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Palmer, Miriam A. 1904

On dorsal glands as characters of constant specific value in the Coccid genus, *Parlatoria*.



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Reviewed

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Introduction.

There has been much confusion as to classification of the different species of the genus *Parlatoria*. About nineteen species have been described, but the status of so many of these has been so uncertain that authorities have differed among one another, even the same authority being found to change his ^{own} opinion from time to time. Cockerell (1896)(c) and (1899)(~~R~~^R) and Mrs. Fernald (1903) give the genus as consisting of seventeen species but do not agree exactly in their lists of species, and Marlatt in his manuscript of March 1900 tentatively declares the genus to consist of at most but six species. The cause of this confusion is the want of established constant ~~so~~ specific characters on which to base a system of classification.

It is the purpose of this paper to give the result of investigations made upon the pygidia of the females of a number of the species of this genus for the purpose of ascertaining constant specific characters. The species or so-called species studied are *aonidiformis* Green, *blanchardi* Targ., *cingala* Green, *mytilaspiformis* Green, *proteus* Curt., *pergandei* Comst., *crotonis* Ckll., *theae* Ckll.

and thea variety euonym^v Ckll., victrix Ckll., viridis Full., thea viridis Ckll., and zizyphus Lucas, these being all the species that have been available. All the literature at hand on these species has been carefully consulted and compared in making conclusions.

For studying the characters herein discussed great care must be given to the technique. For this study the method used was as follows: The insects removed from under the scale were bleached in a strong solution of caustic potash, either by boiling till sufficiently bleached or by leaving them in the solution from twelve to twenty-four hours. Great care must be exercised that the bleaching process may be carried just far enough to show all the necessary characters in the pygidium, but not so far that the insect becomes quite transparent or there will be great danger of loosing it during the process of transferring from one solution to another. The mouth-parts retain color longest and often when the rest of the body is invisible to the naked eye the presence of the insect can be detected by the mouth-parts. After bleaching the insects were removed from this liquid and washed twice in distilled water being left each time for about ten minutes, then transferred to fifty per cent alcohol for

about fifteen minutes, then to ninety-five per cent alcohol and left for the same length of time. Since these insects are very difficult to from one liquid to another without danger of maceration and great lose of time and energy, it was found best after removing them from the caustic potash to leave them in the same vessel , changing the liquid by means of a pipette. They were next transferred into a drop of clearing mixture #on a slide and left thus for fifteen minutes or longer, then a drop of xylol-balsam was added and the mount completed.

The materials used for this study were furnished by Professor S. J. Hunter, the head of the department, and the writer wishes to thank him|for his direction and kindly assistance to which this paper is largely due. The illustrations were all made by the writer with the use of the camera lucida.

This clearing mixture was composed of two parts by measure of carbolic acid crystals and three parts of rectified oil of turpentine.

Discussion.

Description of Genus Parlatoria.

The following description of the genus Parlatoria is given as gathered from the descriptions of Signoret (1868), Comstock (1881), Newstead (1901), and Green (1899) together with personal observations.

Scale of female.- The female scale may vary from circular to elongate and consists of two exuviae with more or less of secretory area around the sides.

Scale of male.- The male scale is long, narrow, and non-carinated, with the median portion depressed after escape of male. The exuviae are at the cephalic end. The scale is usually much smaller than that of the female.

Pygidium of female.- The most prominent characteristics of the genus, found in the pygidium, are the conspicuous marginal gland pores, situated ^{between} around the bases of the lobes and giving a crenulated appearance to the pygidium, and the fringed plates or squames situated between the lobes. The circumgenital glands or spinnerets are usually in four groups but sometimes there are a few glands present representing the missing median group, as noted by Green (1899) and seen by myself in theae. There are always three pairs of well-developed lobes and sometimes rudiments of the fourth and fifth pairs.

Description of species.

Parlatoria Zizyphus Lucas.

Plate I fig. 1 and 2.

This species, being regarded as the type species of the genus *Parlatoria*, is described first. The most important generic and specific characteristics in the genus *Parlatoria* are found in the pygidium of the female, and since it is only with these characteristics that this paper pretends primarily to deal, there will hereafter be no attention paid in descriptions to any characteristics outside of the pygidium. The reason for this is the inconsistency of the characters outside of the pygidium, such as shape and color of scale and color of body. This can be plainly seen on examination and comparison of literature and will be brought out in the discussion of the synonymy of the species herein discussed.

There are four groups of spinnerets, also called circumgenital, grouped, abdominal, or ventral glands. These groups are designated as the anterior lateral and posterior lateral pairs of groups. There are four pairs of lobes, the fourth lobe being fairly well developed. The first three pairs are trilobate in form, the fourth lobe is about one third the width of the third lobe and tapers to a point. Its length is almost equal to that of the third lobe. Between the bases of the lobes are

the marginal gland orifices or semi-lunar pores which resemble on superficial examination chitinized crescents, but on closer examination are seen to be rather elliptical-shaped openings. Directly cephalad of each marginal gland orifice are found structures resembling small chitinized rods. These are according to Berlese (1896), the chitinized discs of the marginal gland orifices. These crescents alternate with the lobes until after the third lobe when there are two before the fourth lobe. There are also found between the lobes thin, flat, transparent, fimbriated processes called plates or squames. They are the same length as the lobes and vary in number of incisions from three to four in those plates mesad of the third lobe and number as high as eight to twelve or even more in those laterad of the third lobe. These plates are situated two in each of the spaces between the lobes mesad of the second lobes and three in the spaces between the second and third lobes, and the third and fourth lobes. Scattered over the pygidium and more numerous toward the edges are found the spool-shaped dorsal glands. These seem at first glance to have no definite arrangement but on more careful observation of a number of specimens certain of these glands are found to be constant in position. These are the median dorsal gland, found on the median line just cephalad of the median

marginal gland orifice, and a pair of glands situated one on each side of the pygidium on a line drawn from the anal opening to the third lobe and situated at about from one to two thirds of the entire distance from the anal orifice. This pair of glands was found in no other species studied. The arrangement of the rest of the glands is less constant. The dorsal glands near the margin and laterad of the median gland are sometimes arranged in a row even with the median dorsal gland, there being one dorsal gland approximately above each marginal gland (See Plate I fig. 1). In different specimens and even in the ^{two sides of the} same specimen the arrangement of the glands laterad of the median gland may vary considerably, some being found more cephalad and some more caudad than the median dorsal gland. The number has been ^{found} to be fairly constant. There is also sometimes a second pair of glands found half way between the pair above mentioned and the second or third lobes.

This species has been found on *Zizyphus pinnachristi*, date-palm, and the following varieties of citrus, orange, lemon, and mandarin. The habitat is Europe, Algeria, Hawaiian Islands, Formosa, China, West Australia, and in the United States on imported fruit.

This description has been made from the study of ten mounted specimens from lemon, mandarin, and a citrus plant whose variety is not given, together with descriptions

by Signoret (1868), Berlese (1896), Newstead (1901), and Comstock (1883) at hand and used for reference.

Parlatoria blanchardi Targ.

Plate II figure 2.

This species has four groups of circumgenital glands. There are three pairs of well developed lobes. The rudimentary fourth lobe is absent. The form of the lobes is not trilobate as in *Scaphis zizyphus* but ^{broadly rounded at the ends without notches on either side. The marginal gland orifices are of the same form as in *zizyphus*} the chitinized discs are not visible. The plates have the same arrangement as those in *zizyphus* but are narrower in shape. Those along the sides laterad of the third lobe are much longer and have fewer incisions than those in *zizyphus*. The median dorsal gland is present. Laterad of this median dorsal gland and cephalad of the second marginal gland orifice is a group of three dorsal glands. Cephalad of the third marginal gland orifice and the third lobe is another group of three or four dorsal glands. The chitinized discs are not distinctly visible or are seen very close to the orifices, the glands being probably situated almost at right angles to the body wall so that the chitinized discs are hidden below the orifices.

The food plant is date-palm. Habitat; Australia, Algeria, and the Sahara.

Described from nine mputed specimens.

Parlatoria victrix Ckll.

Plate II figure 3.

Victrix agrees in every particular with blanchardi. The food plant is also the same. They differ only in habitat as given, victrix being found in Arizona and blanchardi in Algeria, Sahara, and Australia; but Marlatt in his manuscript of 1900 to Professor S. J. Hunter says that Cockerell's victrix originally came from the same locality as blanchardi. Victrix has been determined as synonymous with blanchardi by Hunter in manuscript and by Marlatt in manuscript and it is so given by Mrs. Fernald (1903).

Studied from thirty ^{mounted} specimens taken from material received from Cockerell.

Parlatoria cingala Green.

Plate VI figure 2.

This species differs from zizyphus in the number and shape of the lobes. There are three pairs of well developed lobes. There is no rudimentary fourth lobe but in place of it is found a broadly spindle-shaped thickening situated with its long axis coincident with the body line. The lobes are not notched or trilobate as in zizyphus but entire in outline and of a shape peculiar to the species as shown in the figure. The marginal gland orifices appear in crescent form between the lobes

till laterad of the third lobe when they appear more of the oval type. The chitinized discs are distinctly visible with both forms of glands. The plates are found situated as in zizyphus but they tend to have fewer incisions, varying from two or three to four mesad of the third lobe. There are no dorsal glands found in the region of the pygidium cephalad of the first and second pairs of lobes. There is a large gland found directly cephalad of the third lobe. The pore of this gland lies with its long diameter parallel to the median line instead of at right angles to it as the pores in zizyphus. Along the edge of the body laterad and cephalad of the third lobe the dorsal glands are numerous.

The food plants are leaves of the Flacourtia and Scolopia. The habitat is Ceylon.

Described from five mounted specimens taken from material received from E. E. Green, together with his (1899) original description and figure.

Parlatoria aonidiformis Green.

Plate II figure 1.

This species has four groups of circumgenital glands as in zizyphus though they are not shown in the figure because they werenot observed, the only specimens available not being sufficiently well cleared to show them satisfactorily. There are three pairs of well developed

lobes decreasing in size from the median line outwards. The rudimentary fourth lobe is more or less developed. The first three pairs of lobes have each two notches on the outer edge and one or two on the inner edge. The marginal gland pores are found as in zizyphus except that there is only one between the third and fourth lobes, while in zizyphus there are two. The chitinized discs of the marginal glands are present though not very prominent. The plates are unusually narrow and long, the incisions are not deep, and average about three or four in number. There are no dorsal glands like those in zizyphus to be found in the pygidium but there are, according to Green (1899) and indistinctly seen in specimens observed, minute circular glands arranged in a row cephalad of the second lobe.

The food plants are *Nothopegia Colebrookiana*.

Habitat, Ceylon.

Described from two mounted specimens from material received from Green, supplemented by reference to Green's (1899) original description and drawing.

Parlatoria proteus Curt.

Plate III figure 1.

pergandei Comst. Plate III figure 2.

crotonis Dougl. Plate VI figure 1.

mytilaspiformis Green Plate IV figures 1 and 2.

thea Ckll. Plate V figure 1.

var.? euonymi Ckll. Plate V figure 2.

var.?viridis Ckll. Plate V figure 3.

Proteu has four groups of circumgenital glands .

There are three pairs of well developed lobes. The rudimentary fourth lobe is absent and in its place is found a plate. The lobes are trilobate in form. The marginal gland orifices are as in zizyphus. The position of the dorsal glands, however, differs from that in zizyphus , there being no median dorsal gland. Neither is the pair of glands mentioned as characteristic in the description of zizyphus found in proteus. The glands are also fewer in number. There is a pair of glands cephalad of the ~~third marginal gland~~ first pair of lobes, a single gland cephalad of the third marginal gland or the third lobe, then come numerous glands whose arrangement seems to be less constant.

The food plants are Selenipedium, Macrozamia, Pinus insignis, Myrtus, Citrus, Camellia, Machillus, apple, & date-palm, and Vanda.

Habitat is Europe, Australia, Japan, China, Formosa, Hawaiian Islands, Brazil, and Ceylon.

Described from ten mounted specimens from Pinus and orchid from Ceylon and Japan with Comstock's (1883), Newstead's (1901), and Signoret's (1869) descriptions at hand for reference.

pergandei Comst.

Plate III figure 2.

Pergandei has four groups of circumgenital glands. There are three pairs of well developed lobes, trilobate in form. The rudimentary fourth lobe is present but not nearly so well developed as in zizyphus. It is often only a pointed prominence of the body wall bearing a spine. The rudimentary fifth lobe is also present and similar in form and degree of development to the fourth lobe. The marginal gland orifices are situated as in zizyphus. The chitinized discs are present. The plates are similar in form and position to those in zizyphus. The dorsal glands are the same in nature and arrangement as those in proteus.

Food plants are orange, lemon, ^{and} Japonica. Habitat is Mexico, Japan, Hawaiian Islands, Algeria, Europe, and southern United States.

Described from eleven mounted specimens from material on orange from China, Florida, and Lawrence greenhouse, with the original description of Comstock (1881) and also Newstead's (1901) description at hand.

mytilaspiformis Green.

Plate IV figures 1 and 2.

Mytilaspiformis has four groups of spinnerets or

circumgenital glands. There are three pairs of well developed lobes, trilobate in form. The rudimentary fourth and fifth lobes are very variable, being found present in some specimens and absent in others, even being present sometimes on one side and absent on the other in the same individual. The marginal glands and plates are found the same in form and position as in zizyphus and proteus. The form and arrangement of the dorsal glands is the same as in proteus.

Food plants are *Psychotria thwaitesii* and tea plant. Habitat is Ceylon.

Described from four mounted specimens from material received from Green, together with his (1899) original description and figure.

thea Ckll.

Plate V figure 1.

Theae has the four groups of circumgenital glands found in zizyphus, but in addition there are one or two glands representing the missing median group. Cockerell (1896)(b) in his description says that there is but one median gland, but in one specimen observed two glands were seen as shown by the figure. There are three pairs of well developed lobes decreasing in size from the median line outwards and trilobate in form. The rudimentary

fourth lobe is tolerably well developed and resembles that of pergandei. The marginal glands and plates are the same in form and position as in proteus, pergandei, and zizyphus. The dorsal glands are the same in character and arrangement as in pergandei and proteus .

Foodplants are tea plant and Japanese maple. Habitat is Japan.

Described from four mounted specimens together with Cockerell's (1896)(a) and (1896)(b) descriptions at hand.

theae variety euonymi Ckll.

Plate V figure 2.

This ~~group~~ differs from theae only in having no representative of the median group of circumgenital glands, as ascertained from the study of four type specimens and reference to Cockerell's (1897) original description.

The food plant is Euonymous. Habitat is Japan.

viridis Full.

syn. theae viridis Ckll.

Plate V figure 3.

Viridis has five groups of circumgenital glands according to Cockerell (1896)(a), the median group being represented by from one to four glands. In the specimens ^{studied,}, however, it was impossible to determine whether the median group was present or not, the specimens not being

sufficiently well cleared, and they are accordingly not shown in the figure. There are three pairs of well developed lobes decreasing in size from the median line outwards. They are trilobate in form and the tips are ~~usually~~ more produced beyond the plates than in theae. The rudimentary fourth lobe is about the same in form and development as in pergandei. The marginal glands are the same in form and position as in theae and pergandei. The plates are the same in form and position as in theae but they are generally not quite as long, allowing the lobes to project slightly beyond them, but this characteristic is rather variable. The dorsal glands have the same form and arrangement as those in theae, pergandei, and proteus.

Food plant; Theae viridis has been found on Ilex pedunculosa in Japan and viridis on Pittosporum in West Australia.

Described from three ^{mounted} specimens of viridis and eight specimens of theae viridis, four of which are type specimens, together with Cockerell's (1896)(a) and (1896)(b) original descriptions and drawings.

proteus variety crotonis Dougl.

Plate VI figure 1.

Crotonis has four groups of circumgenital glands. There ~~are three pairs of well developed lobes, trilobate in form~~

are three pairs of well developed lobes, trilobate in form

and decreasing in size from the median line outward. The presence of the rudimentary fourth lobe is very variable. The marginal glands, plates and dorsal glands are as in proteus and pergandei.

The food plant is Croton. Habitat is Antigua, Jamaica, Great Britain, and in Massachusetts in botanical gardens.

Described from five mounted specimens with descriptions by Newstead (1901), Cockerell (1892), and (1899)(a).

Discussion of synonymy.

The above so-called species described under proteus have been determined synonymous on the basis of the similarity of the arrangement of the dorsal glands. Although originally described as separate species their validity has never been finally established. The distinguishing characteristics given by the various authorities have in every case proved inconstant or not of specific value, as will be brought out in the following discussion of the synonymy of these species with proteus.

Comstock (1883) differentiates proteus and pergandei on the basis of the shape of the scale of the female, & given as circular in pergandei and elongated in proteus, but in (1881) in his original description of pergandei he says that the scale of the female varies, being sometimes nearly circular but usually somewhat elongated.

Hunter (1900) or (1904) says he finds no steadfast distinction either in shape or color of the female scale, finding circular scales among proteus and elongate scales among pergandei. Newstead (1901) says that the puparium of the female of pergandei is very variable, often being circular but sometimes elongate. It is accordingly evident that there has been no specific distinction found in the scale.

Comstock (1881) in a foot note mentions as a distinction between proteus and pergandei Signoret's description of the plates in proteus as being smooth on the mesal margin and serrate on the lateral while those in pergandei are palmately incised, but this distinction has neither been observed by the writer nor found in any other descriptions or figures and Comstock (1883) himself in his later description and figure of proteus shows the plates of proteus just the same as those of pergandei.

Newstead (1901) gives as a distinctive characteristic between these two groups the distinction of the rudimentary fourth lobe, present in pergandei and absent in proteus. This characteristic has been determined by the writer on examination of a number of the so-called allied species to be not of specific value, as will be brought out in the following discussion of the rest of the species above pronounced synonymous with proteus.

Authorities are also undecided on the question of the

status of pergandei. Cockerell (1896)(c) gives pergandei as a distinct species and in (1899)(b) as a variety of proteus and Marlatt in his manuscript of 1900 says pergandei, which he makes a separate species, merges into Proteus.

We will now investigate the status of mytilaspiformis as a valid species. Green (1899) says that the species approaches very closely to proteus but that it may be distinguished by the elongate form of the female scale and by the more prominent and elongate lobes of the pygidium. He also says that the pellicle or exuviae of the male scale of proteus is said to be black. As to the shape of the scale, proteus is also often elongated, as discussed above, and examination of specimens of mytilaspiformis on Psychotria sent by Green, proteus on orange from China, sent by Craw, proteus on orchid collected by Green, and proteus on Pinus from West Australia shows that there is much variety in the shape of the scale; in mytilaspiformis, some being quite elongate while others are nearly circular, and in proteus they also vary from some as long as those in mytilaspiformis to nearly circular so that no distinction in shape of scale can be observed. As to the more prominent and elongate lobes of the pygidium, no difference of any moment was detected by the writer either by observation of specimens or by

comparison of descriptions or figures in any literature at hand. This can not therefore be of specific value.

As to the color of the pellicle of the male scale, Signoret (1869) says that in proteus the male scale is light brown with the exuviae blackish, Newstead (1901) says the exuviae are pale yellow with dark green dorsum, Comstock (1883) says the exuviae of the male are black. In mytilaspiformis Green says the pellicle is yellow with greenish center. According to these descriptions the exuviae of the male in proteus seem to vary from pale yellow with dark green dorsum to black and there does not seem to be any sufficiently constant difference between the two groups to differentiate mytilaspiformis as a valid species. Now there remains only the fourth lobe characteristic which might be looked to for differentiation, but it is found to be inconstant, being present together with the rudimentary fifth lobe in some individuals and absent in others and even being present on one side and absent on the other of the same individual. In some the place of the fourth lobes is filled by a plate as in proteus. No valid specific difference between mytilaspiformis and proteus seems to have been found, thus confirming the synonymy determined on the basis of the arrangement and character of the dorsal glands.

Theae euonymi agrees in all observed characteristics,

with theae except in the presence of the median ventral glands as mentioned above. Since it has never been named as anything but a variety of theae no discussion of it here is necessary.

Cockerell (1896)(b) and (1896(a) describes viridis making it a variety of theae. Fuller (1897) and (1899) describes a distinct species which he names viridis. Neither of Fuller's descriptions are at hand, but specimens received from him were compared with type specimens of theae viridis Ckll. and no differences were detected in any pygidial characters. Cockerell (1896)(b) though he names viridis as a variety of theae, says that he is not certain that it not a valid species. A discussion of the value of the characters which he gives as distinguishing it from theae, namely, the length of the median plates which he says are shorter than the lobes, the bright green color of the body of the female, the five groups of ventral glands, the pale flattened scale, would not be to the point here except so far as they might affect the relation of viridis to proteus. As to the length of the median plates, no difference can be observed between this group and proteus, this character being found variable in both. Nor does the color of the body seem to be a sufficiently constant character to distinguish it as a species. The body color in proteus is said by Newstead (1901) to be variable but usually purplish, Comstock (1881)

says that in pergandei it varies from nearly white to purplish. Whatever difference there may be in the color of the body of the female in these two groups would not seem therefore to be of specific moment though it might distinguish a variety. As to the five groups of ventral glands, there has not been opportunity in this study to investigate their constancy as a specific characteristic, but they do not seem to be considered to be of specific moment by Cockerell himself for in (1897) he places euonymi which has no ~~ventral~~^{median} glands, as a variety of theae, which has the median group represented. This can not therefore distinguish it as a different species from proteus. Neither does the pale flattened scale separate it from proteus, for in proteus pale flattened scales were also found upon observation of specimens at hand. From study of pygidial characters no noticeable differences from proteus were found except the fourth lobe which was the same as that in pergandei; but pergandei has already been determined to be synonymous with proteus.

The status of crotonis also is unsettled and this affords another argument for the synonymy of proteus and pergandei and the invalidity of the fourth lobe characteristic, which is found to be quite variable in this group. Crotonis has been described by Douglas (1887) as a variety of proteus. Later Cockerell describes Crotonis as a variety of pergandei but in (1899)(a) he says that it appears

to be the same as that described by Douglas , whose article on the subject he had overlooked. However in (1902) he makes it a distinct species, on what basis it is not known to the writer, the article not being available; but his previous changes of opinion would seem to indicate that he found no strong distinctive characteristics. The same unsettled state of opinion is seen in the case of Newstead. In (1900) he gives crotonis as a variety of pergandei and in (1901) as a variety of proteus. From this it appears that crotonis has no distinctive character to differentiate it as a species, and that there is no constant character differentiating proteus and pergandei.

Summary.

1. There have been no constant specific characteristics established in the Coccid genus Parlatoria, on which to base a system of classification. This is shown by the resulting confusion and difference of opinion as to the status of many described species.

2. The shape and color of the scale and color of the body of the female is so easily affected by change of environment, and on observation of specimens is found to vary so much in the same species that it seems useless to look to these characters to find constant specific characteristics on which to base a system of classifica-

tion.

3. The pygidium of the female being less exposed to external influences and being much used, it would seem that its characteristic structures would be most likely to persist. It has therefore been to this part of the body that the investigation of this study have been directed?

4. In the pygidium the dorsal glands have been found to possess a certain constancy in character and arrangement, differing in the different species but remaining quite constant in the different individuals of the same species.

5. In corroboration of (4), it may be said that all the literature available on the subject has been consulted, and comparison of the results obtained with the opinionsⁿ of the different authorities shows that in every case where the distinction of the form and arrangement of the dorsal glands was found the status of the group as a valid species was unquestioned. On the other hand where there was no distinction in these glands the authorities were found to differ among themselves and the characters given as distinguishing the species have on investigation proved invalid. The classification made on this basis was found on comparison to agree exactly with Marlatt's synonymy tentatively worked out and given in his manuscript

of 1900, except that pergandei which Marlatt makes a separate species but says merges into proteus is here made synonymous with proteus. On what basis Marlatt determined his synonymy is unknown to the writer of this paper.

6. Based upon the above discussed characteristics of the form and arrangement of the dorsal glands the following classification or key ^{to the species} has been worked out.

A. Dorsal glands absent or very minute and inconspicuous in the portion of the pygidium cephalad of the first and second pairs of lobes.

B. Large dorsal gland with longitudinal pore cephalad of the third lobe, the rudimentary fourth lobe replaced by a spindle-shaped thickening, (see plate VI figure 2), lobes not notched or serrate. cingala.

BB. No pronounced dorsal gland cephalad of the third lobe, the rudimentary fourth lobe present, lobes notched. aonidiformis.

AA. Dorsal glands present and easily seen in well cleared specimens in the portion of the pygidium cephalad of the first and second pairs of lobes.

B. Median dorsal gland present. (Plate I figure 1).

C. Chitinous discs of marginal glands visible.

zizyphus.

CC. Chitinous discs of marginal glands not visible.

blanchardi.

BB. Median dorsal gland absent. proteus.

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