

Notes on the Species of *Aspidaphium* Börner, 1939

(Homoptera: Aphididae)

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(With 2 textfigures)

BÖRNER (1939) described the new genus *Aspidaphium*, based on two new species, *A. escherichi* (the typus generis) and *A. jeschkei*, both known only from specimens collected by soil or litter sieving and not associated with a host plant. Subsequently STROYAN (1955) described another species in the genus, *A. cuspidati* sp. n., from waterlogged moss in Britain; and later the same author (1957) recorded *A. escherichi* BÖRNER from moss in Berkshire and Hertfordshire. HEINZE (1961) reviewed the genus and keyed the three described species with figures. He recorded *A. jeschkei* BÖRNER from Scotland.

Since 1957 considerable quantities of *Aspidaphium* apterae have been obtained by the use of a Berlese funnel extractor from moss gathered in Hertfordshire and Bedfordshire. A recent re-examination of this material suggested that a detailed overhaul of specific criteria in the genus was now possible. Through the kindness of Professor H. SACHTLEBEN I have been able to see the type material of *A. escherichi* and *A. jeschkei* from the BÖRNER collection in the Deutsches Entomologisches Institut, Berlin; and Dr. K. HEINZE has kindly lent me material collected by him in Scotland and determined as *A. jeschkei*. In addition to this material I have had at my disposal 95 apterous viviparae collected in Hertfordshire and Bedfordshire between March 1957 and April 1959, and notes on a small sample from Berkshire recorded in a previous paper (STROYAN, 1957).

BÖRNER (1939) described *Aspidaphium* as follows:

„27. *Aspidaphium escherichi* und *jeschkei* C. B. n. g. n. spp. Generotypus: *escherichi* n. sp. Die neue Gattung ist nächstverwandt mit *Galiobium* C. B. (*langei* C. B.), aber das hinten gerundete Rückenschild des 7. Hinterleibsringes bleibt frei (bei *Galiobium* mit dem großen Rückenschild verwachsen). 8. Hinterleibsring normal, schmal (bei *Aspidaphis* Gill. und *Trilobaphis* Theob. kapuzenartig verlängert und das Schwänzchen deckend). Fühler 5-gliedrig. Siphio etwa doppelt so lang wie das kleine, vor dem Ende eingeschnürte Schwänzchen, kegelförmig, grobgekörnt, mit kleiner, innenseitlicher Öffnung vor der Spitze. Larven und ungeflügelte Erwachsene mit bedornten Schienen. Pleuralborsten der Junglarven vom 2. Brust- bis 5. Hinterleibsring. Gezügelte nicht bekannt. Beide Arten etwa 1 mm, hellgrün (*escherichi*) oder bräunlich (*jeschkei*). Siphonen von *escherichi* etwa von der Länge des 3. Fühlergliedes, von *jeschkei* deutlich kürzer. Große Rückenplatte des Rumpfes bei *escherichi* fast glatt, bei *jeschkei* deutlich fein und an den Seiten etwas gröber gekörnt. *A. escherichi* aus Gesiebe vom bayerischen Wald (Escherich), *jeschkei* aus Gesiebe vom Riesengebirge (Jeschke).“

BÖRNER's material in the Deutsches Entomologisches Institut now consists of four slides, the particulars of which are as follows:

(1) Slide No. 29/78. Contains a single battered and dismembered aptera, with detached appendages scattered over the slide, and one first instar, apparently embryonic and so full of degradation pigments that no detail can be made out. Biometric data that can be obtained from this aptera are: length of antennal flagellum 0.540 mm., joint ratios (III—V) 55:29:25+26; siphuncular length 0.180 mm., caudal length 0.072 mm.; apical segment of rostrum 0.100 mm., second joint of hind tarsus 0.076 mm. The labels of the slide read "*Aspidaphium jeschkei* C. B. Typus. K. HEINZE" and "Serpentinwiese 3. Berlese. JESCHKE leg. Ti 1—3'''.426?". It should be noted that this type designation is apparently that of HEINZE. The label written by BÖRNER (the second quoted) has on it the number 426?, which is the number allotted to another moss-feeder, *Pseudacaudella rubida* (BÖRNER), in BÖRNER's catalogue "Europae centralis Aphides" (1952). On the other hand the number 497a (that of *A. jeschkei* in E.c.A.) occurs on slides 29/90 and 35/9 (see below).

(2) Slide No. 29/89. Contains fragments of three specimens, of which two were evidently mature and one immature. Their condition is similar to that of the specimen in 29/78, and they are so much dismembered that it is impossible to know to which of the mature apterae the single antenna in the slide belongs. This antenna (flagellum only) measures 0.432 mm., its constituent joints being in the ratios 42:26:20+20. The siphunculi of both mature apterae measure 0.176 mm., the caudae 0.072 and 0.078 mm., both apical rostral segments 0.100 mm. and one second hind tarsal joint 0.070 mm. The labels of the slide read „wahrscheinlich Typus von *Aspidaphium escherichi* C.B." and "Waldstreu. Aspidaphis. Ti 3'''. ESCHERICH 1926. 497." Again, only the second label is in BÖRNER's writing.

(3) Slide No. 29/90. Contains a single whole aptera, somewhat flattened. The biometric data are: Body 0.95 mm., antennal flagella 0.416 and 0.408 mm., the flagellar joint ratios 41:24:20+19 and 40:25:19+18 respectively, siphunculi 0.152 and 0.138 mm. respectively, cauda about 0.05 mm., apical rostral segment 0.092 mm., second joint of hind tarsus 0.065 mm. The labels read "nach briefl. Mitt. v. HILLE RIS LAMBERS: *Aspidaphium escherichi* nicht *jeschkei*! 1954" and "FRANZ A 156/0—3. *Aspidaphium jeschkei*. 497a." Again, only the second label is in BÖRNER's writing.

(4) Slide No. 35/9. Contains a single immature aptera so obscured by infiltrated air that it cannot be properly seen, except that it is obviously not *Aspidaphium*. The labels read "nach HILLE RIS LAMBERS (Brief v. 15. ii. 54) *Metopolophium* spec." and "JESCHKE. Basalt Wiese 8. ?. 497a". Again the second label only is BÖRNER's own.

It will be seen that the status of the type of *jeschkei* is not very satisfactory. BÖRNER had two slides of material collected by JESCHKE. On one, which contains an aphid that is not *Aspidaphium* at all, he wrote the

number corresponding to *jeschkei* in his catalogue of 1952; on the other, which does contain *Aspidaphium*, he wrote the number of a totally different moss aphid, *Pseudacaudella rubida*. It would seem that HEINZE's action in selecting this second slide as type was the correct one, in spite of the misleading number, since by no stretch of the imagination could the aphid in slide 35/9 agree with the generic diagnosis of *Aspidaphium*. It seems probable that the E.c.A. numbers are subsequent additions to the slide labels, since the pencil with which they were written had a finer and harder point than that which wrote the rest of the data.

HEINZE (1961) keyed the central European species of *Aspidaphium* as follows:

- „1. Siphon $3\frac{1}{2}$ bis 4mal so lang wie der mittlere Durchmesser, vermutlich kürzer als Fühlerglied III, lückig mit großen flachen, stumpfen Schuppen besetzt. Große Rückenplatte fast glatt. Papillen an Körperseiten stumpf bis rundlich konisch, relativ klein. 1 mm, hellgrün. Vermutlich an Moosen nicht zu feuchter Standorte. Sehr selten (Bayerischer Wald und Österreich) . *A. escherichi* C. B.
- Siphon kürzer als $3\frac{1}{2}$ mal seines mittleren Durchmessers, etwa so lang wie Fühlerglied III, dicht (stachelig) beschuppt. Große Rückenplatte mit kräftiger Fellebung. Papillen an den Körperseiten etwa doppelt so groß wie bei *escherichi*, mit flachen oder konvexen Spitzen und basaler Einschnürung.
2. Fühlergeißel der Ungeflügelten etwa $\frac{6}{5}$ — $\frac{7}{5}$ der Basis des V. Gliedes. Rüsselendglied etwa so lang wie das 2. Glied des Hinterfußes. Siphonen plump gedrungen kegelförmig, dicht stachelig geschuppt, nur etwa $2\frac{1}{2}$ mal so lang wie ihr mittlerer Durchmesser. Schwänzchen unter (bei Geflügelten über) $\frac{1}{2}$ Siphollänge, fingerförmig, Ende relativ schwach abgesetzt. Schienen nur distal rückenseits schwach bedornt. Geflügelte ohne Hautstruktur, an III 15—24, an IV 4—13 (V 4—7) Rhinarien. Geißel mindestens $1\frac{3}{4}$ mal Basis. Hinterleib mit einzelnen Querbinden. 1— $1\frac{1}{4}$ mm., grünlich braun, Rücken und Siphonen schwärzlich. An Moosen im Wasser, auch unter der Wasseroberfläche. Bisher an *Acrocladium cuspidatum* und *Drepanocladus aduncus* in England festgestellt.
 *A. cuspidati* STROYAN.
- Fühlergeißel etwa so lang wie oder wenig kürzer als die Basis des V. Gliedes. Rüsselendglied fast um $\frac{1}{3}$ länger als das 2. Glied des Hinterfußes (basal 3—4borstig). Siphonen etwas schlanker, mindestens dreimal so lang wie ihr mittlerer Durchmesser. Schwänzchen etwas länger als $\frac{1}{3}$ Siphollänge. Endteil sehr deutlich abgesetzt. Schienen ventral von der Basis bis zur Spitze, dorsal und seitlich im Endviertel oder Drittel bedornt. Geflügelte ohne Hautstruktur, an III 15—20, an IV 7—11, (an V 5—6) Rhinarien, Geißel nur wenig länger als Basis. 1 mm., bräunlich. An Moosen (*Rhytidiadelphus loreus*), aber mehr im trockenen Bereich, selten, Riesengebirge, Schottland. *A. jeschkei* C. B.“

This key was based on BÖRNER's type material, on type material of *A. cuspidati* and on the Scottish sample referred to above. It may be noted that HEINZE amends the details given by BÖRNER in that he says of *escherichi* "siphunculi . . . probably shorter than antennal joint III" and of *jeschkei* (and *cuspidati*) "siphunculi . . . about as long as antennal joint III". He adds characters derived from the lateral sculpture of the body cuticle, the sculpture of the siphunculi and the ratio of the length to median width of the latter.

When all the material of *Aspidaphium* now available is taken into account it appears that the morphological criteria that have been put forward for the separation of *Aspidaphium escherichi* and *jeschkei* are not valid. I shall now discuss these criteria in chronological order.

1. Relative lengths of antennal joint III and siphunculus

BÖRNER's type specimens have the following values of the ratio ant. III

siphunculus :

Type of *escherichi* (29/89) 1.05

Type of *jeschkei* (29/78) 1.22

FRANZ A 156/0—3(29/90) 1.08 & 1.16.

HEINZE's material from Scotland, determined as *jeschkei*, contains six apterae. The same ratio measured in these specimens varies from 1.02 to 1.23, mean 1.10, standard deviation 0.075.

Material from Hertfordshire and Bedfordshire yields the data tabulated below for the same ratio.

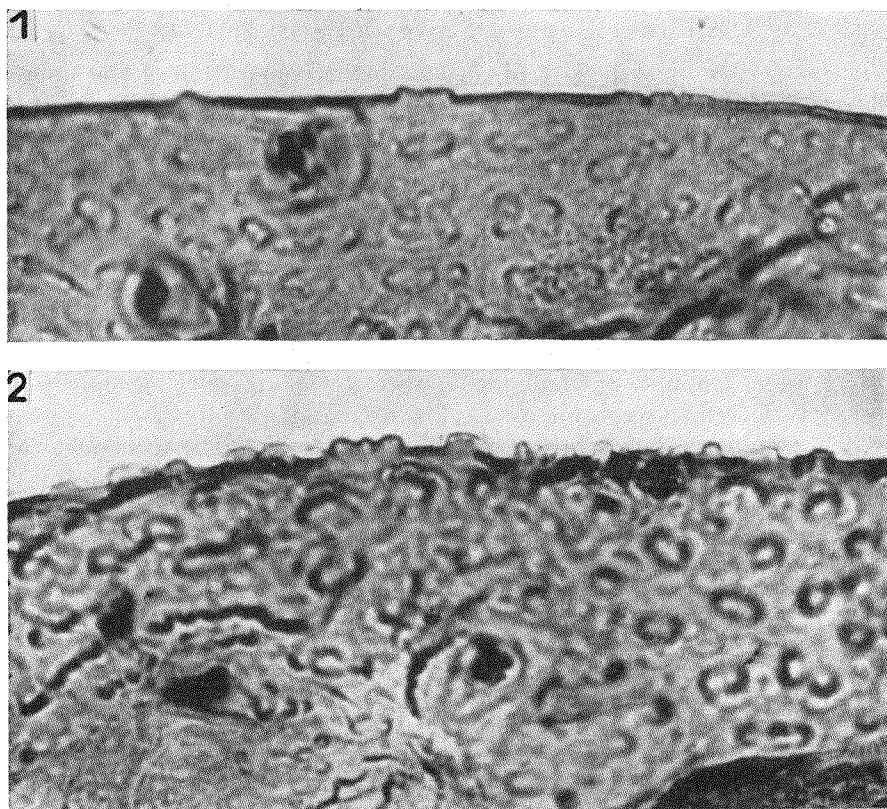
Date	Locality	No. of specimens	Values of ant. III/siphunculus		
			Range	Mean	S. D.
5. 3. 57	Symondshyde, HT	7	0.88—1.06	0.99	0.056
27. 3. 57	"	12	0.96—1.08	1.01	0.041
15. 4. 59	Flitwick, BD	1	1.04	—	—
22. 4. 57	Symondshyde	9	0.88—1.16	0.98	0.094
1. 5. 58	Ashridge, HT	4	1.06—1.11	1.08	0.022
18. 9. 57	Symondshyde	12	1.02—1.18	1.09	0.054
24. 9. 57	"	14	1.00—1.25	1.10	0.069
2. 10. 57	"	24	0.95—1.20	1.11	0.060
27. 10. 57	"	12	1.09—1.24	1.16	0.043

Examination of these data shows clearly that individual samples can cover the whole range of variation between the types of *escherichi* and those of *jeschkei*. There is also some evidence of seasonal variation in this ratio, the highest values occurring from midsummer to autumn and the lowest in early spring. Unfortunately the data of the type slides are deficient as regards date of collection.

2. Dorsal and lateral sculpture

These are difficult to evaluate consistently and objectively. An attempt to apply a numerical scale, based on the density and size of the lateral papillae, and the presence or absence of sculpturing over the mid-dorsal cuticle, was not wholly successful. However, it was possible to detect the fact that, as with the ant. III/siphunculus ratio, all grades of development of the sculpturing could be present within a single sample. The micro-

photographs (Figs. 1—2) show the lateral margins of the abdomen in two specimens from Symondshyde: 1 corresponds to the types of *A. escherichi*, 2 to that of *A. jeschkei*. It seems possible that the degree of sculpturing may be correlated with environmental conditions such as temperature and humidity, particularly when it is remembered that *A. cuspidati*, which



Figs. 1—2. Lateral Margin of abdomen in two apterous viviparae of *Aspidaphium escherichi* C. B. from Symondshyde, Herts., England. — Fig. 1: March 27, 1957 — Fig. 2: September 9, 1957

lives in waterlogged moss, frequently actually under water, has extremely strongly developed sculpture that assists it to maintain an air film over the dorsal surface of the body. The mosses in which *A. escherichi* lives are liable to great seasonal variation in water content, and the microclimate in which the aphids develop must show similar severe fluctuations.

A further point in connection with cuticular sculpture is, that the distribution of the sculptured areas is such that a small degree of lateral rolling of the body in a slide mount can greatly alter the apparent density and shape of the lateral papillae, by bringing into silhouette a contour that

is actually dorsal or ventral to the true lateral outline, where the sculpture is most marked. Specimens of *Aspidaphium* are frequently hard to mount tidily, owing to the more or less sclerotic dorsal "carapace"; and therefore many specimens are too ill-postured to assess accurately for degree of cuticular sculpturing.

3. Siphuncular sculpture and proportions

HEINZE (1961) uses density of the squamous imbrication of the siphunculi as a discriminant character between *escherichi* and *jeschkei*. I cannot see any such difference as he describes between the types of the two species, and the difference is not convincingly shown by the figures with which his key is illustrated. Both the sculpture and the proportions of the siphunculi are, like the lateral body sculpture, liable to apparent alteration by the posture of the aphids. The cross section of the siphunculus at half length is not circular but slightly elliptical, and the apparent width therefore varies with the angle from which the siphunculus is viewed. Apart from rolling of the body, the apparent width of the siphunculi can be increased by flattening of mounts in which media of too low a viscosity, or embodying polyvinyl alcohol, have been used. There is undoubtedly a considerable range of genuine variation in siphuncular proportions in the specimens that I have examined; but I cannot correlate it with any taxonomic discontinuity, and in view of the paucity of the material from which BÖRNER originally described his two species I do not believe that it is in any way significant. The ranges quoted by HEINZE for the length/median width ratio merge into a single continuous range when a few more specimens are examined than he had before him.

There remains the colour difference between *escherichi* and *jeschkei* described by BÖRNER. All the British material that I have examined, including specimens morphologically agreeing with *escherichi*, was pale brown. It therefore seems likely that this character also is not one that can be relied upon. Colour in aphids is a very fugitive character after death, and since the types of both *Aspidaphium* species described by BÖRNER were obtained by sieving, by different workers, it seems quite likely that colour notes were only recorded after death, and perhaps in an alcoholic preservative. On the other hand, it may be that there is a colour variation from green to brown in *Aspidaphium*, as there is for example in *Jacksonia papillata* THEOB. and *Myzus ascalonicus* DONCASTER. Both these latter species live concealed in moist sheltered habitats as does *Aspidaphium*, and in both the green form of the apterae is relatively rare, although intermediate colour forms are more frequent. Brown coloration in aphids is often associated with the degree of sclerotization of the integument, and in *escherichi* this is less than in *jeschkei*, as exemplified by the weakness of the cuticular sculpture.

In the light of the foregoing considerations I believe that it is no longer possible to regard *Aspidaphium escherichi* and *A. jeschkei* as distinct species, and the latter will fall as a synonym of the former, both by line priority and by virtue of the type status of *escherichi*. The British species of the genus will key as follows:

- 1 (2) Processus terminalis from $1\frac{1}{5}$ to $1\frac{1}{2}$ times as long as base of ant. V in apterae, or from $1\frac{2}{3}$ to $2\frac{2}{11}$ times as long as base of ant. VI (V) in alatae. Apterae with very strong and regular papillar sculpture, especially on mid-dorsum and lateral margins of body, the papillae being flat or convex topped with a basal constriction. Apterae appearing black from the very strongly sclerotic dorsum. On *Acrocladium cuspidatum* and *Drepanocladus aduncus* in very wet situations *cuspidati* STROYAN
- 2 (1) Processus terminalis from $\frac{7}{9}$ to $1\frac{3}{19}$ times as long as base of ant. V in apterae, or from about 1 to $1\frac{3}{17}$ times as long as base of ant. VI (V) in alatae. Apterae with very variable sculpture, but with the lateral papillae not regularly flat topped or basally constricted, and the dorsum at most with small granules. Apterae pale brown (or pale green). On *Eurhynchium praelongum*, *Pseudoscleropodium purum*, *Rhytidiadelphus loreus* and ?*Mnium hornum*, growing in moist but not waterlogged habitats *escherichi* BÖRNER
(syn. *jeschkei* BÖRNER)

I am indebted to Professor H. SACHTLEBEN and Dr. K. HEINZE for the loan of specimens for examination, and to Mr. R. N. B. PRIOR for invaluable assistance in the obtaining of material of *Aspidaphium escherichi*, without which this problem could not have been adequately resolved.

Summary

The author examines the morphological characters of the European species of *Aspidaphium*, with special reference to the BÖRNER type specimens and to more recent British material. The name *Aspidaphium jeschkei* C. B. becomes a synonym of *A. escherichi* C. B. The author further offers a key for the identification of the British species of the genus *Aspidaphium* C. B.

Zusammenfassung

Der Autor untersucht die morphologischen Merkmale der europäischen *Aspidaphium*-Arten, mit besonderer Berücksichtigung der Typen von BÖRNER und neueren britischen Materials. Der Name *Aspidaphium jeschkei* C. B. wird Synonym von *A. escherichi* C. B. Ferner gibt d. A. einen Bestimmungsschlüssel für die britischen Arten der Gattung *Aspidaphium* C. B.

Резюме

Автор исследует морфологические признаки европейских видов *Aspidaphium*, с особым учетом типов Бёрнера и более нового британского материала. Название *Aspidaphium jeschkei* C. B. является синонимом *A. escherichi* C. B. Кроме того автор дает ключ для определения британских видов рода *Aspidaphium* C. B.

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Untersuchungen über die Beziehungen zwischen Flügelreduktion und Ausbildung des Metathorax bei Carabiden

unter besonderer Berücksichtigung der Flugmuskulatur

(*Coleoptera: Carabidae*)

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(Mit 34 Textfiguren)

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¹⁾ Meinem verehrten Lehrer, Herrn Professor Dr. J. O. HÜSING, zu seinem 50. Geburtstag gewidmet.