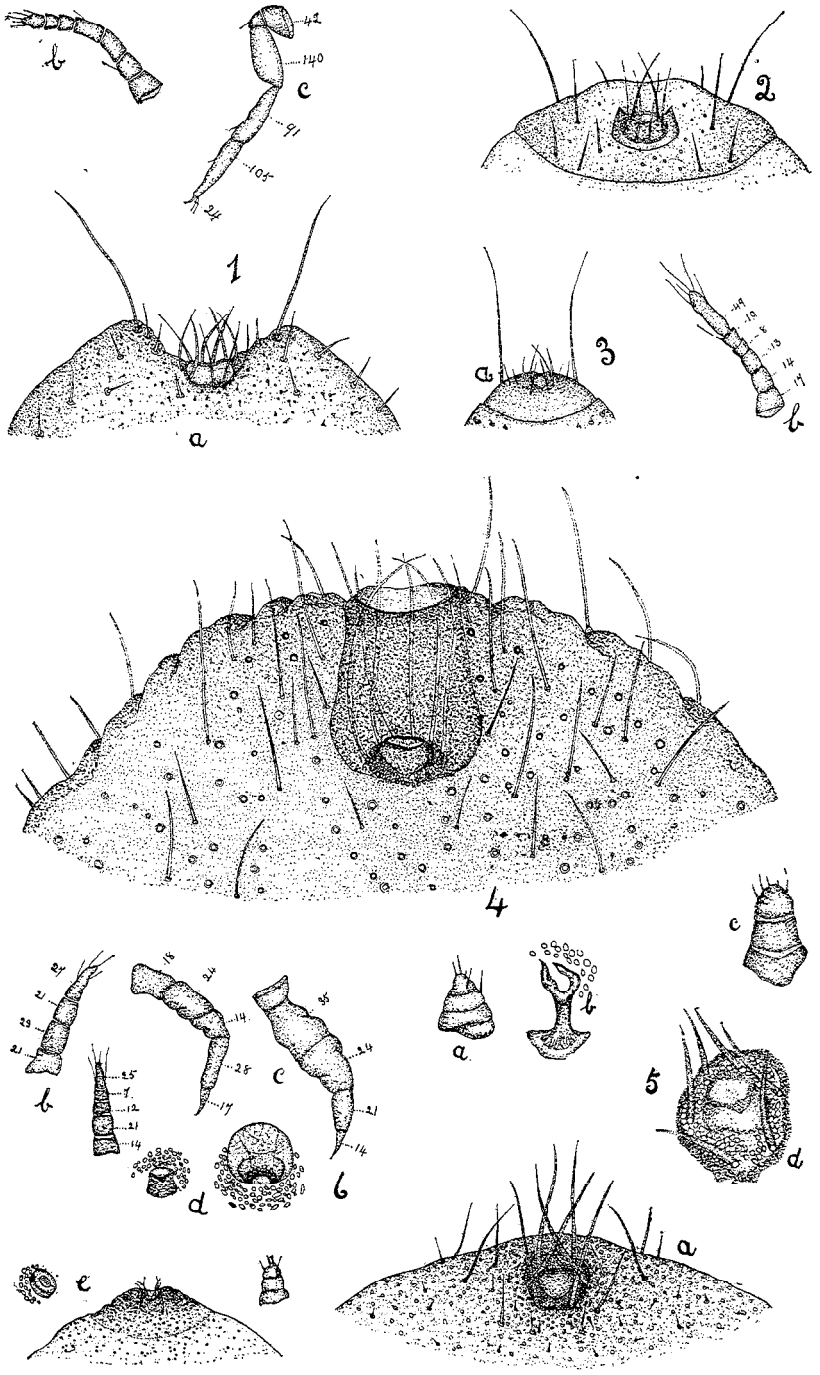
cular glands in number; in some specimens the spines are scarcely apparent. In all other respects the Kansas specimens agree well with *californicum.* In his description, Ehrhorn speaks of the spines as resembling the shape of a spearhead set in a socket. In our mounts they more resemble acorns. An examination of a large number of mature and immature forms of both lots, which we do not possess, would undoubtedly clear up these slight differences.

PLATE I.

Fig. 1.—Eriococcus kemptoni.
a. anal ring of female.
b. antenna of female.
c. leg of female.
Fig. 2.—Anal segment of immature female of Antonina bouteloueæ.
Fig. 3.—Antonina bouteloueæ.
a. anal segment of larva.
b. antenna of larva.
Fig. 4.—Antonina bouteloueæ.
anal ring of female.
Fig. 5.—Antonina bouteloueæ.
a. antenna of female.
b. spiracle of female.
Antonina nortoni.
c. antenna of female.
d. anal ring of female.
Fig. 6.—Antonina graminis.
a. anal ring of female.
b. antennæ.
c. legs.
d. spiracles.
Antonina bouteloueæ, from Texas.
e. anal segment, antenna and spiracle.

All figures greatly enlarged.

PLATE I.



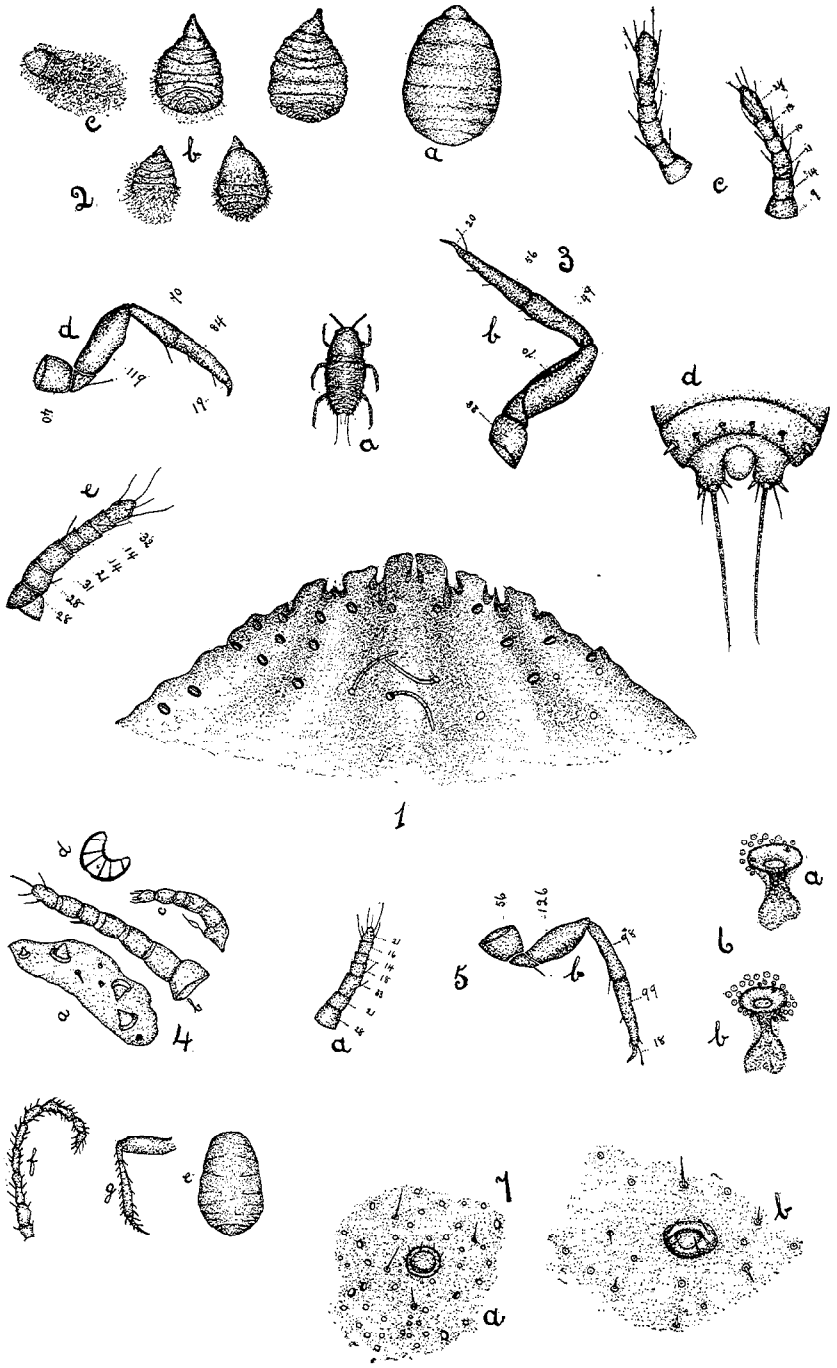
P. J. Parrott, del. ad nat.

PLATE II.

Fig. 1.—Aspidiotus marlatti.
anal segment of female.
Fig. 2.—Gymnococcus ruber.
a. adult female.
b. female with slight cottony secretion.
c. female with ovisac.
d. leg of female.
e. antenna.
Fig. 3.—Gymnococcus ruber
a. larva.
b. leg of larva.
c. antennæ.
d. anal segment.
Fig. 4.—Gymnococcus agavium.
a. derm of female with short conical spines.
b. antenna.
c. antenna of larva.
d. anal ring of female.
e. female.
f. antenna of male.
g. leg.
Fig. 5.—Gymnococcus nativus.
a. antenna of female.
b. leg.
Fig. 6.—Gymnococcus nativus.
a. spiracle.
Gymnococcus ruber.
b. spiracle.
Fig. 7.—Gymnococcus nativus.
a. anal ring.
Gymnococcus ruber.
b. anal ring.

Fig. 4.—adapted from Douglas and Newstead.
All figures greatly enlarged.

PLATE II.



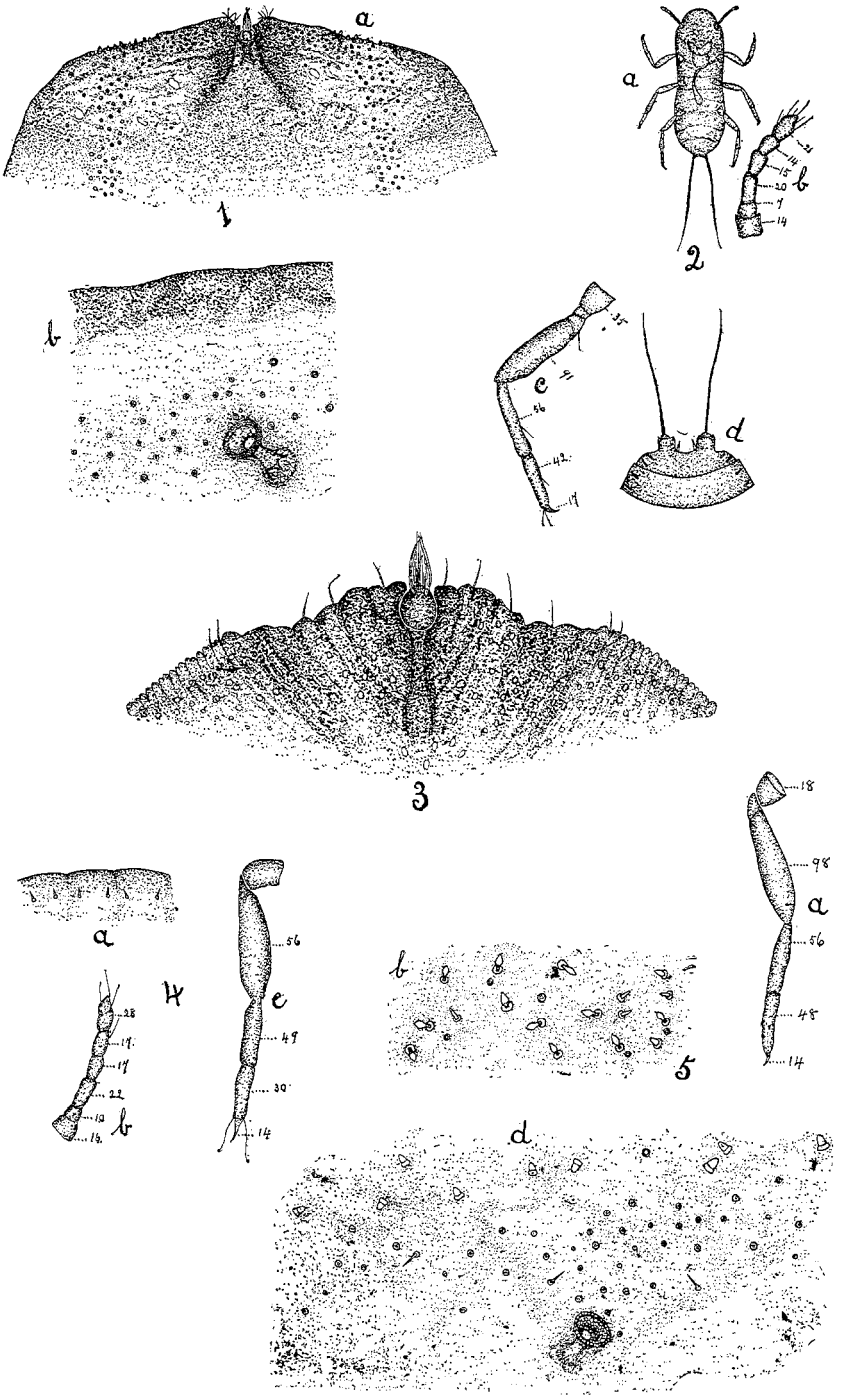
P. J. Parrott, del. ad nat.

PLATE III.

Fig. 1.—Pseudolecanium obscurum.
a. anal segment of female.
b. section of derm with glands.
Fig. 2.—Pseudolecanium obscurum.
c. larva.
b. antenna of larva.
c. leg.
d. anal segment.
Fig. 3.—Pseudolecanium californicum.
anal segment of female.
Fig, 4.—Pseudolecanium californicum.
a. section of margin of larva, showing lateral spines.
b. antenna of larva.
c. leg.
Fig. 5.—Pseudolecanium californicum.
a. leg of adult female.
b. section of derm from local specimens, showing arrangement of glands and spines.
d. section of derm from California specimens, with glands and spines.

All figures greatly enlarged.

PLATE III.



P. J. Parrott, del. ad nat.

PLATE IV.

Fig. l.—Antonina graminis upon Eragrostis trichodes.
Fig. 2.—Gymnococcus ruber upon Bouteloua eriopoda.

Magnified two diameters.

PLATE IV.

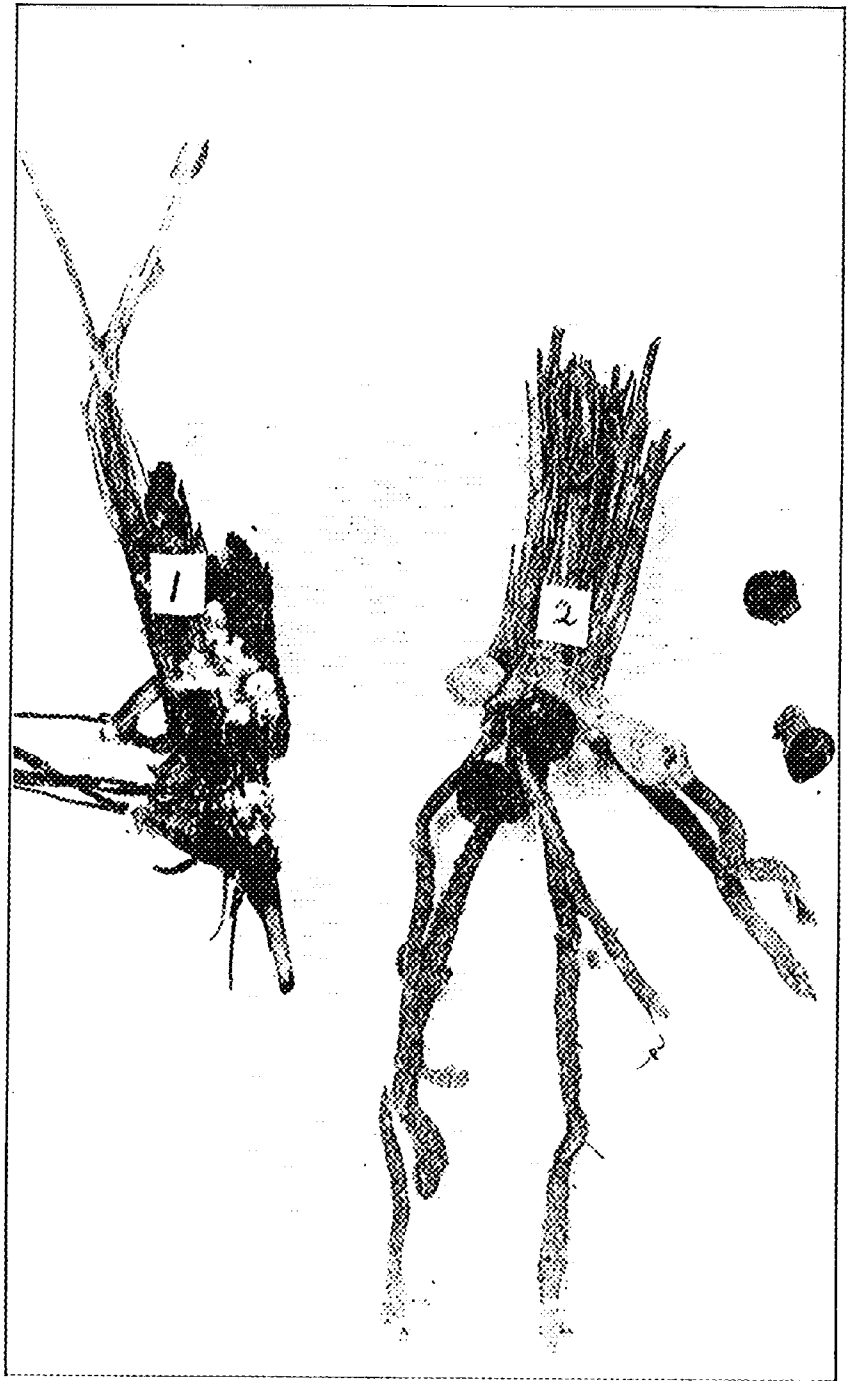


Photo from nature, magnified two diameters.

PLATE V.

Fig. 3.—Antonina bouteloua upon Bouteloua hirsuta.
Fig. 4.—Antonina nortoni upon Bouteloua racemosa.
Fig. 5.—Eriococcus kemptoni upon Andropogon scoparius.

Magnified two diameters.

PLATE V.

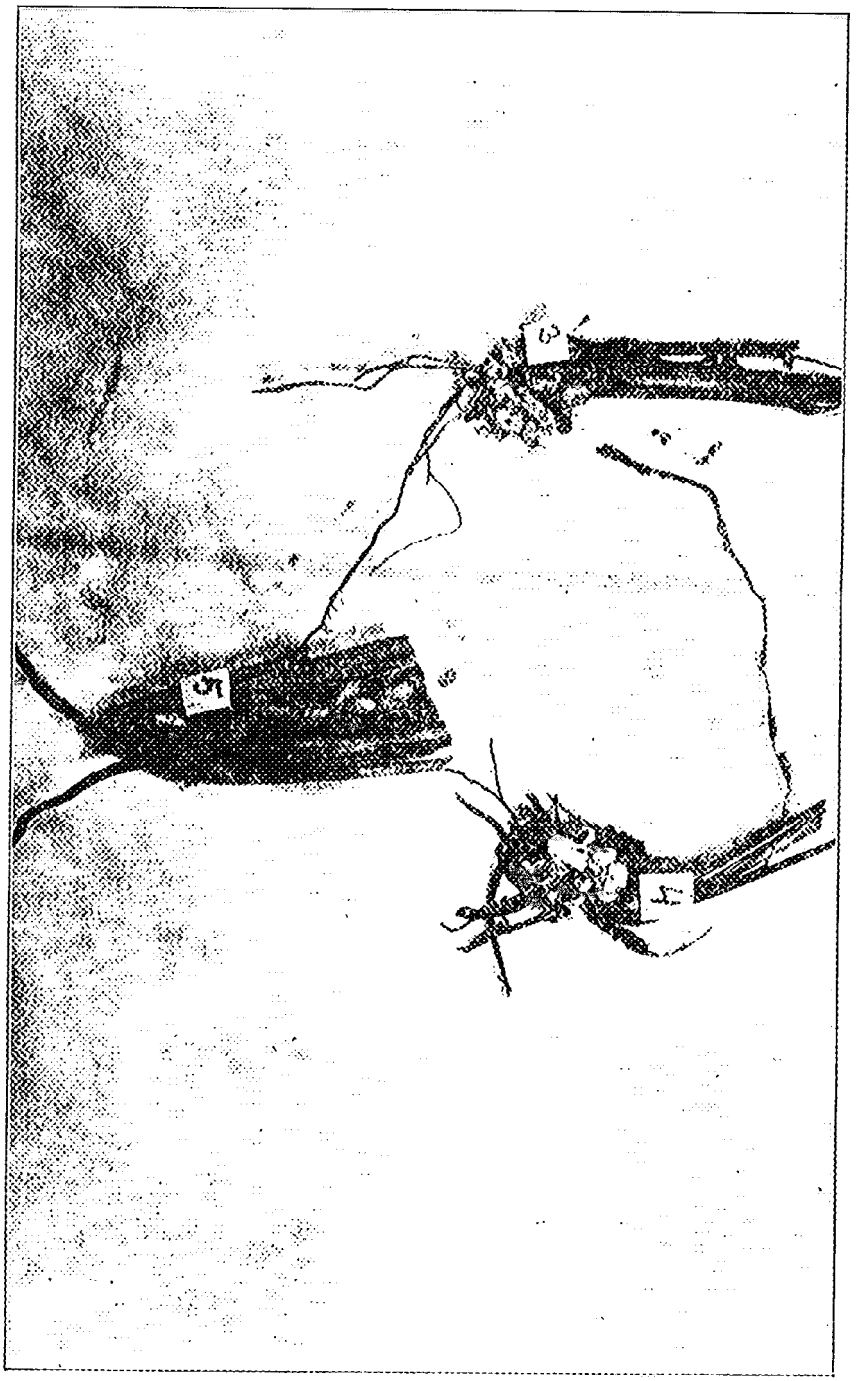


Photo from nature, magnified two diameters.

PLATE VI.

Fig. 6.—Gymnococcus nativus upon Sporobolus cryptandrus.
Fig. 7.—Pseudolecanium obscurum upon Andropogon scoparius.

Magnified two diameters.

PLATE VI.

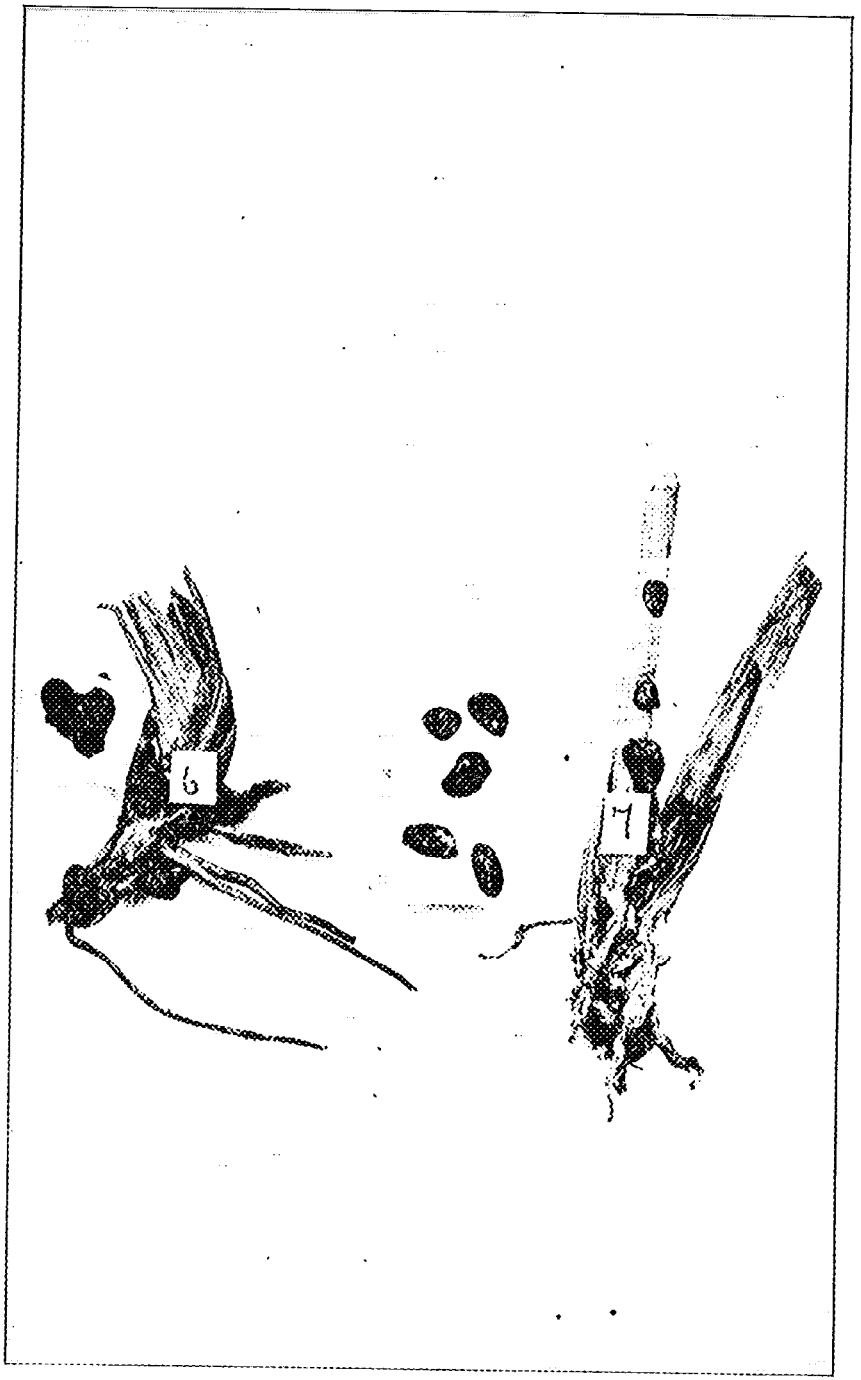


Photo from nature, magnified two diameters.