

The synonymy of *Rabdophaga clavifex* (Kieffer) (Diptera, Cecidomyiidae)

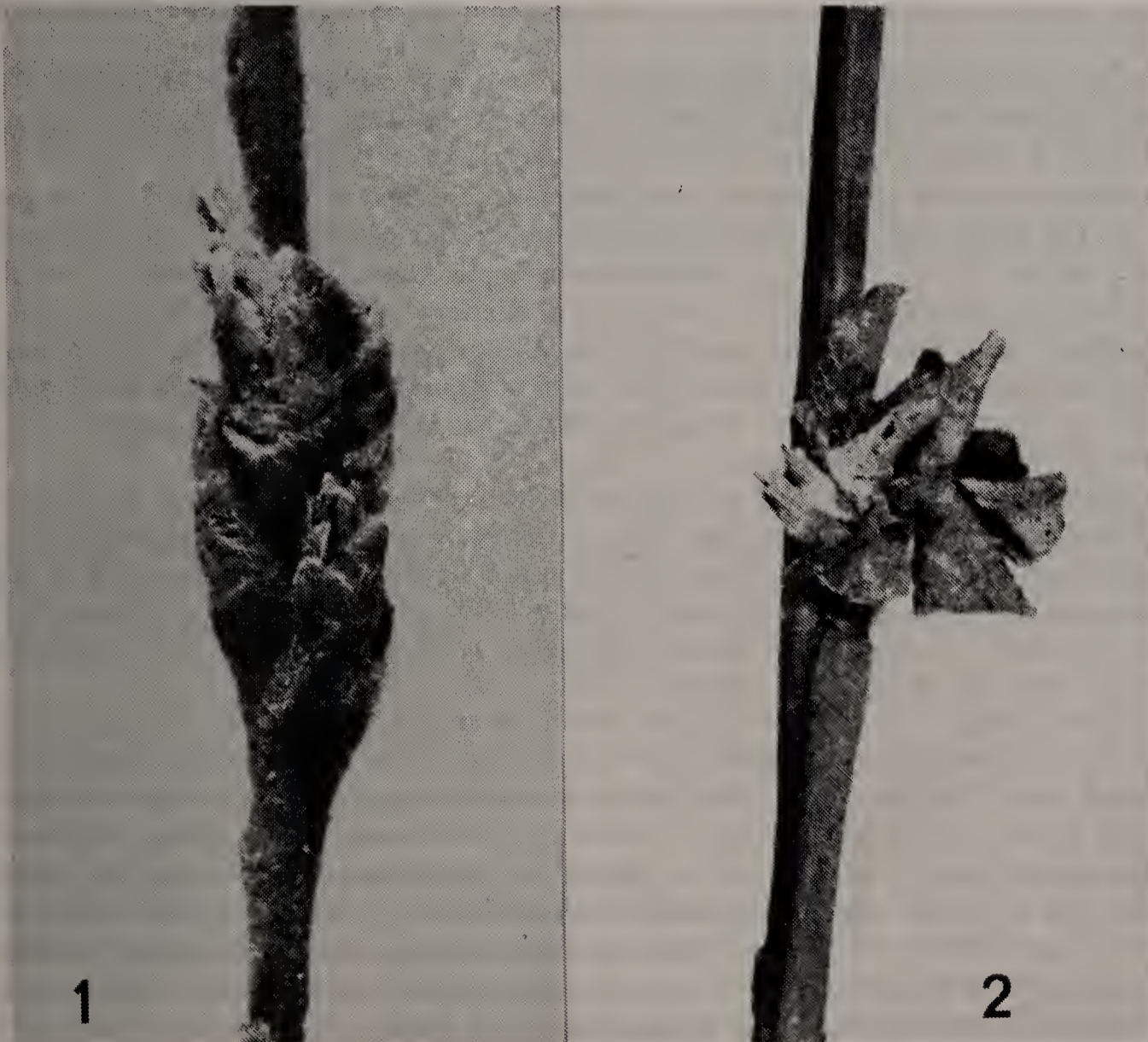
by

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ABSTRACT. — Four new synonyms of *Rabdophaga clavifex* (*R. pulvini*, *R. repenticola*, *R. rosariella*, *R. superna*) are established. It was not possible to synonymize *R. gemmarum* and *R. gemmicola*, two other associates of *Salix*, with *R. clavifex*. *R. congregans* is a nomen nudum. Attention is paid to the importance of the larval spatula in the taxonomy of *Salix*-inhabiting *Rabdophaga* species.

The larvae of the following gall midge species have been recorded in the literature as living in or being associated with the lateral buds of Willows (*Salix* spp): *Rabdophaga clavifex* (Kieffer), *R. gemmarum* Rübsaamen, *R. gemmicola* (Kieffer), *R. pulvini* (Kieffer), *R. repenticola* Stelter, *R. rosariella* (Kieffer) and *R. superna* (Kieffer). In order to determine the validity of these species, I have examined larvae and adults, taken from infested buds on Creeping Willow (*Salix repens* L.) in the Netherlands and other material in the collections of the Instituut voor Taxonomische Zoölogie (Zoölogisch Museum) in Amsterdam; the Rijksherbarium in Leyden; and material, sent to me by Dr. E. Möhn (Staatliches Museum für Naturkunde, Stuttgart, Federal Republic of Germany), Dr. M. Skuhrová (Encyklopedický institut CSAV Praha I, Czechoslovakia), and Dr. H. Stelter (Institut für Kartoffelforschung, Gross-Lüsewitz, German Democratic Republic). I



Rabdophaga clavifex (Kieffer). Fig. 1. bud gall, $\times 2$; 2. rosette like gall, $\times 2$.

have studied the original descriptions of the species involved and I have considered the published information in Buhr (1964/5). I have not seen Kieffer's type material of *R. clavifex*, which is presumed lost, but I examined Stelter's type material of *R. repenticola*.

Kieffer (1891) originally described the galls and both sexes of *R. clavifex* in the genus *Cecidomyia* Meigen and gave short descriptions of the egg, larva and pupa. He reared many males and females from galls, presumably collected from *Salix aurita* L., *S. caprea* L. and *S. cinerea* L. near Bitche, Lorraine. Several other species of *Salix* have been cited in the literature as food plants of *R. clavifex*. Ross & Hedicke (1927) recorded its occurrence on *S. myrsinifolia* Salisb. (= *nigricans* Sm.); Henriksen & Tuxen (1944) recorded it on *Salix alba* × *fragilis* in Denmark, and Ambrus (1960) recorded it on *S. eleagnos* Scop. (= *incana* Schrank) in Hungary.

The larvae of *R. clavifex* live in swollen lateral buds (fig. 1) and in lateral rosettes (fig. 2). Sometimes the twigs are thickened and dwarfed between the buds, giving a "wheat ear" appearance which is also known from the North American *Rabdophaga triticoides*, described by Walsh (1864). The red larvae hibernate in the galls and pupate in spring. There seems to be one generation annually.

Rabdophaga pulvini was originally described in the genus *Cecidomyia* by Kieffer (1891). The larvae were taken from malformed buds on *Salix aurita* L. and *S. cinerea* L. near Bitche, Lorraine. Kieffer stated that the adults were very similar to those of *R. clavifex* and separated both species mainly on the basis of the length of tergum X and sternum X, but these characters are too variable to be of any real diagnostic value. According to page 245 of Kieffer's paper, *R. pulvini* has no spatula in its larval stage, which separates it from *R. clavifex*, but on page 257 it is stated that the larval skin shows a distinct spatula when the body content has been removed. No further information was given concerning its shape, but in 1895 Kieffer wrote in his "Tableau dichot. pour la distinction des larves du genre *Dichelomyia* vivant sur le Saule: spatule composée de deux pointes hyalines (renflement du coussinet d'une feuille)... *D. pulvini* Kieffer (Klugi Meig?)"

There is no doubt that this spatula is similar to that of *R. clavifex*, described in 1891 ("fast ungestielt"). Other similarities are shown by the empty antennal sheaths (fig. 3). I therefore consider that *R. pulvini* falls as a synonym of *R. clavifex*, syn. n.

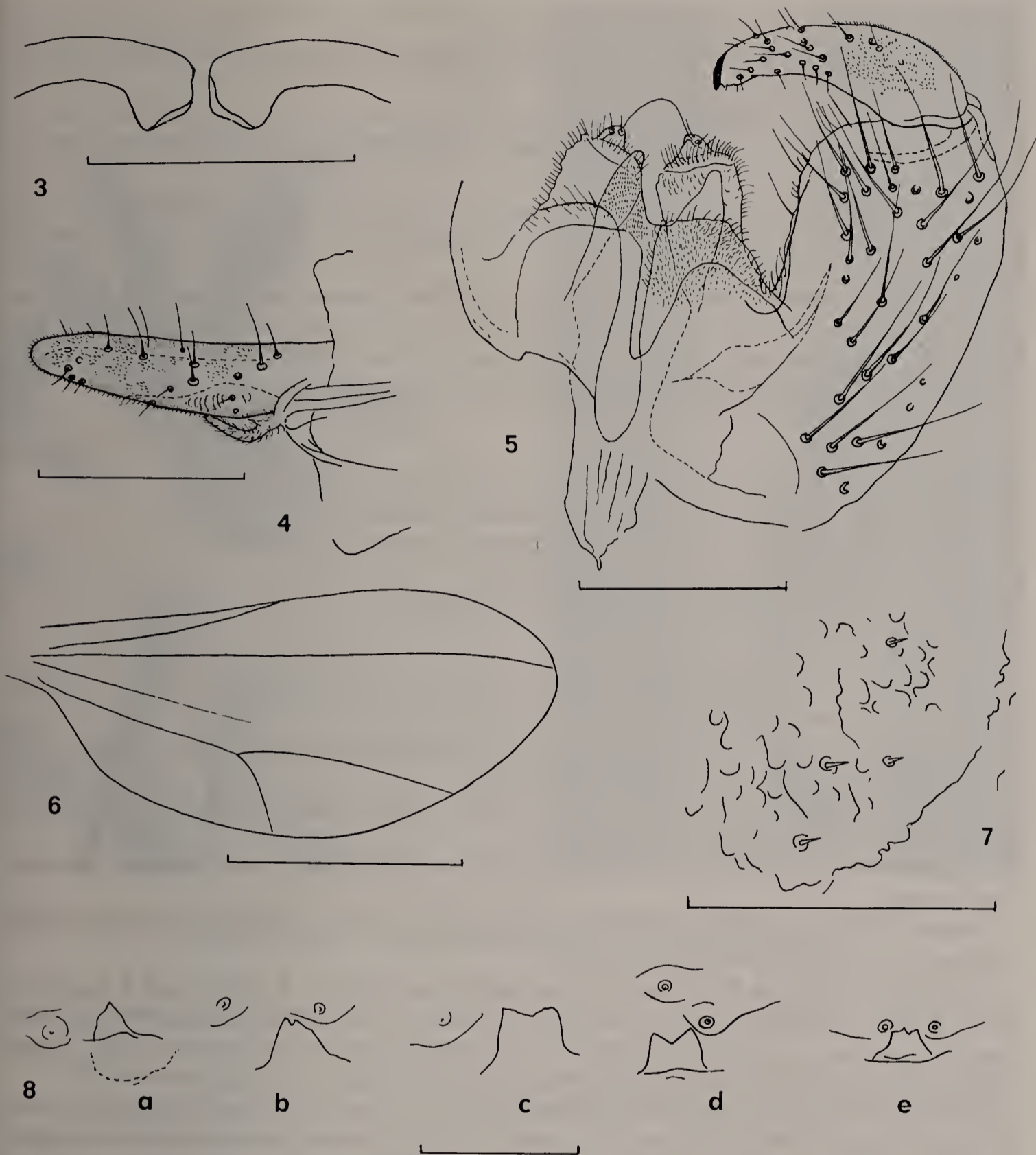
Rabdophaga rosariella and *R. superna* were originally described by Kieffer (1897) in the genus *Bertieria*. The larvae had been taken from malformed buds of *Salix aurita*. The spatula was characterized as follows: "sans tige ou manquant complètement," a type similar to that of *R. clavifex*. After studying the published information of Kieffer (1897) and Jaap (1918) in which the latter author already discussed the possible synonymy of *R. pulvini*, *R. rosariella* and *R. superna*, and after examination of galls, larvae and pupal skins of *R. pulvini* and *R. rosariella*, kindly sent to me by Dr. M. Skuhrová and Dr. H. Stelter, I consider that *R. rosariella* and *R. superna* must fall as synonyms of *R. clavifex*, syn. n., too.

As mentioned before, the sternal spatula has no shaft, which makes it easy to distinguish *R. clavifex* from other *Salix*-inhabiting gall midges. The same type was also observed in larvae, dissected from bud-galls on *Salix repens*, found in a collection of Otto Jaap, which is in the Rijksherbarium in Leyden. The galls were labelled as follows: "Rabdophaga congregans Rüb. n. sp., 2.X.1914". However, this species has never been described, so that *Rabdophaga congregans* has to be considered as a nomen nudum.

The problem of *Rabdophaga repenticola*

Stelter & Buhr (1964) published additional notes on the morphology and the gall formation of *R. clavifex* and described a new species, *R. repenticola*, which causes similar galls on *Salix repens*. Both species are mainly separated on the basis of the wing venation, on the flagellar antennal segments and on the lamellae of the female ovipositor and it is stated that they show a high degree of host specificity and that their occurrence is determined by environmental conditions. This was illustrated by the fact that in localities with *Salix aurita*, *S. caprea*, *S. cinerea* and *S. repens*, the galls of *R. repenticola* could only be found on *S. repens*.

The alleged differences in morphology between *R. clavifex* and *R. repenticola* overlap in many cases, owing to the variability that occurs in the genus *Rabdophaga*. This variability was observed



Rabdophaga clavifex (Kieffer). Fig. 3. empty antennal sheaths; 4. female ovipositor (lateral); 5. male genitalia (part., dorsal); 6. wing; 7. larval terminal segment (part., dorsal); 8 a-e. outlines of larval sternal spatula. Scales: fig. 3. 0.5 mm; 4. 0.1 mm; 5. 0.1 mm; 6. 1 mm; 7. 0.1 mm; 8. 0.05 mm.

again during an examination of reared specimens and after studying the original descriptions of both species. I used the material and information listed below.

- a. Dutch material of *Rabdophaga* sp. on *Salix repens*
- b. German material of *R. repenticola* on *S. repens*
- c. Stelter's description of *R. repenticola* on *S. repens*
- d. Kieffer's description of *R. clavifex* on *S. aurita*, *caprea* and *cinerea*
- e. Stelter's additional description of *R. clavifex* on *S. aurita*, *caprea* and *cinerea*.

The variability has been studied of the antennae, wings, male hypopygium and female ovipositor. The number of animals examined is given within parenthesis. The descriptions referred to under c, d and e are based on an unspecified number of animals. The number of antennal segments is specified in table I.

Wings (fig. 6)

- a: R 1 joining C beyond bifurcation of Cu_1 and Cu_2 , generally running just between C and R 5, seldom closer to C in the basal section (10).
 b: R 1 joining C near bifurcation of Cu_1 and Cu_2 , running closer to R 5 in the basal section (6).
 c: R 1 joining C before bifurcation of Cu_1 and Cu_2 , generally running just between C and R 5, seldom closer to R 5.
 d: R 1 joining C near bifurcation of Cu_1 and Cu_2 , running a little closer to C in the basal section.
 e: R 1 joining C beyond bifurcation of Cu_1 and Cu_2 , generally running closer to R 5, seldom just between C and R 5 in the basal section.

Other wing characters given for the separation of *R. clavifex* and *R. repenticola* are the distances between R 5 and Cu_1 and between Cu_1 and Cu_2 , but they are so variable that they overlap in most cases, not only in the descriptions, but also in the Dutch material. This was observed again while using the characters, given for the basal section of Cu_1 .

Male hypopygium (fig. 5)

- a: tergum X longer and sternum X longer or shorter than claspettes (8).
 b: tergum X and sternum X shorter or nearly as long as claspettes (4).
 c: tergum X and sternum X both equal and somewhat longer than claspettes.
 d: tergum X and sternum X shorter than claspettes.
 e: tergum X longer and sternum X nearly as long as claspettes.

Female ovipositor (fig. 4)

- a: length of inferior lamella shorter, longer or equal to height of superior lamella; superior lamella 2.7-3.9 times as long as high, microtrichia in groups (11).
 b: length of inferior lamella longer or equal to height of superior lamella; superior lamella 3.7-3.9 times as long as high, microtrichia in groups (2).
 c: length of inferior lamella equal to height of superior lamella; superior lamella 3.3-3.7 times as long as high, without microtrichia.
 d: length of inferior lamella shorter than height of superior lamella; superior lamella 1.5 times as long as high.
 e: length of inferior lamella shorter than height of superior lamella; superior lamella 2.3-2.6 times as long as high, microtrichia in groups.

According to Stelter & Buhr one of the main differences between *R. clavifex* and *R. repenticola* is the absence of microtrichia on the superior lamella of the female ovipositor in the latter species. However, an examination, for which a phase-contrast microscope was used, showed distinct groups of microtrichia in *R. repenticola* later on, as is indicated in fig. 4.

Most attention has been paid to the sternal spatula in the discussion of the larval characters of *R. clavifex* and *R. repenticola*. There is no distinct shaft and the lobes show the great diversity in outline that could also be recognized in the Dutch material from *Salix repens* (fig. 8 a-e). The

Category	Male	Female
a	2 + 13 - 19 (8)	2 + 11 - 19 (18)
b	2 + 18 - 19 (4)	2 + 17 - 18 (2)
c	2 + 16 - 18	2 + 14 - 19
d	2 + 16 - 17	2 + 15 - 16
e	2 + 15 - 18	2 + 12 - 18

Table I. Number of basal and flagellar segments in material of *R. clavifex* and *repenticola*, specified in the text.



Rabdophaga clavifex (Kieffer). Fig. 9. gall nr. 1001 in herbarium Docters van Leeuwen, $\times 2$; 10. larva of *Helicomyia saliciperda* in lateral bud of *Salix alba*, $\times 5$.

sternal spatula could not be seen in some larvae. The number of terminal papillae varies from six to eight (fig. 7).

The differences in the external structure of the galls are of no real diagnostic value in this case. They have to be considered as a specific reaction of the different host plants on the feeding behaviour of the larvae (Nijveldt, 1971).

The separation of *R. clavifex* and *R. repenticola* on the basis of a high degree of host specificity is debatable. It could be expected that female midges, emerged from galls on *Salix repens*, would prefer the same host among other *Salix* species for oviposition again. Müller (1869) observed that females of *Dasineura marginemtorquens* (Bremi) selected one single specimen of *Salix viminalis* for oviposition, neglecting all the other bushes of this willow in the same hedge. No breeding experiments, however, have been attempted to establish the host plant range of *R. clavifex* and *R. repenticola* and there is no evidence that *R. repenticola* cannot live on *Salix aurita*, *caprea* and *cinerea* and that *R. clavifex* cannot live on *S. repens*.

My conclusion is that there is no reason to separate *R. repenticola* from *R. clavifex* on morphological or biological characters and that *R. repenticola* falls as a synonym of *R. clavifex*, syn. n. The Dutch species, bred from galls on *Salix repens*, belongs to *R. clavifex* and also does the species in Docters van Leeuwen (1957, nr. 1001) which was supposed to be *R. repenticola* (fig. 9).

Rübsaamen's description of *R. gemmarum* (1915) is too inadequate to decide whether this species is synonymous with *R. clavifex* or not, because no attention has been paid to the larval characters. The spatula sternalis of *R. gemmicola* (Kieffer, 1896) was described as dark brown

with a distinct robust shaft, which separates it from *R. clavifex*. It will be very difficult, if not impossible, to establish the relationship of *R. gemmarum* and *R. gemmicola* with other *Rabdophaga* species, not dealt with in this paper. The larvae of *R. heterobia* (H. Loew) that normally cause deformation of male catkins and small rosettes at the extremities of the shoots on *Salix triandra* L., occur in lateral buds too. A larva of *Helicomyia saliciperda* Dufour, one of the so-called shot hole midges, was taken by me from a bud of *Salix alba* L. in Wageningen in February 1968 (fig. 10). Thus it is not impossible that larvae of the gall-causing *R. dubia* (Kieffer) and *R. salicis* (Schrank) might have been present in buds of *Salix aurita*, from which Kieffer sampled his *R. gemmicola*. In any case the description of the spatula points to a certain similarity with *R. salicis*.

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