

Two New *Tetramorium* Species (Hymenoptera: Formicidae) from Vietnam with a Discussion of the *mixtum*, *tonganum* and *scabrosum* Groups

by

Eric Roncin¹

ABSTRACT

Tetramorium securis sp. nov. and *Tetramorium kieti* sp. nov. are described from Vietnam. They both belong to the *mixtum*-group *sensu* Bolton (1977). Reconsideration of the characters that define this group led us to question its validity and to transfer its constituting species to the *tonganum*- and *scabrosum*-groups. The recently described species *Tetramorium malabarensis* Sheela & Naredran, 1998 and *T. sentosus* Sheela & Naredran, 1998, and the two new species described in this paper are here assigned to the *scabrosum*-group.

INTRODUCTION

The genus *Tetramorium* Mayr, 1855 (subfamily Myrmicinae) comprises 424 described species throughout the world including 69 species from the Oriental region. The species from Nearctic, Neotropical, Ethiopian, Australasian and Oriental regions have been revised by Bolton (1976, 1977, 1979, 1980, 1985), and more recently 8 new species have been described from southeast China (Wang *et al.* 1988; Wang 1993; Xu & Zheng 1994; Zhou 1997). According to Bolton, the genus is presently represented in the Oriental region by 13 indigenous species-groups, and one introduced from Africa (*Tetramorium simillimum* group). During our study of the myrmecofauna of southeast Asia, we found many species of the genus new to science, which are currently under study. Two of them, both of the *mixtum*-group *sensu* Bolton (1977), are described in the present article. In these species, the main character that defines the group is intermediate between that of the *mixtum*-group and that of the *scabrosum*- and *tonganum*-group. This led us to reevaluate the diagnostic characters of these three species-groups and to propose the suppression of the *mixtum*-group.

MEASUREMENTS AND INDICES

All measurements, except for total length (TL), were made on specimens in alcohol using a Leitz Weitzlar Stereomicroscope at

¹Laboratoire d'Ecologie Terrestre, UMR 5552 du CNRS, 118, route de Narbonne, 31062 Toulouse cedex 04 (France). E-mail: roncin@cict.fr

magnification of 216x. They are given in millimeters. The measuring accuracy at this magnification is estimated at $\pm 1.5 \mu\text{m}$ (1/3 of smaller division of the micrometric ocular represents approximately $3 \mu\text{m}$).

In the Formicidae, the eyes range from absent to well developed, and the profile of eyes varies greatly from one species to another, from flat to very globose. The measurement head width (HW) could follow two different definitions. HW includes the eyes for Ward (1989, 1999) but excludes them for most other authors. The resulting values may be therefore different in ants where eyes protrude laterally. No author has given both HW measurements in his descriptions. Both measurements are used in this paper as they provide complementary information.

The following abbreviations according to Bolton (1976) and Ward (1989) are used:

Total Length (TL). Total length of an individual, from the mandibular apex to the gastral apex

Head Length (HL). The length of the head, excluding the mandibles. This measurement is taken in frontal view on the sagittal line from the foremost point of the clypeal margin (or its projection if situated laterally to the line) to the most posterior point on occipital margin (or its projection)

Head Width including Eyes (HW+E). Maximum head width including the eyes

Head Width excluding Eyes (HW). Maximum head width excluding the eyes. If situated at the level of eyes, the measurement is taken on a line below or above them, where HW is maximal

Scape Length (SL). Length of the first antennal segment, excluding the condylus

Cephalic index (CI). $CI = (HW / HL) \times 100$

Scape Index (SI). $SI = (SL / HW) \times 100$

Eye Diameter (EL). Maximal length of eye

Pronotal Width (PrW). The maximum width of pronotum, measured in dorsal view

Mesosoma Length (ML). Diagonal length of the mesosoma in lateral view from the point at which the pronotum meets the cervical shield to the base of the propodeal lobes. Often called Weber's length of mesosoma

Dorsal Petiole Width (DPW). Maximum width of the petiole, measured in dorsal view

Dorsal Postpetiole Width (DPpW). Maximum width of postpetiole, measured in dorsal view

The holotypes of the new species are deposited in the Museum National d'Histoire Naturelle de Paris (MNHN) and the paratypes in the author's collection.

***Tetramorium securis* n. sp.**

(Figs. 1, 3, 5)

Holotype. WORKER. TL 1.9, HL 0.506, HW+E 0.489, HW 0.453, CI 90, SL 0.362, SI 80, EL 0.114, PrW 0.326, ML 0.535, DPW 0.139, DPpW 0.194

Head nearly as long as wide with feebly concave posterior margin in full face view; sides weakly convex, and head width moderately decreasing from eyes to anterior clypeus margin. Mandibles with faint striation, with three strong apical teeth, the two first closer to each other than to the third one; followed by a series of four minor denticles. Anterior clypeal margin entire, moderately and regularly convex. Clypeus with three main longitudinal rugae. Anterior clypeus margin with a small horizontal rim below the anterior declivity bordering the basal margin of the mandibles when closed. Frontal carinae extending back almost to occipital corners, but behind level of eyes becoming weak and no more strongly developed than cephalic rugae. Eyes situated in front of the middle of sides of head, their maximum length 0.114 mm, about $0.25 \times HW$. Dorsal head sculpture between frontal carina longitudinally rugulose, the rugae being slightly sinuous, turning to a rugoreticulum dorsally in the $1/5$ posterior part of head from the level of the superior limit of the scrobes to occiput in full face view. This rugoreticulum also covers lateral and ventral parts of head from the lower margins of the scrobes, and from mandibular insertions to occiput, and becomes very weak posteromedioventrally. Spaces between frontal rugae and in inner parts of the reticulation filled with small reticulate-puncturations. Upper part of scrobes possesses only this fine puncturation and appears less sculptured than neighboring areas. Scrobes not really delimited by a margin posteriorly and laterally.

Dorsal surface of scapes with one or two erect hairs and with decumbent pubescence.

Mesosoma without any trace of dorsal sutures, and regularly convex in profile. Pronotal humeri angulate in dorsal view. Propodeal lobes well developed, acute, slightly shorter than the propodeal spines and with dorsal and ventral outlines concave in lateral view. Propodeal spines semi-translucent, acute, flattened in the sagittal plan, slightly upcurved at their extremities, and almost parallel in dorsal view. Mesosoma with fine reticulate-puncturations superimposed to coarse rugoreticulations. Former sculpture reduced on lateral parts of propodeum.

Node of petiole in profile bent backwards with tergal portion slightly higher than long, posterior and dorsal face meeting through a curve, not separated by an angle. Anterior face of node concave. In dorsal view

node 1/3 longer than wide, its lateral portions steeply sloping downward and meeting on the top in a sharp longitudinal edge. Sternal part of the node visible in dorsal view and wider than the tergal part (maximum width of the tergal part of the petiole = 0.118).

Petiole and postpetiole quite bright but with superficial reticulation. In profile, dorsal outline of the anterior peduncle of the petiole backwards prolonged by a strong diagonally ascending ruga that almost reaches the upper posterior part of the node. Postpetiole transverse and rectangular in dorsal view. Dorsal face of the tibia III with a few suberect hairs.

Base of first gastral tergite concave, widely connected with postpetiole. Anterolateral parts of first tergite gaster forming blunt tubercles anterior to the level of medioanterior margin of gaster in dorsal view. Posterior visible part of the abdominal pretergite IV with a transverse groove armored with short longitudinal costae. Gaster fairly shining but with superficial fine reticulation (visible in alcohol under high magnification and saturated light reflection).

All dorsal surfaces of the body with erect, stout, and rather small hairs, the longer of them situated on the back of head, mesosome and gaster reaching 0.055 mm.

Color light yellowish brown, the appendages yellowish.

Material examined: holotype worker, VIETNAM: Dong Nai Province: Binh Chau, forest, 35 m, litter surface, 22.i.1995, pitfall (VIET 173), L. Deharveng, A. Bedos coll.

Paratypes workers: 2 workers, same locality, 22.i.1995, pitfall traps (VIET 154), L. Deharveng, A. Bedos coll.

Standard measurements of paratype workers: TL 1.9-2.0, HL 0.506-0.531, HW+E 0.486-0.502, HW 0.547-0.455, CI 86-88, SL 0.375-0.379, SI 83-84, EL 0.110, PrW 0.346-0.354, ML 0.573-0.582, DPW 0.143-0.150, DPpW 0.202-0.235

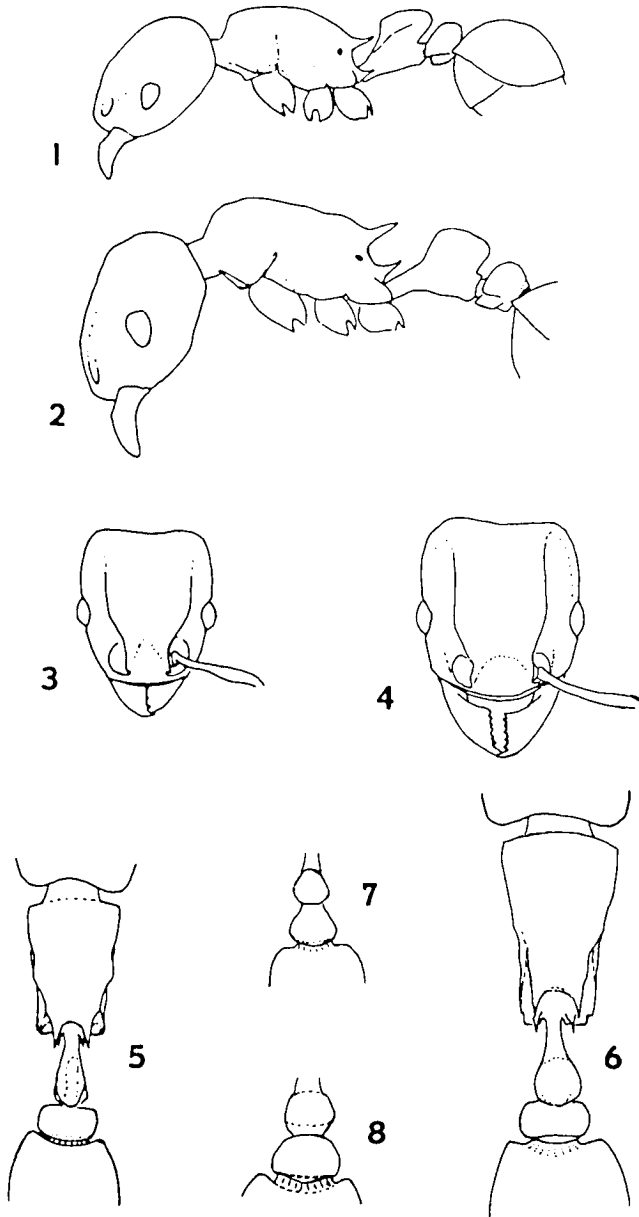
Etymology: from the latin *securis* which means axe; refers to the shape of the petiole.

***Tetramorium kieti* n. sp.**

(Figs. 2, 4, 6)

Holotype. WORKER. TL 2.1, HL 0.544, HW+E 0.517, HW 0.485, CI 89, SL 0.392, SI 81, EL 0.118, PrW 0.362, ML 0.624, DPW 0.148, DPpW 0.219

Head slightly longer than wide with feebly concave posterior margin in full face view; sides weakly convex, and head width slightly decreasing from eyes to anterior clypeus margin. Mandibles striate, with seven teeth, the two first distinctly stronger and the third, and the last one



Figs. 1-8. *Tetramorium* workers. *Tetramorium securis* (Nam Cat Tien, Vietnam): lateral view (1), dorsal view (5), head in frontal view (3), *Tetramorium kietii* (Hon Chong, Vietnam): lateral view (2), dorsal view (6), head in frontal view (4). *Tetramorium kraepelini* (Loksado, South Kalimantan, Borneo): petiole, postpetiole and base of gaster in dorsal view (7), *Tetramorium seneb* (Chiang Mai: Doi Pui, Thailand): petiole, postpetiole and base of gaster in dorsal view (8).

situated at the basal angle of mandibles, more developed than the three intercalary ones. Second tooth closer to the first than to the third one.

Anterior clypeal margin entire, moderately and regularly convex. Clypeus with three main longitudinal rugae. Anterior clypeus margin with a small horizontal rim below the anterior declivity bordering the basal margin of the mandibles when closed. Frontal carinae extending back almost to occipital corners, but behind level of eyes, becoming weak and no more strongly developed than cephalic rugae. Eyes slightly situated in front of the middle of sides of head, their maximum length 0.118 mm, about 0.24 x HW. Dorsal head sculpture between frontal carinae longitudinally rugulose, the rugae being slightly sinuous, and with some cross-meshes, more numerous near frontal carina. Rugoreticulations on posterior 1/5 of head, from the level of the posterior limit of the scrobes in full face view. This rugoreticulum also covers lateral and ventral parts of head from the lower margins of scrobes, and from mandibular insertions to occiput. Postero-medioventrally this sculpture is reduced. Spaces between frontal rugae and between the wrinkles of the coarse rugoreticulation on head and mesosoma filled with small reticulate-puncturations. Scrobes not really delimited by a margin posteriorly and laterally.

Dorsal surface of scapes with one to five erect hairs and with decumbent pubescence.

Mesosoma without any trace of dorsal sutures, its dorsum flat in profile, and with a feeble concavity between mesonotum and propodeum. Pronotal humeri angulate in dorsal view. Propodeal lobes well developed, acute, nearly as long as the propodeal spines and with dorsal and ventral outlines concave in lateral view. Propodeal spines acute, straight to barely upcurved at their extremities, divergent in dorsal view.

Node of petiole in profile with tergal portion higher than long, roughly rectangular, with almost parallel rectilinear anterior and posterior faces and an evenly convex dorsum which meets each face in blunty right angles. In dorsal view the node is rounded and slightly longer than wide.

Petiole and postpetiole with fine superficial rugoreticulations. In dorsal view, petiolar node as wide as long or hardly longer than wide. Postpetiole transverse, wider than long, with blunt anterolateral angles and posterolateral margin progressively curved. Dorsal face of the tibia III with a few suberect hairs and with shorter semidecumbent hairs.

Base of first gastral tergite concave, widely connected with postpetiole. Anterolateral parts of first tergite gaster forming blunt tubercles or teeth anterior to the level of medioanterior margin of gaster in dorsal view. Posterior visible part of the abdominal pretergite IV with a transverse groove armored with short longitudinal costae. Gaster fairly shining but

with superficial fine reticulation (visible in alcohol under high magnification and saturated light reflection), and with basal one-sixth of the first gastral tergite with longitudinal rugulae. Lamelliform appendage of the sting projecting at an angle from the sting.

All dorsal surfaces of the body with erect stout hairs, the longer of them, situated on back of head, mesosome and gaster reaching 0.080 mm except one or two pairs on pronotum near neck shield of approximately 0.100 mm length.

Color light brown, slightly darker than *T. seneb* and *T. securis*.

Material examined: holotype worker, VIETNAM: Kien Giang Province: Hon Chong, Nui Binh Tri, litter in secondary forest, 19.i.2000, Berlese extraction of 1000 cm³ of litter (VIET 861), L. Deharveng, A. Bedos coll.

Other material. One worker from VIETNAM: Dong Nai: Nam Cat Tien, forest, approximately 250 m of altitude, surface litter, 25.i.1995, formaline pitfall (VIET 185), L. Deharveng, A. Bedos coll.

Standard measurements: TL 2.2, HL 0.556, HW+E 0.523, HW 0.481, CI 86, SL 0.405, SI 84, EL 0.118, PrW 0.369, ML 0.628, DPW 0.148, DPpW 0.207

Etymology: I have the pleasure to dedicate this species to Professor Le Cong Kiet, head of the laboratory of botany and ecology at Ho Chi Minh-City University, who organized the field trips to Hon Chong and Nam Cat Tien.

DISCUSSION

Of all the known *Tetramorium* species of the Oriental Region, *T. securis* is the smallest; the only one along with *T. kraepelini* with a head width inferior to 0.50 mm. The former species is similar to *T. kieti* by its overall sculpture, proportions of the head, weakness of the posterior part of antennal scrobes, pilosity of scapes and hind tibiae, and moderate development of gastral tubercles, but differs by its size, the shape and sculpture of the petiole, the width of the basis of the propodeal spines, and the sculpture of the basis of the first gastral tergite. *Tetramorium kieti* is close to *T. mixtum* with a very similar shape of the mesosoma and petiole in lateral view. However *mixtum* has a stronger concavity and more developed gastral horns on the anterior part of the first gastral tergite, a longer petiole in dorsal view, and a larger body size.

In his 1977 revision, Bolton defined several species groups in an attempt to organize the huge number of *Tetramorium* species. The two new species described here would clearly fall in the *mixtum*-group to which the following species already belong:

Tetramorium amium Forel, 1912

Tetramorium mixtum Forel, 1902

Tetramorium rugigaster Bolton, 1977

Tetramorium transversarium Roger, 1863

Bolton defined this group by the combination of the following characters: 12-segmented antennae; frontal carinae extending back beyond the eyes; eyes of moderate size; and especially the development of a pair of anterolateral tubercles (gastral horns) on the first tergite of the gaster which surround the posterior portion of the postpetiole in dorsal view. This structure is also visible in profile as a tooth protruding forward above the anterodorsal limit of the sternite. This last character that led Bolton to create the *mixtum*-group, is also shared with the *inglebyi*-group. But species of this latter group differ by their reduced frontal carinae and eyes, smaller node of petiole, shorter propodeal spines, and are more related to the palaeartic *caespitum*-group (Bolton, 1977). Some African species of the *solidum*-group of Bolton (1980) also exhibit a similar development of the anterior part of the first gastral tergite as figured by Prins (1973) for *Tetramorium peringueryi dichroum* (presently *T. dichroum*) and *T. rutilum* (a junior synonym of *T. glabratum*). However this group is not related to the Asiatic groups discussed in this paper.

The types of *amium* and *transversarium* were not examined by Bolton. This author based his placement on the examination of new material (one worker) for *transversarium*, and for *amium* on the original description (Forel 1912), which is quite fragmentary. Actually, *T. amium* does not have the well developed gastral horns that define the *mixtum*-group, as we checked out on a worker of the type series. On the other hand, there are large specific differences in the degree of development of these structures in the *mixtum*-group. The most developed tubercles occur in the largest species: *rugigaster* and *mixtum*, and the less developed ones, in the smallest species: *transversarium* and in the two new species described here. In fact, the state of development of this character in *transversarium*, *kieti* and *securis* is transitional with that observed in species of the *tonganum*- or of the *scabrosum*-group. Bolton (1977) already stated the close proximity of these latter groups to the *mixtum*-group. *Tetramorium seneb* Bolton of the *tonganum*-group has indeed the anterolateral parts of its gaster angled / slightly dentate (Fig 8), as clearly as *transversarium* of the *mixtum*-group ; this character is a little less marked but still present (Fig. 7) in *T. kraepelini* Forel of the *scabrosum*-group. The anterolateral gastral margin varies from regularly curved to angled and at the extreme markedly tuberculate in each of these groups.

and cannot be used as a supra-specific diagnostic character. We therefore propose to abandon the *mixtum*-group and to transfer its species into the *scabrosum* and the *tonganum* groups, both groups being defined according to Bolton (1977), except for the gaster morphology. Even so, as already stated by this author, the *tonganum* and *scabrosum* groups remain weakly defined and are more taxonomically practical groups than monophyletic units. According to this conception, the species of the *tonganum* and *scabrosum* groups are listed below:

***scabrosum*-group**

- scabrosum* (F. Smith), 1859 (Aru, New Guinea)
transversarium Roger, 1863 (Sri Lanka)
punctiventre Emery, 1887 (New Guinea)
curtulum Emery, 1894 (Burma, Malaya, Sarawak)
pulchellum Emery, 1897 (New Guinea)
kraepelini Forel, 1905 (China, Java, Japan, Kalimantan, Philippines, Thailand, Vietnam) *
amium Forel, 1912 (Taiwan) **
aptum Bolton, 1977 (Thailand, Malaya) ***
parvum Bolton, 1977 (Java)
rugigaster Bolton, 1977 (India)
tanakai Bolton, 1977 (Japan)
crepum Wang & Wu, 1988 (China)
malabarensis Sheela & Narendran, 1998 **** (India)
sentosus Sheela & Narendran, 1998 **** (India)
kieti, sp. nov. (Vietnam)
securis, sp. nov. (Vietnam)

*New localities for *T. kraepelini*:

Indonesia, Kalimantan Selatan, Loksado, 5.viii.1998 (LOK-022).

Thailand, Chiang Rai Province, Mae Sai, 7.vii.1987 (CR-013).

Vietnam, Dong Nai Province, Nam Cat Tien, 25.i.1995 (VIET-191).

***T. amium* is transferred to the *scabrosum* group on the basis of the pilosity of its scape and hind tibiae, observed on one specimen of the type material.

***New locality for *T. aptum*: Vietnam, Dong Nai Province, Binh Chau, 22.i.95 (VIET-143, VIET-153).

****The two Indian species, described posteriorly to the Bolton revision, were placed near species of the *mixtum*-group, though their position in the Bolton's system was not explicitly stated. According to the original figures and diagnoses, *T. sentosus* possesses developed

gastral horns, that are lacking in *T. malabarensis*. By their other characters, these two species belong to the *scabrosum*-group.

tonganum-group

mixtum Forel, 1902 (India)

tonganum Mayr, 1870 (widespread in the Oriental region and Pacific islands)

christiei Forel, 1902 (Bhutan, India)

salvatum Forel, 1902 (Himalaya, India)

infraspinum Forel, 1905 (Java)

cuneinode Bolton, 1977 (Thailand)

difficile Bolton, 1977 (Buthan, Nepal, Vietnam) *

laparum Bolton, 1977 (Philippines)

seneb Bolton, 1977 (Java, Malaya, Thailand) **

vandalum Bolton, 1977 (Papua Niugini)

*New locality for *difficile* :

Vietnam, Kieng Giang Province: Hon Chong, 21.xii.94 (VIET-032).

**New localities for *seneb*:

Thailand, Chiang Mai Province: Mae Tho, 14.vii.1985 (CL-020); *Ibid.*: Doi Pui, 03.ix.85 (CL-084); *Ibid.*: Doi Chiang Dao, track of Ban Na Lao, 04.vii.85 (DC-054); *Ibid.*: Ban Tham Chiang Dao, 17.xii.80 (THA-001, THA-007); *Ibid.*: Chiang Dao, near Tham Klaeb Yai, 17.vii.85 (NE-022).

Thailand, Chantaburi Province: Khao Wong, 03.viii.87 (CTI-004); *Ibid.*: Khao Chamao, 03.viii.87 (CTI-007, CTI-008).

Thailand, Phangnga Province: Ko Ping Khan, 22.vii.87 (PAG-026).

Thailand, Surat Thani Province: Phanom, 25.vii.87 (SUT-022).

To accommodate the changes and the new taxa proposed here, the *Tetramorium* key of Bolton (1977) has to be amended: (i) *T. amium* keyed out at entry 29 has to be transferred near the species of the *kraepelini* complex (*kraepelini*, *parvum*, *tanakai*), because of the weak development of the anterolateral angles of its gaster and other characters; its exact placement cannot be determined at the moment; (ii) *T. seneb* (fig. 8), *T. securis* sp. nov., *T. kieti* sp. nov., and *T. sentosus* Sheela & Narendran, 1998 fall at entry 29, which should be modified as follows :

- 29 Node of petiole as long as broad or longer than broad in dorsal view
 29a
 — Node of petiole broader than long in dorsal view (India) ... *sentosus*
 29a Petiole node in dorsal view markedly longer than broad. A strong
 diagonal ascending ruga extending anteriorly from the point where

- the dorsal face of the anterior peduncle of the petiole meets the anterior face of the node to almost the upper posterior part of the node. HW <0.50 (Vietnam) *securis* n. sp.
- Petiole node in dorsal view as long as or slightly longer than broad. Node without a strong diagonal ruga. HW >0.55 29b
- 29b Node of petiole in profile with tergal portion as high as long. Gaster with a pair of well developed anterolateral tubercles surrounding posterior border of postpetiole. HW >0.70 (India) *mixtum*
- Node of petiole in profile with tergal portion higher than long. Gaster with a pair of moderate anterolateral tubercles surrounding posterior border of postpetiole. HW <0.60 29c
- 29c Postpetiole globose and unsculptured. Tergal portion of the petiolar node narrowing upwards. Dorsal face of scapes only with dense short pubescence (Java, Malaya, Thailand) *seneb*
- Postpetiole transverse with fine rugoreticulations. Tergal portion of the petiolar node widening upwards. A few erect or suberect hairs on dorsal face of the scapes longer than decumbent pubescence (Vietnam) *kieti* n. sp.

ACKNOWLEDGMENTS

Many thanks to Louis Deharveng, Claude Boutin, Bernard Kaufmann, Alain and Andrea Dejean who read and helped to improve the manuscript, to Pr. Barry Bolton for his useful comments, to Anne Bedos, Louis Deharveng, Le Cong Man and Prof. Le Cong Kiet who provided the material studied in this paper, to Andreas Taeger from the Deutsches Entomologisches Institut in ZALF for the loan of a syntype of *Tetramorium amium* from Sauter's collection.

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