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Note on coprophily and necrophily in the Hemiptera Heteroptera

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Abstract

Several recent observations of Heteroptera on excrement and carcasses are reported and discussed. Observations are separated into two groups, predatory and phytophagous species. Phytophagous specimens are mainly members of the Alydidae Alydinae and Coreidae Peudophloeinae and all are males. Review of the previously published informations on the subject is given. Hypotheses are discussed on the significance of that behaviour. The most commonly observed species to show that behaviour are illustrated.

Résumé

Plusieurs observations récentes d'Hétéroptères sur des excréments et des cadavres sont rapportées et discutées. Les observations sont classées en deux groupes selon qu'elles concernent des espèces prédatrices ou phytophages. Les spécimens phytophages sont principalement des membres des Alydidae Alydinae et des Coreidae Pseudophloeinae et tous sont des mâles. Les publications antérieures sur le sujet sont passées en revue. Des hypothèses quant à la signification de ce comportement sont discutées. Les espèces observées le plus communément sont illustrées.

Key words: coprophily, necrophily, Heteroptera, Coreidae, Alydidae, behaviour, aggregation.

Introduction

Coprophagy and coprophily as well as necrophagy and necrophily in the Hemiptera Heteroptera are little known and rarely observed phenomena. Such behaviour has been reported in a small number of species to date and its significance remains unclear.

ADLER and WHEELER (1984) gave a good review of our knowledge of the unusual feeding behaviour of some phytophagous Hemiptera Heteroptera on bird droppings, dung and carrion. They listed the observations known to date of Heteroptera on those substrates, feeding on it or not. They report 8 families and 35 species: Acanthosomatidae (2 species), Alydidae (4), Coreidae (6), Corimelaenidae (1), Cydnidae (3), Largidae (1), Lygaeidae (9), Miridae (3), Pentatomidae (2), Rhopalidae (1) and Tingidae (3). Seventy percent of the feeding records are attributed to 10 species of the Coreoidea families Coreidae and Alydidae.

ADDITIONAL DATA.

(1) the Lygaeidae *Emblethis verbasci* (FABRICIUS) feeding on carcasses of vertebrates (SCHWOERBEL, 1957).

(2) the Coreidae *Coriomeris denticulatus* (SCOPOLI) on a dead red squirrel, *Sciurus vulgaris* L. (MASSEE, 1958).

(3) *Ceraleptus gracilicornis* (HERRICH-SCHÄFFER), *Ceraleptus lividus* Stein and *Coriomeris denticulatus* on dead grass snake, *Natrix natrix* L. (Colubridae), the last in great numbers (GNATZY, 1968).

(4) one male of the Scutelleridae *Chrysocoris fascialis* (WHITE) feeding on the putrefied flesh of a Colubridae snake, *Xenochrophis piscator* (SCHNEIDER), in Thailand (CHÉROT *et al.*, 1998).

(5) the Reduviidae *Lophocephala guerini* LAPORTE feeding on the juice of fermenting cowdung in Southern India (AMBROSE & LIVINGSTONE, 1979).

(6) 10 species of Cydnidae from the Oriental region: *Chilocoris costatus* LIS, *C. vanstallei* LIS, *Cydnopeltus sulawesicus* LIS, *Parachilocoris borneensis* LIS, *P. navus* LIS, *Katakadia caliginosa* (WALKER), *Macroscytus celebensis* BREDDIN, *M. transversus* (BURMEISTER), *Microporus laticeps* (SIGNORET) and *Pseudoscoparipes kinabalensis* LIS, taken in traps for coprophagous Coleoptera baited with human excrement,

dead fish or dung (LIS, 1994). Both males and females are listed. PLUOT-SIGWALT (1995) wisely wonders if the specimens were effectively attracted by baits or just fell in the trap as they are ground dwelling species (e.g.: one specimen of *Macroscytus celebensis* was taken by Van Stalle (VAN STALLE, *in litt.*) in unbaited pitfall).

(**7**) some Rhopalidae Serinethinae have been observed by J. Carayon to feed on excrement (MOULET, 1995).

(**8**) large numbers of nymphs of the Coreidae *Gelonus tasmanicus* (LE GUILLOU) feeding on bird droppings, and the Pyrrhocoridae *Dindymus versicolor* (HERRICH-SCHÄFFER) feeding on the bodies of dead *Dindymus* and other arthropods (e.g. millipedes), and on dead lizard (STEINBAUER, 1996).

(**9**) WHEELER (2001) documented extra-phytophagous food sources of the family Miridae and discussed the significance of the presence of some species in birds' nests, stating that they might be feeding on bird droppings.

(**10**) HUH *et al.* (2005) tested fish baited traps to attract *Riptortus clavatus* (THUNBERG) (Alydidae), a pest on soybean and sweet persimmon in Korea. Sweet persimmon growers already used that technique and the authors showed that 98.7% of the bugs attracted to the traps were males. However, the pheromone involved was not identified and further research has not been successful yet to identify it (C.G. PARK, *pers. comm.*, 2007)

PAYNE *et al.* (1968) mentioned two species of Alydidae, *Alydus eurinus* (SAY) and *Megalotomus quinquespinosus* (SAY), and ADLER and WHEELER (1984) one species of Largidae, *Largus succinctus* (L.) to be mating on carcasses of pigs for the first two and on bird dropping for the last. It is also suggested that aggregation behaviour observed in Alydinae on carrion, possibly due to scent glands, would be adaptative for resource use as well as for bringing together the sexes (ADLER and WHEELER, 1984).

A number of the few observations in which the sex of the feeding specimens is known refer to females, contrary to what can be observed in other groups (e.g. Lepidoptera and Cicadellidae) in which males represent more than 95 % of the observations (ADLER and WHEELER, 1984). The only study that matches well observations in other groups is that of HUH *et al.* (2005), with males representing 98.7% of the observed specimens.

SCHAEFER (1980) suggested that necrophagy and coprophagy could provide Alydinae with water and concentrated semi-liquid protein and MOULET (1995) states that captive Alydidae and Coreidae Pseudophloeinae feed on their own eggs if no animal protein is provided supplementary to the phytophagous diet. Furthermore, RALPH (1976) reports the Lygaeidae *Oncopeltus fasciatus* (DALLAS), and Dominique PLUOT-SIGWALT (*pers. comm.*, 2007) Pyrrhocoridae of the genera *Pyrrhocoris* FALLÉN, *Scantius* STÅL and *Dysdercus* GUÉRIN MÉNEVILLE, Cydnidae of the genera *Macroscytus* FIEBER, *Chilocoris* MAYR and *Geotomus* MULSANT & REY as well as some Lygaeidae, to show cannibalistic behaviour when reared in captivity on a normal diet of seeds.

Predatory Heteroptera on dungs and carrions

Heteroptera found on dungs and carrions can be separated into 2 groups: predatory and phytophagous insects.

The occurence of predators is explained by the abundance of prey (larvae and adults of other insects) in, on and close to the dung and carrion, so that it can be stated that those species are attracted by the aggregation of potential prey better than by droppings or carrion themselves.

This can be illustrated by a number of observations:

- *Geocoris lapponicus* ZETTERSTEDT (Lygaeidae), *Coranus subapterus* (DEGEER) (Reduviidae), *Nabicula flavomarginata* (SCHOLTZ) (Nabidae), and nymphs and adults of *Saldula orthochila* (FIEBER) (Saldidae) on cow dung and sheep droppings in Switzerland, the last three feeding on larvae of Diptera and on Collembola (M. DETHIER, *pers. comm.*, 2000).

- Three species of Reduviidae: *Oncocephalus geniculatus* (STÅL), *Melanolestes picipes abdominalis* (HERRICH-SCHÄFFER) and *Sinea diadema* (FABRICIUS) feeding on larvae and adults of Diptera Calliphoridae on pig carrion in the USA (PAYNE *et al.*, 1968).

The only observation of predatory bugs feeding on excrement is that of AMBROSE & LIVINGSTONE (1979) who reported the feeding behaviour of *Lophocephala guerini* on fermented cowdung. They also report for that species a unique case of mutualism with the ant *Anoplolepis longipes* (JERDON) which guides the bug to its food sources. These observations need confirmation as the bugs could as well have been feeding on larvae living in the cowdung (the bug did not survive more than 10 days in laboratory when given only fermented

cowdung for food). The association with the ant needs also more investigation to be fully understood and correctly interpreted.

Phytophagous Heteroptera on dung and carrions

1. Bugs on dog droppings

Between 8th and 15th May 1999, numerous bugs were observed on dog droppings in Saint-Christol d'Albion (France, Vaucluse).

No fewer than 13 species representing 4 families were collected:

Coreidae: *Coriomeris denticulatus* (Scopoli), *Coriomeris hirticornis* (Fabricius), *Coriomeris affinis* (Herrich-Schäffer), *Bathysolen nubilus* (Fallén), *Loxocnemis dentator* (Fabricius), *Bothrostethus annulipes* (Costa), *Ceraleptus lividus* Stein, *Ceraleptus gracilicornis* (Herrich-Schäffer) and *Ceraleptus obtusus* (Brullé).

Lygaeidae: *Emblethis verbasci* (Fabricius) and *Gonianotus marginepunctatus* (Wolff).

Thyreocoridae: *Thyreocoris scarabaeoides* (L.).

Pentatomidae: *Sciocoris* sp.

All the specimens of all species were males. The aggregations were impressive and up to 40 specimens per dropping were counted with the most common species being *Ceraleptus gracilicornis* (Plate 1 D), *Coriomeris denticulatus* (Plate 1 B) and *Coriomeris affinis* (Plate 1 A), and in a minor way *Loxocnemis dentator* (Plate 1 C). Only single specimens were collected for the species of the families Lygaeidae, Thyreocoridae and Pentatomidae.

Bugs were present on all 10 droppings found, with some of the droppings even totally covered with bugs.

It seems interesting to mention that, depending on the place where the dropping was, the associations of species were not the same: while *Ceraleptus gracilicornis* and *Coriomeris denticulatus* were always present, the other species were found only in the drier and more sunny places.

The same sites had already been prospected in 1997 and 1998, at about the same dates, but only coprophagous beetles were found on dog droppings those times. Moreover, by collecting bugs with more «conventional» methods (e.g. sweeping, beating, sight collecting on and at the feet of plants), only 3 of the species collected on the droppings had been found (*Ceraleptus gracilicornis*, *Ceraleptus lividus* and *Coriomeris denticulatus*).

Bugs were present on the droppings 24 hours a day: the first observation was made in the night at about 2 a.m. and the density was similar to that observed during day time. Furthermore, numerous bugs could be found on droppings from which all individuals had been collected the day before.

Strangely, among the hundreds of specimens observed, no single individual was clearly seen feeding on the dropping.

It seems important to mention that all the species found on the droppings are mainly ground-dwelling species (what can explain that they were poorly collected the preceding years) and that all the Coreidae collected are members of the subfamily Pseudophloeinae.

In addition to the species listed above, one specimen of *Camptopus lateralis* (Alydidae) has been observed on a dog dropping on a small road in Saint-André-les-Alpes (France, Alpes de Haute-Provence), in July 1996. That specimen had not been collected and its sex is not known.

Finally, at the end of May 2000, 5 specimens of *Coriomeris denticulatus*, all males, were observed feeding on a dropping attributed to a fox in the nature reserve of Devant-Bouvignes in Dinant (Belgium, province of Namur). Those specimens were very nervous and the weather was stormy at that moment. They were captured and transferred into a terrarium to allow further observation but none of the specimens showed any interest in the dog droppings that were placed in the container.

2. Bugs on horse dung

On 10th September 1995, seven specimens of *Alydus calcaratus* (L.) (Alydidae) (Plate 1 E) were collected in Porté-Puymorens (France, Pyrénées Orientales), burried into a somewhat dry horse dung. All the specimens were males.

3. Bugs on carrions

Two observations are worth being mentioned here:

- Our colleague Jean-Yves Baugnée found in Resteigne (Belgium, province of Luxemburg) on 11th September 1999 one specimen of *Coriomeris denticulatus* on the carcass of a field mouse, *Apodemus sylvaticus* (L.) in a wasteland in warm weather. That specimen was not collected and we do not know its sex (J.-Y. Baugnée, *pers. comm.*, 2000).

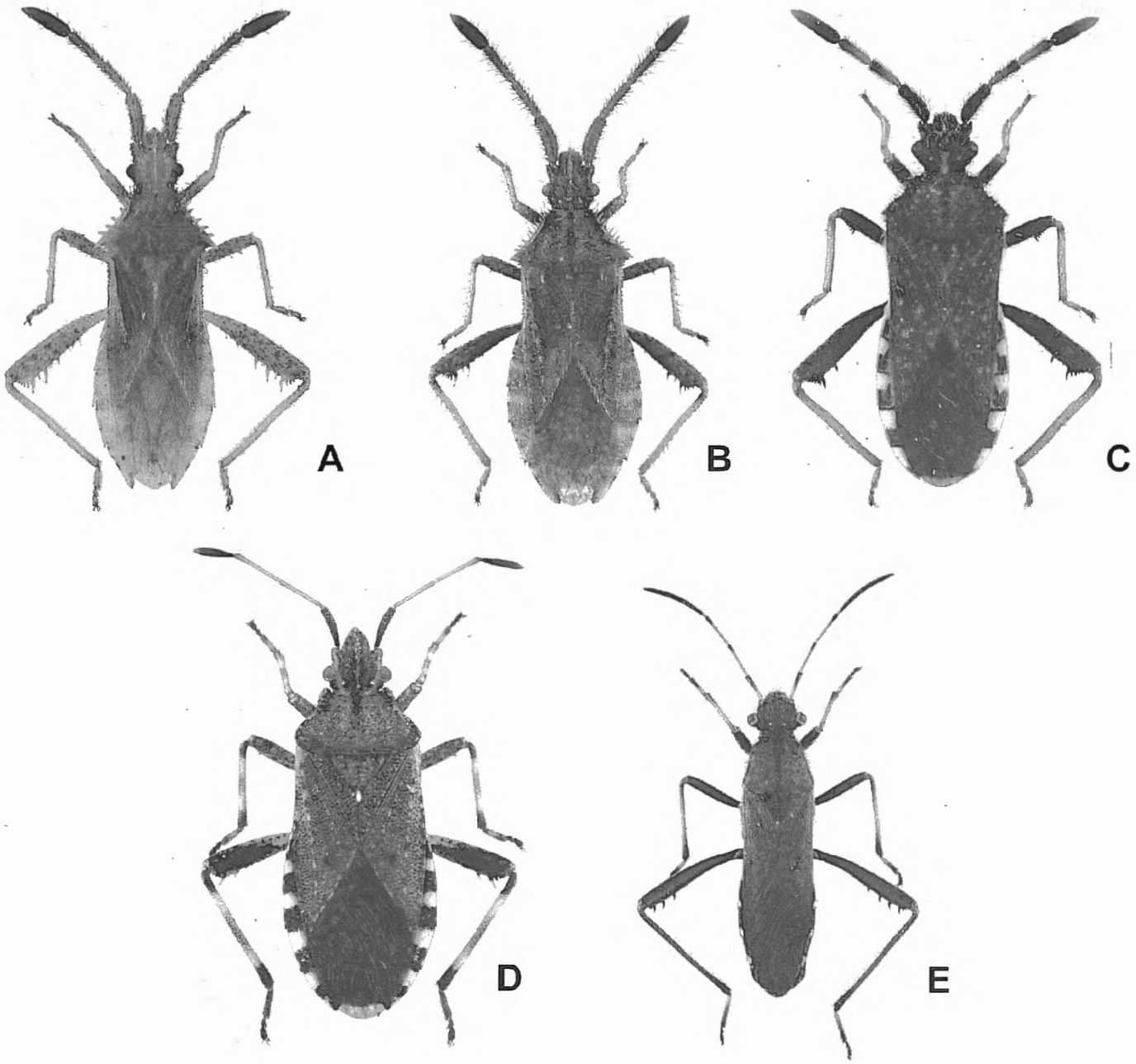

Plate 1 — A-E. — **A.** *Coriomeris affinis*, habitus. **B.** *Coriomeris denticulatus*, habitus. **C.** *Loxocnemis dentator*, habitus. **D.** *Ceraleptus gracilicornis*, habitus. **E.** *Alydus calcaratus*, habitus.

- In an unpublished study on the necrophilous fauna conducted in Treignes (Belgium, province of Namur) in 1976, R. Anderson writes [translated from French]: «*Coreus hirticornis* [actually *Coriomeris denticulatus*] *was quite abundant in April and May on the somewhat dry carcasses, but only in meadows. We have observed it with the labium inserted between the rat's hairs, probably feeding*».
Two specimens collected during that study have been examined by Jean-Yves Baugnée, dated 21st and 22nd April 1976. Both are males (J.-Y. BAUGNÉE, *pers. comm.*, 2000).

Discussion

Alydidae Alydinae and Coreidae Pseudophloeinae represent the largest majority of our observations. Whenever the sex is known, we have only found males, which does not match with the hypothesis of ADLER and WHEELER (1984) that sexes could be brought together by the attraction to excrement and carcasses. Our data give a view of the phenomenon that is closer to what has been reported for other groups of insects, e.g. Lepidoptera and Hemiptera Cicadellidae where 95 % of the data deal with males (ADLER and WHEELER, 1984),

and that is supported by the study of HUH *et al.* (2005).

Feeding on excrement and carcasses seems to be a sporadic behaviour that is not linked to location (in 1999 in Saint-Christol d'Albion but not in 1998 and 1997) or to the period of the year (from April to September). It is maybe interesting to note that Alydinae and Pseudophloeinae are groups that are both linked to Fabaceae, nitrogen-rich plants (SCHAEFER, 1980; MOULET, 1985), and that they are considered as primitive among Coreoidea by some authors (SCHAEFER, 1980).

It is not impossible that droppings and carcasses at some stage of decay contain chemicals that are close to some aggregation or sexual molecules of bugs, as has also been observed by HUH *et al.* (2005). It seems also clear that not all droppings attract bugs and maybe this could be linked to the alimentation or to the sexual cycle of the animal that produced the dropping. Furthermore, it appears that the attractive substance is not specific as several species are attracted together. It is also possible that some of the specimens found are attracted by aggregation pheromones of other species, as has been shown for *Piezodorus hybneri* (GMELIN) (Pentatomidae) which is attracted by one component of the aggregation pheromone produced by the males of *Riptortus clavatus* (THUNBERG) (HUH *et al.*, 2006). Maybe comparative biochemical analysis of droppings that attract bugs and of the pheromones produced by the males found on those droppings could lead to a better comprehension of this strange behaviour.

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References

ADLER, P.H. & A.G. WHEELER, Jr., 1984. Extra-phytophagous Food Sources of Hemiptera-Heteroptera: bird droppings, dung and carrion. *Journal of the Kansas Entomological Society*, 57 (1): 21-27.

AMBROSE, D.P. & D. LIVINGSTONE, 1979. On the bioecology of *Lophocephala guerini* Lap. (Reduviidae: Harpactorinae) a coprophagous reduviid from the Palghat Gap, India. *Journal of Natural History*, 13: 581-588.

CHÉROT, F., O.S.G. PAUWELS, J. E. EGER & C. CHIMSUNCHART, 1998. Unusual feeding behavior in a scutellerid: a case of scavenging on snake. *Natural History Bulletin of the Siam Society*, 46: 207-208.

GNATZY, W., 1968. Faunistisch-Ökologische Untersuchungen an Heteropteren im Bereich von Lorch/Hessen. *Mainzer Natur-Wissenschaftliches Archiv*, 7: 225-264.

HUH, H.S., K.H. PARK, H.Y. CHOO and C.G. PARK, 2006. Attraction of *Piezodorus hybneri* to the aggregation pheromone components of *Riptortus clavatus*. *Journal of Chemical Ecology*, 32 (3): 681-691.

HUH, W., H.S. HUH and C.G. PARK, 2005. Fish materials as potent attractants for the male of bean bug, *Riptortus clavatus*. *Journal of Asia-Pacific Entomology*, 8 (4): 419-422.

LIS, A.J., 1994. *A revision of Oriental burrower bugs (Heteroptera: Cydnidae)*. Bytom: Upper Silesian Museum, 349 pp.

MASSEE, A.M., 1955. The county distribution of the British Hemiptera-Heteroptera. 2nd edition. *Entomologist's Monthly Magazine*, 91: 7-27.

MOULET, P., 1995. *Hémiptères Coreoidea (Coreidae, Rhopalidae, Alydidae), Pyrrhocoridae, Stenocephalidae euro-méditerranéens*. Faune de France 81, 336 pp. Paris.

PAYNE, J.A., F.W. MEAD and E.W. KING, 1968. Hemiptera associated with pig carrion. *Annals of the Entomological Society of America*, 61 (3): 565-567.

PÉRICART, J. 1998. *Hémiptères Lygaeidae euro-méditerranéens*. Faune de France, 84, vol. 1: xx + 468 pp., vol. 2: vi + 453 pp., vol. 3: vi + 487 pp. Paris.

PLUOT-SIGWALT, D., 1995. Analyse d'ouvrage: Jerzy A. Lis "A revision of oriental burrower bugs (Heteroptera: Cydnidae)", 1994. Bytom: Upper Silesian Museum, 349 p. *Annales de la Société Entomologique de France (N.S.)*, 31 (2): 195-196.

RALPH, C.P., 1976. Natural food requirements of the large milkweed bug, *Oncopeltus fasciatus* (Hemiptera: Lygaeidae), and their relation to gregariousness and host plant morphology. *Oecologia*, 26: 157-175.

SCHAEFER, C., 1980. The host plants of the Alydinae, with a note onHeterotypic feeding aggregations (Hemiptera: Coreoidea: Alydidae). *Journal of the Kansas Entomological Society*, 53 (1): 115-122.

SCHWOERBEL, W., 1957. Die Wanzen und Zikaden des Spitzberges bei Tübingen, eine faunistisch-ökologische

Untersuchung. *Z. Morph. Ök. Tiere*, 45: 462-560.

STEINBAUER, M.J., 1996. Notes on extra-phytophagous food sources of *Gelonus tasmanicus* (LE GUILLOU) (Hemiptera: Coreidae) and *Dindymus versicolor* (HERRICH-SCHÄFFER) (Hemiptera: Pyrrhocoridae). *Australian Entomologist*, 23 (4): 121-124.

WHEELER, A.G. Jr., 2001. *Chapter 15: scavenging and Use of Other Animal Associated Foods*. In *Biology of the Plant Bugs (Hemiptera: Miridae) Pests, Predators, Opportunists with a foreword by Sir T. Richard E. Southwood.* Comstock Publishing Associates, Cornell University Press, Ithaca and London. xv + 507 pp. (pp. 317-323).

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