SPECIFIC CHARACTERS USED IN THE GENUS PSEUDOCOCCUS.

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INTRODUCTION.

The purpose of this investigation was to determine the value of the specific characters used in the descriptions of species of *Pseudococcus*. While all characters used have probably not been noted and while some of those omitted may be of considerable value still the more common and important characters have received attention.

The investigation has been limited to five species,* namely: *agrifoliae* Essig, *citri* Risso, *crawii* Coq., *longispinus* Targ., and *obscurus* Essig. A large number of individuals in each species has been used giving a comparative study for specific variation.

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TABULATION AND STUDY OF CHARACTERS.

An examination of the descriptions of species in this genus shows a great similarity in the characters used. Provided that these characters do not vary beyond certain limits, this would make the identification of the species easier. However, if these characters vary to any great extent and overlap and merge into each other, the adherence by systematists to these characters instead of the introduction of new ones is unfortunate, and would make the identification of species very difficult, if not impossible. In that case the most valuable data in the descriptions would be the locality and host-plant data.

BODY. 1. Size.—In the great majority of descriptions, the length and width of the body is given. In the measurements given, a great variation in the length of each species is noted.† Lengths such as 3–4 mm., 2–5 mm., 1.5–4 mm., are very frequent, showing the wide variation noted by those describing species. The tables‡ showing the lengths of the body, (Tables 1, 2, 3, 4, 5) in the five species studied do not show a variation any greater than this. A variation of from one and one-half

* The writer does not express an opinion upon the validity of these species.

† R. Mathewson. Can. Entom. XXXIX, p. 286.

‡ In these and the following tables an ocular micrometer with a 2.5 and 1.8 inch objective were used. All measurements are given in microns.

to twice the length of the smaller specimens is shown. A greater variation would probably be found if a larger number of specimens were measured.

TABLE 1. *PSEUDOCOCCUS OBSCURUS* ESSIG.

Specimen	Length of Body	Length of Setal-loop	Length of Setae of Anal-lobes		Length of Setae of Anal-ring
I	2736	544	152	136	176
II			152	152	168
III	2784		160	160	184
IV	2526	736	152	144	192
VI	2304	720	152	148	190
IX	3120	560	156	146	185
XI	2040	320	136	135	176
XII	2688	848	137	145	168
XIII	3000	696		152	167
IVX	3072		150	142	168

TABLE 2. *PSEUDOCOCCUS AGRIFOLIAE* ESSIG.

Specimen	Length of Body	Length of Setal-loop	Length of Setae of Anal-lobes		Length of Setae of Anal-ring
I	2928	1160	221	216	240
II	3312	1129	224	223	200
III	4200	1165		208	184
V	3336		182	184	176
VII	4205	120	208	225	292
X	2928	400	200		200
XIII	3120	405		215	248
XVII	4080		208	203	208

TABLE 3. *PSEUDOCOCCUS CITRI* RISSO.

Specimen	Length of Body	Length of Setal-loop	Length of Setae of Anal-lobes		Length of Setae of Anal-ring
I	3120	416	162	178	108
II	2304	256	180	163	108
III	2526		245	223	120
IV	2808		216	209	129
V	2664	448		228	118
VI	2448	240	224	216	117
VII	3144		181	182	120
VIII	2328		192		115
IX	2682	144	235	216	125
X	2712		225	233	130

TABLE 4. *PSEUDOCOCCUS CRAWII* COQ.

Specimen	Length of Body	Length of Setal-loop	Length of Setae of Anal-lobes		Length of Setae of Anal-ring
I	3048	98	228	245	144
IV	2184	101	241	239	168
V	2160	120		200	154
A	2256		216	215	176
B	2160			256	192
VI	2165			248	201
VII	2208	108	208	201	169
VIII	2376		200	176	160
IX	2373		224	222	184
X	2448		223	220	160

TABLE 5. *PSEUDOCOCCUS LONGISPINUS* TARG.

Specimen	Length of Body	Length of Setal-loop	Length of Setae of Anal-lobes		Length of Setae of Anal-ring
I	2088		132	120	139
II	2160		130	124	132
III	1944		96	108	120
IV	2328		95	113	121
VI	2664		113	121	132
VII	2592		127	128	137
VIII	2952		125	123	144
X	3312		228	126	131
A	2950		120	119	138
B	2526		115	122	131

Also only the larger individuals were studied because of the danger of including those in the nymphal stage. Each species was collected from the same or neighboring host plants and were apparently under similar conditions, so that size cannot be taken as a specific character of any great importance. These measurements were taken from mounts. If unmounted specimens were used, the variation would probably be still greater, as then a second factor, namely, the amount of secretion present, would enter. Because of the great variation in size of the different individuals in a species the size of a specimen can be of but little if any value in specific determination.

2. *Shape*.—In descriptions the shape of the body is variously given as elongate-ovate, rounded-oval, convex, tapering at ends, elongate, etc., words which are nearly synonymous. A few species are stated to be considerably out of the ordinary

in shape, but in general synonyms are used in the descriptions of body shape. In the species studied, this could not be an important specific character as all the species studied were of practically the same shape. However, in some species, this might be a distinguishing character.

3. Color.—In descriptions the color of specimens is usually given, being stated as, whitish, greyish, pinkish, with a red tinge, etc. The dermis of specimens in this genus is red. The color of the insect depends on the extent that this dermis is hidden by the waxy secretion. The amount of waxy secretion depends largely on the position in which the individual develops. Those in exposed position requiring more of the waxy covering as a protection than those developing in well protected situations. This variation in color is well shown in *agrifoliae* Essig. The color in this species is usually of a reddish, pinkish, or pinkish brown. The writer has found specimens, however, ovipositing in exposed positions which were completely covered with the waxy secretion and through which the red dermis was not visible. Thus all variations from a white to a red specimen were found. In the other species studied the color was normally white. In the five species studied color as a character for separating the species could not be relied upon.

4. Segmentation.—In many descriptions the segmentation is referred to as distinct or not distinct. This is a character that is not used to any great extent. This is fortunate as the value of the prominence of the segmentation as a specific character is extremely doubtful. In mounted specimens it would depend to a large extent upon the method used in preparation. The segmentation in chloroform mounts is well preserved. In caustic potash mounts it would be largely obliterated. In unmounted as well as mounted specimens the age and size of the specimens is of great importance. In nymphs of *Pseudococcus* the segmentation is very distinct. As it passes through its last moult and becomes an adult, this distinctness of the segmentation is lost to a degree. Then as the insect becomes more and more distended with eggs this tendency to lose its prominent segmentation is increased. Also the distinctness of the segmentation in unmounted specimens would depend somewhat upon the amount of secretion covering the insect. With these factors it does not seem that the distinctness of the segmentation can be a very satisfactory specific character,

ANTENNAE.—The number of segments of the antennae is a generic and not a specific character, and so is of no importance in separating species. Several species have been described with seven segmented antennae. The number of segments, eight, of the type of the genus, *longispinus* Targ, has been adopted in this paper. However, a dimorphism has been described in two instances, viz.: by Folsom for *trifolii* Forbes, and by Essig for *agrifoliae* Essig. In these descriptions there is said to be a winter form which has seven segmented antennae; this form giving rise to the summer form with the normal eight segmented antennae. If further investigation shows these observations to be correct, it will be of both specific and generic importance.

The comparative length of the different segments of the antennae is a character that is the most used of any of the characters of the insect's body. The relative length of the segments and the formulae deduced from the measurements is almost invariably contained in descriptions. Sometimes a considerable variation is noted, several formulae being given.

In this study ten specimens of each species were used. Aside from the question of variation which will be taken up later, the relative length of the antennal segments is not a desirable character to use. The greatest difficulty in its use is the difficulty of making correct measurements and the determination of the exact limits of the various segments. The chitin is not continuous from one segment to the next and consequently the portion between the chitinous parts of the segments, the conjunctiva, is not visible or only slightly so in well cleared specimens. Consequently, in making measurements, the determination of the end of a segment will be only approximately at the center of the conjunctiva. This difficulty will be much increased if there are some bends in the antennae. A second difficulty is to determine some point at the end of the segment from which the measurement will always be taken. This difficulty is most apparent with the first segment. This segment is an irregular truncated cone with the sides of different lengths, and but little longer than the width across the base. It will be seen that the determination of the same points for the measurement of this segment would be nearly impossible. In the tables given the writer does not feel that the measurements of the first segment are dependable. Another difficulty in getting dependable formulae is the very slight difference in

the length of some of the segments compared to each other. A difference of only two or three microns is all that is found in some of the segments. It would be exceedingly difficult to eliminate inaccuracies to the extent that the formulae would not be changed by them. Or in other words, the limit of error is so small that error, even with the greatest care, is bound to occur. Unconsciously the measurements would be made to conform to a given formula or to other measurements. The writer continually met this difficulty. The measurements given in Tables 6-10 were taken with an ocular micrometer at a magnification of 660 diameters. Much more accurate work was possible than would have been with a camera lucida.

TABLE 6. PSEUDOCOCCUS CRAWII COQ.

Specimen	1st	2nd	3rd	4th	5th	6th	7th	8th	Formulae
I	60	67	74	55	38	46	48	108	88214765
	65	67	77	53	48	41	48	106	88214(75)6
II	67	72	87	48	50	48	48	110	88216(647)
	62	79	84	46	48	46	53	115	882175(64)
III	60	72	74	53	58	46	50	108	88215476
	62	67	79	53	48	48	50	108	882147(65)
IV	70	72	94	55	58	53	48	108	88215467
	70	77	96	46	53	48	48	118	88215(67)4
V	60	72	96	50	60	53	48	116	88215647
	67	74	94	48	58	48	50	117	88215764
VI	62	77	91	46	55	50	50	118	88215(67)4
	65	79	86	48	70	46	48	110	88251(47)6
VIII	62	70	82	53	53	53	46	115	8821(456)7
	62	67	82	50	53	50	50	115	88215(467)
IX	60	67	74	48	55	48	53	108	882157(64)
	60	70	74	48	65	48	53	113	882157(64)
X	60	67	79	48	50	46	50	108	8821(57)46
	58	67	77	48	52	43	48	108	88215(47)6
XI	65	67	72	48	48	53	50	106	882167(45)
	60	69	77	43	48	41	48	106	8821(57)46

An examination of the tables mentioned will show the great variation met with. Following herewith is a discussion of the tables of each species:—

CRAWII COQ. Formula (2, 3, 8) 5, 4, 7, 6, 1, Coq. West Am. Scientist '89.

There is no question about the determination of this species. They were all taken from one plant of white sage (*Ramona polystachia*) at Santa Paula, California. In the tables a formula is found which agrees with the one given by Coquillett. In but one specimen was the formula the same for the right and left antennae of the same individual. All the other formulae differed as much as the specifically diagnostic formulae published for all the species of *Pseudococcus*.

LONGISPINUS TARG. Formula, (2, 3, 8) (1, 4, 5, 6) 7. Newstead, "British Coccidae." Vol. II. The specimens examined were taken from palms in the Horticultural Forcing-house of Cornell University. Of the ten specimens measured, the formulae of the right and left antennae of but one specimen were identical. No formula was found which agreed with the one given by Newstead. The formulae varied as much as the specifically diagnostic formulae published for all the species of *Pseudococcus*.

TABLE 7. *PSEUDOCOCCUS LONGISPINUS* TARG.

Specimen	1st	2nd	3rd	4th	5th	6th	7th	8th	Formulae
I	79 84	79 79	84 84	41 43	53 50	43 43	50 48	101 96	83(12)5746 8(31)257(64)
II	65 67	72 67	79 74	36 38	41 46	38 36	46 43	103 101	83217564 83(12)5746
III	58 60	65 62	63 60	36 36	41 43	38 34	43 41	96 91	82317564 82(13)5748
IV	62 58	62 58	70 70	31 34	48 48	41 38	48 43	108 96	83(21)(75)64 83(21)5764
V	55 58	72 72	67 65	29 36	50 48	29 43	43 46	106 106	823157(46) 82315764
VI	62 60	72 77	74 74	43 46	60 58	46 48	48 48	106 106	83215764 82315(76)4
VII	74 72	72 82	74 91	48 50	62 62	43 46	43 48	101 103	8(13)254(67) 88215476
VIII	65 70	67 72	70 70	43 41	50 46	41 43	48 46	98 96	83215(47)6 82(31)(75)64
IX	55 60	65 65	65 65	36 34	48 50	38 41	46 43	101 101	8(32)15764 8(23)15764
X	62 62	72 70	65 65	43 41	58 48	41 43	48 43	101 103	82315746 82315(76)4

TABLE 8. PSEUDOCOCCUS AGRIFOLIAE ESSIG.

Specimen	1st	2nd	3rd	4th	5th	6th	7th	8th	Formulae
I	94	77	74	50	55	50	48	108	81235(46)7
	89	82	74	53	55	53	48	115	81235(46)7
II	72	72	74	48	58	48	41	106	83(21)5(46)7
		74	72	48	48	53	53	108	
V	72	79	72	48	48	48	50	113	82(13)7(456)
	72	79	72	48	53	53	43	110	82(13)(56)47
VII	72	82	72	53	60	50	48	115	82(13)5467
	72	82	70	53	60	50	53	118	82135(47)6
VIII	74	72	74	89	48	53	108		74(13)265
	72	70	79	89	48	98	98		(76)43125
XIII	74	91	82	65	70	55	48	113	82315467
	77	84	82	65	72	60	53	115	82315467
XIV	82	82	74	53	60	53	55	110	8(12)357(46)
	79	79	77	50	65	50	50	120	8(12)35(46)7
XVI	77	84	74	55	60	50	53	115	82135476
	74	79	74	50	62	58	50	110	82(13)56(47)
XVII	72	77	72	53	60	53	50	115	82(13)5(46)7
	72	82	74	55	55	53	46	110	8231(45)67

AGRIFOLIAE ESSIG. No formula is given in the description. The description refers however to the figures of the antennae for the relative length of the segments. Measuring the figure, the following formula is constructed, 7, 1, 3, 2, 4, 6, 5. The figure is evidently taken from a nymph, as this species has normally eight segmented antennae. These specimens were all taken from a single oak tree (*Quercus agrifoliae*) at Santa Paula, California, and are from the lot of specimens that the type of the species was taken. In two specimens the formulae of the right and left antennae were found to be the same although the formula of each specimen is different. The formulae of the twenty antennae varied as much as the specifically diagnostic formulae published for the species of *Pseudococcus*.

TABLE 9. *PSEUDOCOCCUS CITRI* RISSO.

Specimen	1st	2nd	3rd	4th	5th	6th	7th	8th	Formulae
I	67	60	58	41	41	41	43	101	81237(456)
	62	60	60	43	43	48	48	103	81(23)(67)(45)
II	55	60	55	38	36	46	46	103	82(13)(67)45
	60	58	50	36	41	38	43	101	81237564
III	60	67	72	41	48	46	55	106	83217564
	60	65	72	41	48	46	53	108	83217564
IV	60	65	60	36	41	36	50	110	82(13)75(64)
	65	60	62	36	36	38	48	108	813276(54)
V	60	62	67	36	48	43	53	113	83217564
	58	62	65	36	43	43	50	113	83217(65)4
VI	65	72	67	46	48	48	50	103	82317(56)4
	62	72	65	48	46	50	53	110	82317645
VII	67	60	67	36	38	41	48	106	8(13)27654
	67	58	60	38	41	43	43	98	8132(67)54
VIII	67	72	67	38	43	43	46	108	82(13)7(65)4
	72	62	67	41	48	43	48	103	8132(75)64
IX	60	67	60	43	43	38	41	96	82(13)(45)76
	60	65	60	43	41	46	43	96	82(13)6(74)5
X	67	67	72	41	41	41	50	108	83(12)7(456)
	67	65	67	43	48	46	48	108	8(31)2(75)64

CITRI RISSO. Formula 6, 3, 2, 1, 5, (4, 6, 7) Newstead, "British Coccidae" Vol. II. The specimens of this species were taken from coleus in the Horticultural Forcing-houses of Cornell University. No formula was found that agreed with the one given by Newstead. In one specimen the formulae for the right and left antennae were identical. The formulae of the twenty antennae varied as much as the specifically diagnostic formulae published for all the species of *Pseudococcus*.

OBSCURUS ESSIG. Formula 8, 1, 3, 2, 4, 7, 5, 6. Essig, "Pomona Jour. Ent." '09. The specimens of this species were taken from an elder tree (*Sambucus glauca*) at Santa Paula, California, and are from the lot of specimens that the type for the species was taken. In one specimen the formulae of the right and left antennae were identical.

TABLE 10. PSEUDOCOCCUS OBSCURUS ESSIG.

Specimen	1st	2nd	3rd	4th	5th	6th	7th	8th	Formulae
I	84 65	72 67	77 65	41 53	58 58	41 96	53	103	813257(64) 62(31)54
II	84 72	72 75	79 84	48 43	55 53	46 43	48 48	84 98	(81)325(47)6 832157(64)
III	82 72	79 79	84 79	29 38	60 53	50 46	53 50	101 103	83125764 8(32)15764
IV	82 77	89 79	84 86	48 48	65 65	50 48	50 48	108 108	82315(67)4 83215(764)
V	89 74	86 84	91 96	53 50	58 65	48 55	50 48	113 113	83125476 83215647
VI	79 74	74 72	82 82	38 36	65 60	41 41	50 48	106 98	83125764 83125764
VII	77 89	82 74	84 74	38 41	53 53	41 41	50 46	108 106	83215764 81(23)57(64)
VIII	84 84	89 84	89 96	53 48	67 70	48 41	53 50	108 110	8(32)15(74)6 83(21)5746
IX	72 65	79 65	74 60	41 46	60 53	48 146	53	106	82315764 6(12)354
X	84 86	72 74	84 84	48 46	58 60	46 34	55 60	55;43 108	(13)25(78)469 8132(75)46

No formula was found agreeing with the one quoted. In specimen X the right antenna has nine segments and in specimen IX the left antenna has six segments. An examination of Table 1 shows that this specimen is the largest specimen studied, and as it was found in an egg mass it was undoubtedly an adult. Specimen I, which will be seen to be of normal size (Table 1), also had the left antenna with six segments. This variation in the number of segments was also noted in other specimens. The formulae of the twenty antennae measured varied as much as the specifically diagnostic formulae for all the species of *Pseudococcus*, as well as one formula placing the specimen in the genus *Phenacoccus* and two formulae placing the specimens in the genus *Ripersia*.

From the above review it will be readily seen that the relative length of the segments of the antennae are valueless as specific characters. Other workers as well have found this

character very variable. Kellogg & Smith, '04, found that in twenty-five specimens of *Cerepato yuccae*, a closely allied genus, no two formulae agreed, "and that there was practically as much variety in these formulae as there is among the eleven formulae published as specifically diagnostic for eleven North American species of the genera *Cerepato* and *Phenacoccus*." Again Tinsley, J. D., '08, in discussing the variation in the antennae of *P. virgatus* Ckll. gives eleven different formulae. Again the same author, 1900, in his description of a new species, *P. texensis* Tins., gives three different formulae. Ehrhorn, Edw. M., 1900, in his description of a new species, *P. maritimus* Ehr., gives four formulae. The universal use of antennal formulae in descriptions is unfortunate, as this has given an excuse for the creation of new species and is valueless in analytical tables for the determination of specimens. The sooner that the valuelessness of this character is realized by systematists describing new species of this genus, the sooner will a search for valuable characters be begun and a serious mistake in taxonomy be corrected.

LEGS. Tables 11-15. The length of the legs is used to quite an extent in descriptions. Their length compared to the length of the antennae is often stated, also the length of the different segments compared with each other. They are often spoken of as long and strong. The presence of hairs is often noted, also that of knobbed digitules.

For the study of the legs five specimens of each species were used. They were the same specimens that were used in the study of the antennae. The measurements of the different segments are the greatest length of these segments, so that the sum of the lengths of the different segments will be greater than the length of the leg. Like the basal segment of the antennae, the coxa is very difficult to measure and the results are not entirely reliable.

At the right hand side of the tables, formulae are appended. These formulae are constructed in the same manner as the antennal formulae. The segments are numbered in order beginning with the coxa.

The formulae show but little if any more satisfactory results for specific determination than do the formulae of the antennae. The formulae of each pair of legs for each of the species will be discussed together.

Prothoracic Legs. In *crawii* Coq. and *citri* Risso the third segment is always the longest, the fourth segment coming next in order. In the remaining three species the third segment is usually the longest but may be equal to or less than the fourth segment. The first segment is always third in order in the formulae. In no species does the second segment bear any fixed relation to the fifth. The sixth segment is always much the shortest and comes last in order in the formulae.

Mesothoracic Legs. In *crawii* Coq. the third segment is always the longest. In the other species the position of the third and fourth segments vary in relation to each other. The first segment always comes third in the formulae. The second and fifth segments vary in relation to each other in each of the species. The sixth segment always comes last in the formulae.

Metathoracic Legs. In *obscurus* Essig and *citri* Risso the fourth segment is usually longer than the third. In *obscurus* Essig an exception is seen to this in the right leg of Specimen XI. In *obscurus* Risso an exception is seen to this in specimen VII. In the other species the fourth segment is always longer than the third. The first segment always comes third in the formulae. In no species do the second and third segments bear any fixed relation to each other. The sixth segment is always much the shortest and comes last in the formulae.

It will be seen from the above discussion that the variation in the formulae is too great for them to be of service in specific determination. Exceptions are found to any generalization that might be made. The limits within which there can be variation are so small that the variations are almost sure to go beyond these limits. Other parts of the legs as setae, digitules, etc., apparently offer no characters of a specific nature.

TABLE 11. PSEUDOCOCCUS CRAWII COQ.

Segment	Specimen	Side	Coxa	Tr.	Femur	Tibia	Tarsus	Claws	Formulae
Prothoracic	I	Rt.	192	120	288	252	114	39	341256
		Lft.	198	120	288	252	108	36	341256
	IV	Rt.	240	126	312	248	120	42	341256
		Lft.	228	120	318	276	120	42	341(25)6
	V	Rt.	228	120	276	240	108	42	341256
		Lft.	222	120	270	240	108	42	341256
	VIII	Rt.	210	120	276	216	108	30	341256
		Lft.	210	120	282	216	108	30	341256
	IX	Rt.							
		Lft.	204	114	288	252	114	36	341(25)6
Mesothoracic	I	Rt.	204	120	312	264	114	39	341256
		Lft.	210	126	312	270	114	42	341256
	IV	Rt.	246	120	324	306	120	42	341(25)6
		Lft.	234	126	336	312	120	42	341256
	V	Rt.	240	120	300	276	114	42	341256
		Lft.	228	120	300	282	114	42	341256
	VIII	Rt.	216	120	294	270	114	33	341256
		Lft.	222	120	300	270	114	33	341256
	IX	Rt.	210	120	294	276	120	36	341(25)6
		Lft.	216	120	300	288	120	36	341(25)6
Metathoracic	I	Rt.	222	126	330	342	114	42	431256
		Lft.	222	126	330	336	114	45	431256
	IV	Rt.	252	132	360	390	132	48	431(25)6
		Lft.	258	138	348	390	132	48	431256
	V	Rt.	240	126	330	360	120	42	431256
		Lft.	240	126	330	360	120	42	431256
	VIII	Rt.	216	126	306	336	126	36	431(25)6
		Lft.	216	126	306	354	126	36	431(25)6
	IX	Rt.	240	132	336	366	132	39	431(25)6
		Lft.	240	132	342	360	132	39	431(25)6

TABLE 12. PSEUDOCOCCUS CITRI RISSO.

Seg- ment	Spec- imen	Side	Coxa	Tr.	Fe- mur	Tibia	Tar- sus	Claws	Formulae
Prothoracic	I	Rt.	174	90	210	186	90	24	341(25)6
		Lft.	174	90	104	180	90	24	413(25)6
	III	Rt.	198	90	234	210	96	24	341526
		Lft.	192	90	240	210	96	21	341526
	IV	Rt.	180	90	216	192	84	24	341256
		Lft.	180	96	222	192	96	24	341(25)6
	VI	Rt.	138	84	186	174	84	24	341(25)6
		Lft.	138	84	186	174	84	24	341(25)6
	VII	Rt.	174	90	210	192	90	24	341(25)6
		Lft.	174	90	210	192	96	24	341526
Mesothoracic	I	Rt.	180	90			102	27	
		Lft.	186	96	234	228	102	27	341526
	III	Rt.	210	102	264	240	102	30	341(25)6
		Lft.	210	102	264	246	102	30	341(25)6
	IV	Rt.	186	102	240	234	96	24	341256
		Lft.	174	102	240	228	96	24	341256
	VI	Rt.	144	90	210	210	96	30	(34)1526
		Lft.	156	90	210	210	96	30	(34)1526
	VII	Rt.	180	96	240	228	96	27	341(25)6
		Lft.	180	90	234	216	99	27	341526
Metathoracic	I	Rt.	196	96	234	234	108	30	(34)1526
		Lft.	196	96	240	248	108	30	431526
	III	Rt.	222	114	276	282	108	30	431256
		Lft.	216	108	276	282	108	33	431(25)6
	IV	Rt.	192	108	258	270	108	30	431(25)6
		Lft.	192	108	258	270	108	30	431(25)6
	VI	Rt.	168	96	216	228	108	30	431526
		Lft.	168	96	228	240	108	30	431526
	VII	Rt.	186	102	252	252	102	30	(34)1(25)6
		Lft.	194	92	252	246	102	30	341526

TABLE 13. *PSEUDOCOCCUS LONGISPINUS* TARG.

Seg- ment	Spec- imen	Side	Coxa	Tr.	Femur	Tibia	Tarsus	Claws	Formulae
Prothoracic	VI	Rt. Lft.	162 180	96 96	240 240	240 240	102 102	24 24	(34)1526 (34)1526
	VII	Rt. Lft.	216 216	114 114	270 270	240 240	108 108	24 24	341256 341256
	VIII	Rt. Lft.	168 180	96 96	234 234	216 216	108 108	30 27	341526 341526
	IX	Rt. Lft.	156 156	102 96	216 216	204 204	90 96	24 24	341256 341(25)6
	X	Rt. Lft.	180 180	96 96	240 240	240 240	108 108	24 24	(43)1526 (43)1526
Mesothoracic	VI	Rt. Lft.	180 180	108 102	264 264	252 270	114 114	30 30	341526 431526
	VII	Rt. Lft.	222 224	120 120	300 300	294 294	120 120	30 30	341(25)6 341(25)6
	VIII	Rt. Lft.	192 192	108 108	258 252	240 240	108 108	30 30	341(25)6 341(25)6
	IX	Rt. Lft.	162 162	102 102	228 228	240 234	108 108	30 30	431526 431526
	X	Rt. Lft.	192 186	108 108	264 270	264 264	108 108	30 30	(34)1(25)6 341(25)6
Metathoracic	VI	Rt. Lft.	204 204	114 120	306 300	348 360	120 120	30 30	431526 431(52)6
	VII	Rt. Lft.	240 240	132 132	312 318	348 354	120 120	30 30	431256 431256
	VIII	Rt. Lft.	210 204	114 114	288 282	306 300	114 120	30 30	431(52)6 431526
	IX	Rt. Lft.	180 180	108 108	252 258	294 300	120 120	30 30	431526 431526
	X	Rt. Lft.	204 198	120 114	300 300	318 324	114 114	30 30	431256 431(25)6

TABLE 14. PSEUDOCOCCUS OBSCURUS ESSIG.

Segment	Specimen	Side	Coxa	Tr.	Femur	Tibia	Tarsus	Claws	Formulae
Prothoracic	IV	Rt.	186	102	264	258	102	24	341(25)6
		Lft.	180	102	270	264	102	27	341(25)6
	V	Rt.	198	96	258	258	108	30	(34)1526
		Lft.	204	96	264	258	108	27	341526
	VII	Rt.	156	90	240	240	114	30	(34)1526
		Lft.	150	90	246	234	102	30	341526
	VIII	Rt.	180	102	264	258	108	30	341526
		Lft.	180	102	264	258	108	30	341526
	XI	Rt.	180	102	258	246	102	24	341(25)6
		Lft.	180	102	270	258	102	24	341(25)6
Mesothoracic	IV	Rt.	198	108	300	312	114	30	431526
		Lft.	192	108	300	312	114	30	431526
	V	Rt.	210	120	300	312	114	30	431256
		Lft.	210	120	300	312	114	30	431256
	VII	Rt.	150	96			108	30	
		Lft.	150	102	288	282	108	30	341526
	VIII	Rt.	204	108	300	312	108	33	431(25)6
		Lft.	210	108	300	306	114	30	431526
	XI	Rt.	180	120	300	294	108	30	341256
		Lft.	180	108	300	288	108	30	341(25)6
Metathoracic	IV	Rt.	228	120	330	360	120	30	431(25)6
		Lft.	210	120	330	360	120	30	431(25)6
	V	Rt.	222	120	330	366	120	30	431(25)6
		Lft.	228	120	330	360	120	30	431(25)6
	VII	Rt.	210	120	300	330	114	30	431256
		Lft.	204	108	300	330	114	30	431526
	VIII	Rt.	216	114	224	360	120	30	431526
		Lft.	216	120	230	360	120	30	431(25)6
	XI	Rt.	210	120	324	318	120	30	341(25)6
		Lft.	210	120	318	330	120	33	431(25)6

TABLE 15. *PSEUDOCOCCUS AGRIFOLIAE* ESSIG.

Segment	Specimen	Side	Coxa	Tr.	Femur	Tibia	Tarsus	Claws	Formulae
Prothoracic	VIII	Rt.	208	112	256	216	96	32	341256
		Lft.	200	104	248	216	88	32	341256
	X	Rt.	224	120	280	272	96	32	341256
		Lft.	232	120	288	286	88	32	341256
	XIII	Rt.	248	120	288	304	96	32	431256
		Lft.	240	120	288	304	96	32	431256
	XIV	Rt.							
		Lft.	216	112	280	272	104	32	341256
	XVI	Rt.	224	112	260	264	96	32	341256
		Lft.	232	112	280	264	104	32	341256
Mesothoracic	VIII	Rt.	208	120	288	288	112	32	(34)1256
		Lft.	200	112	280	272	112	32	341(25)6
	X	Rt.	232				104	36	
		Lft.	240	128	312	312	112	36	(34)1256
	XIII	Rt.	240	120	328	336	104	36	431256
		Lft.	240	124	328	336	104	36	431256
	XIV	Rt.	232	120	296	296	112	32	(34)1256
		Lft.	224	120	296	304	112	32	431256
	XVI	Rt.	216	112	304	304	112	32	(34)1(25)6
		Lft.	224	120	312	296	112	32	341256
Metathoracic	VIII	Rt.	224	128	312	344	120	36	431256
		Lft.	216	128	304	320	120	36	431256
	X	Rt.	248	128	352	432	120	36	431256
		Lft.	248	128	346	424	120	36	431256
	XII	Rt.	256	128					
		Lft.	264	136	360	432	112	40	431256
	XIV	Rt.	248	128	336	366	120	36	431256
		Lft.	232	120	312	366	120	36	431(25)6
	XVI	Rt.	232	128	328	360	120	32	431256
		Lft.	240	128	320	354	120	32	431256

MARGINAL WAX FILAMENTS. The number, length and stoutness of the marginal wax filaments is a character often used. The length of the filaments compared to the length of the body and to each other is the form most used. The favorite character for separating *longispinus* Targ. and *citri* Risso is the extreme length of the caudal filaments in the former.

This character refers to specimens before treatment with caustic potash. Only a slight study has been made of this character because living specimens of three of the five species studied were not available. A difference however has been noted between *citri* Risso and *longispinus* Targ., in the former the appendages are robust and covered with granules of wax, in the latter the appendages are slender and do not have granules upon them, being more linear and wire like. The objection to the use of this character in the determination of species is the ease with which the filaments are removed and the danger that the specimens consequently would not be in a natural condition. Also in recently moulted specimens the normal waxy covering would not be formed. The length of the caudal filaments in *longispinus* Targ. is evidently a good character if the specimens can be examined in a normal condition.

ANAL LOBES.—The anal lobes are frequently mentioned as being faintly indicated, normal or prominent. Also the presence of one or more setae is occasionally used.

The observations made upon the segmentation of specimens would apply very largely to a discussion of the anal lobes. As a specimen becomes older and more distended with eggs the anal lobes become less prominent. Consequently in the use of this character the age of the individual would have to be carefully considered. In the setae of the anal lobes there is evidently a good character. (Tables 1-5). Upon each anal lobe there are generally several setae. One of these, however, is much longer and more robust than the others and is usually situated at the caudal extremity of the lobe. This is the seta referred to in the tables and discussion. The variation in the length of this seta is considerable, but the limits of variation are so great that this does not lessen the value of the character. The comparison of the length of this seta to the length of the setae of the anal ring is probably the most useful way of expressing the character.

SETAE OF THE ANAL RING.—The number of setae on the anal ring is a generic character and although often given in descriptions is of no importance as a specific character. Their length compared to some other part of the insect is seldom mentioned.

However, the length of these setae is a very promising specific character. The variation is considerable but not so

great as to nullify the usefulness of the character. To determine the distal termination of the setae is sometimes difficult, but it can be done with considerable accuracy. Another difficulty is that the distal end of the setae have a tendency to curl, but in spite of this and the above mentioned factor the length of a seta can usually be quite accurately measured. As stated above the comparison of the length of the setae of the anal ring with the setae of the anal lobes is probably the most available way to use this character.

In *agrifoliae* Essig considerable variation is found and the character is hardly satisfactory. The setae of this species are especially difficult to measure because they are not robust.

DERMIS.—The presence of setae and groups of spinnerets upon the dermis is a character commonly noted. This is usually not given enough in detail to be of assistance in the separation of species.

EGG-SAC.—Considerable use is made of the egg laying habits of the species. Whether the egg-sac is of a fibrous nature or is a mealy secretion is often stated. Also its presence or absence is noted, depending whether the species is ovoviviparous or oviparous.

If a study of specimens of *Pseudococcus* can be made with the insects in a natural condition, the manner of oviposition is a good specific character. Whether a species is ovoviviparous or oviparous is not always a sharply separated condition, for an individual may give birth to living young and also deposit eggs. However, the formation of an egg sac is an indication that a species is oviparous and the formation of this egg-sac is constant for the species. In a normally ovoviviparous form a mealy secretion which is distinctly of a fibrous nature is made upon the plant. *Crawii* Coq. and *longispinus* Targ. do not form a distinct egg-sac but form a mealy secretion upon the plant. *Citri* Risso and *obscurus* Essig form an egg-sac of considerable size. *Agrifoliae* Essig forms an egg-sac but not so extensive a one as the last two named species.

The writer is working on a monograph of the North American species of this genus. He would be glad to exchange specimens of Coccidae for species of *Pseudococcus* not now in his collection. Correspondence to this end is invited.