

**REVIEW OF THE SPECIES OF THE SUBGENUS *MEGAPANGUS* CASEY  
(COLEOPTERA: CARABIDAE, HARPALINI, *HARPALUS* LATREILLE)**

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**Abstract**

I examined types of three named forms and additional specimens of subgenus *Megapangus* Casey, and here recognize two species as valid. I present distribution records defining the range of *Harpalus caliginosus* Fabricius and *Harpalus katieae* Battoni. Variation in diagnostic characters previously used to separate the species and additional characters of the last exposed tergite, gonocoxae and internal sac of the aedeagus and their states are discussed.

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When Casey (1914) described the subgenus *Megapangus*, it was monotypically represented by *Harpalus caliginosus* Fabricius (1775). Casey (1924) subsequently described *Harpalus caliginosus dux*. But this subspecies is, as Lindroth (1968) stated, "superfluous." Despite Casey's proclivity for describing new species, a cryptic sibling species *Harpalus katieae* Battoni was not described until 1985. Because of the limited material examined by Battoni (1985) it was not clear whether *H. katieae* was a distinct species or represented the southern end of clinal variation in *H. caliginosus*. Unfortunately Battoni's work has not been widely referred to and most collections contain mixed series of these two species. This paper presents unequivocal evidence that these are two distinct species, presents the ranges of the two species and provides characters to facilitate identification.

**Material Examined and Methods**

Approximately 1,800 specimens were examined from the following states (abbreviations from Bousquet and Laroche (1993), ♂ or ♀ = respective genitalia examined, \* = new records):

- H. caliginosus*—AL♂♀, AR♂♀, AZ♂♀, CA♂♀, CO♂♀, CT♂♀, DC♂, FL♂♀, GA♂♀, IA♂♀, ID♂♀, IL♂♀, IN, KS♂♀, KY♂, MA, MD♂, MI♂♀, MN, MO♂♀, MS♂♀, NE♂♀, NC♂♀, NH♂, NJ, NM♂♀, NY♂♀, OH♂♀, OK♂♀, OR, PA♂♀, SC, TN♂♀, TX♂♀, UT♂♀, VA, VT, WA♂♀, WI♂, WV♂♀, WY, MEX♂♀
- H. katieae*—AL♂♀\*, AR♂♀, CO♂♀\*, GA♀\*, FL♂♀\*, IL♂♀\*, LA♂♀\*, MO♀, MS♂♀\*, NE♂\*, NC♂\*, NM♂♀, OK♂♀, TN♂♀\*, TX♂♀, MEX♂♀\*

The lectotypes of *H. caliginosus*, *H. caliginosus dux* and paratype of *H. katieae* were examined. Information concerning synonymy and location of types is in Lindroth (1968), Battoni (1985) or Noonan (1991).

Specimens were examined using a standard dissecting microscope. Overall length was measured using an ocular grid. Genitalia were extracted by methods outlined by Liebherr (1992). Many specimens had terminalia exposed and needed no further preparation. This condition was common enough to allow

inspection of more than 200 medial lobes and a similar number of gonocoxae. Techniques for eversion of the male internal sac followed Allen (1972). The internal sac was everted from six specimens of each species selected from apparently sympatric and allopatric populations. Gonocoxae were examined in situ when exposed or teased out with forceps from specimens softened by steeping in hot water. Female genitalia of representatives from the type areas for both species were extracted and stained for examination of internal structures. Types were examined for external characters. The medial lobe of the paratype of *H. katiae* and the tip of the gonocoxae of the female *H. caliginosus* associated with the lectotype (Fabricius 1775, Lindroth 1968) were examined. Because of their value, types were dissected no further.

#### Taxonomic Analysis

The species of *Megapangus* can be separated from members of other *Harpalus* subgenera by their large size (14–35mm) and lack of a mentum tooth, in combination with a hairy field at the sloping base of the elytra. Characters of male genitalia and external characters used by Battoni (1985) were examined and found to be stable and useful in separating the two species. Character states for color, structure of internal sac, female tergite and gonocoxae are also diagnostic (Table 1). Both external morphology and those genitalic characters that were available for examination are congruent with all aspects of this diagnosis for types of *H. caliginosus* and *H. katiae*. Subspecies *H. caliginosus dux* is a merely a large female *H. caliginosus* with relatively flat elytral intervals.

Internal structures of the female reproductive tract for both *H. caliginosus* and *H. katiae* consist of a large, highly sclerotized bursa, annulated spermathecae, and thin gland typical of Harpalini. General conformation of the bursa differed for a fit with the conspecific male endophallus.

Geographical variation in color and size was observed. Specimens of *H. katiae* from Texas and New Mexico are consistently large (24–30mm) and rufo-piceous, while those east and north of Texas and New Mexico vary more widely.

The following couplet can be inserted into keys in Noonan (1991:22, Key A #1) or Lindroth (1968:752, couplet 12).

- x Head scarcely punctulate to strongly punctate (Fig. 2a); ♂ with medial lobe ventrally at most strigose, never with spinules (Fig. 3a); ♀ last exposed tergite reflexed at apical margin with a distinct medial process (Fig. 5a); gonocoxae darker, relatively thicker, apex rounded (Fig. 6a)  
..... *H. caliginosus*
- x' Head perfectly glabrous, never punctate (Fig. 2b); ♂ with medial lobe ventrally with distinct spinules (Fig. 3b); ♀ last exposed tergite ± reflexed at apical margin, smoothly rounded, without medial process (Fig. 5b); gonocoxae thin, diaphanous, apex much more acute (Fig. 6b) . . . . . *H. katiae*

The known range of *H. caliginosus* was reported most completely by Bousquet and Larochelle (1993). This range is summarized in figure 1a. Records for *H. katiae* reported by Battoni (1985) and Dunn (1986, 1987), suggest a generally southern range (Dunn 1986). From specimens I examined the range can be expanded and more accurately defined (Fig. 1b). Records for Colorado, Nebraska and Illinois seem to be associated with the large rivers and may mark the northward advance of *H. katiae* along these major river systems.

**Table 1.** Diagnostic characters for species of *Megapangus*.

	♂♂ <i>H. caliginosus</i>	♂♂ <i>H. kattia</i>	♀♀ <i>H. caliginosus</i>	♀♀ <i>H. kattia</i>
Punctuation of the head, Fig. 2	Varies from strongly punctate to punctulate	Smooth, never punctate	As in males	As in males
Lateral bead of the pronotum	Varies from strongly narrowed at hind angle to coarse throughout its length	Coarse throughout its length or slightly narrowed at the base	As in males	As in males
General coloration	Varies from black to rufo-piceous or rufo-brunneous, lighter colored individuals rare	Varies from black to rufo-piceous or rufo-brunneous, light colored individuals predominate	As in males	As in males, light color more consistent
Last exposed tergite, Fig. 5	Smoothly rounded, never reflexed	Smoothly rounded, never reflexed	Strongly produced and reflexed medially	Slightly reflexed but never produced medially
Aedeagus, Fig. 3	Ventral surface with central groove and laterally strigose	Ventral surface with spinules		
Internal sac, Fig. 4	Dorsal medial sacculus with large, dense field of large spines, dorsal basal sacculus with dense field of small spines, tip simply rounded	Dorsal medial sacculus with smaller field of large spines and a secondary sacculus with 0-4 large spines (4-6 usual), dorsal basal sacculus with dense field of small spines, tip with paired diverticula		
Gonocoxae, Fig. 6			Tip rounded, short, thick and dark	Tip acute, lighter, edges diaphanous

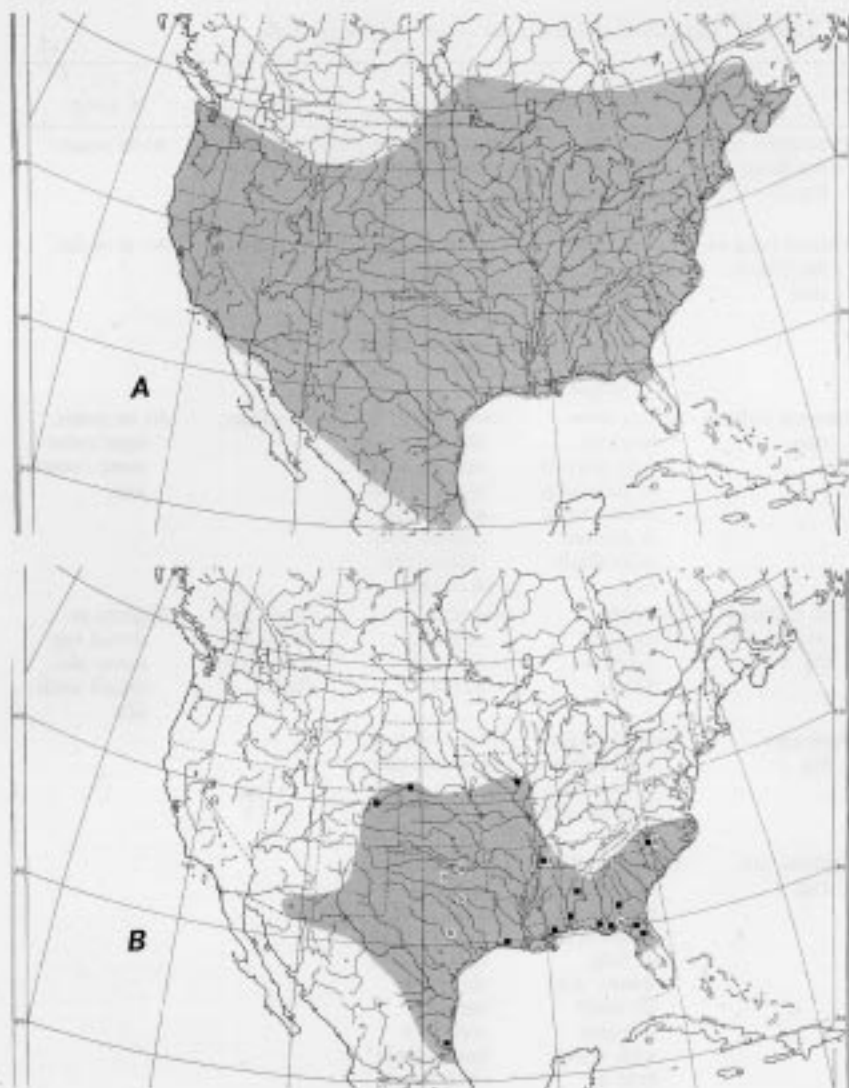


Fig. 1. Distributions. A) *H. caliginosus*. B) *H. katiae*. (■) new records, (○) sympatric records.

These two species are largely sympatric (Figs. 1a,b). Data for sympatric and syntopic records apparently taken by the same method are marked with the double daggers (††) in the following list.

**Locality Data for new Records for *H. katiae*.** **Alabama:** Mobile Co., Dauphin Island, NE side by sea lab. 11.X.1975 (2 specimens), Mobile, 28.VII.1960, light, coll. B. K. Dozer (1). Tusca[loosa], at light, coll. B. Valentine, ††Tuscaloosa, 18.VIII.1952, light, B. D. Valentine (1). **Colorado:** Mor-

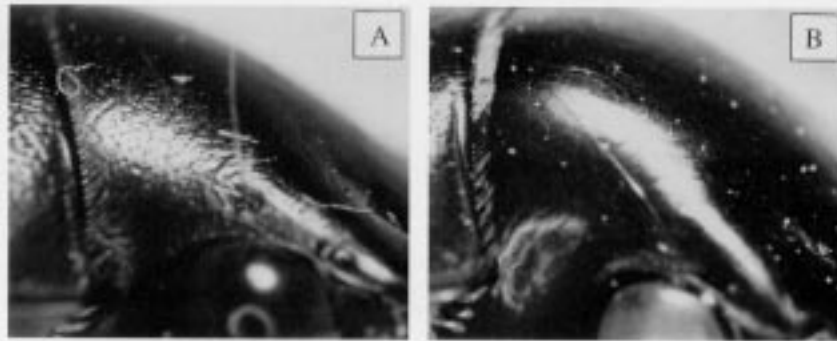


Fig. 2. Right lateral view of head: A) *H. caliginosus*. B) *H. kattiae*.

gan Co. 12.VIII.1977, coll. Kondratieff (1). **Florida:** Alachua Co. Gainesville, Doyle Corner Bldg. 28.VIII.1972, Blacklight trp, coll. F.W.Mead (1), Gainesville, 27.VIII.1965, at light, coll. L.C.Kuitert (1), ††Leon Co., Tall Timbers Research Station, [numerous dates from 14.VII.1969 to 24.IX.1973] Pitfall traps, (14), Marion Co. 5.VII.1963, coll. E. J. Moore (1), Ocala Co. Japanese beetle trp., coll. T. R. Adkins, Walton Co., Defuniak Springs, 10.IX.1987, coll. W. Zanol (1). **Georgia:** Lawndes Co., Valdosta, 28.VIII.1977 (1). **Illinois:** Thomson, Carol Co. 8.IX.1949 (3) 1 ♀ labeled "sandunes active daytime." **Louisiana:** Cameron, 26.VI.1930, coll. F.H.Shoemaker (2). **Mississippi:** Ocean Spring, Jackson Co. 4.VI.1930 (2), 22.VI.1930 (4), coll. H. Dietrich. **Nebras-**

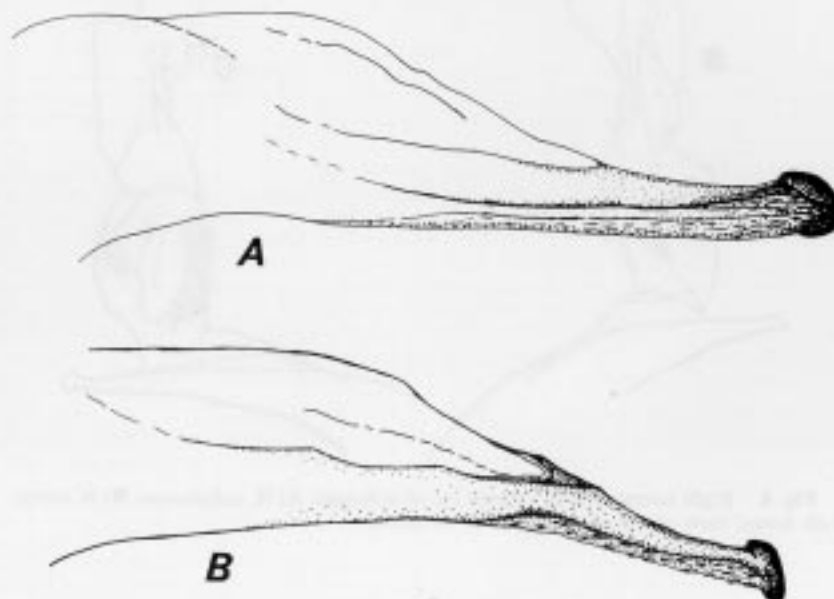
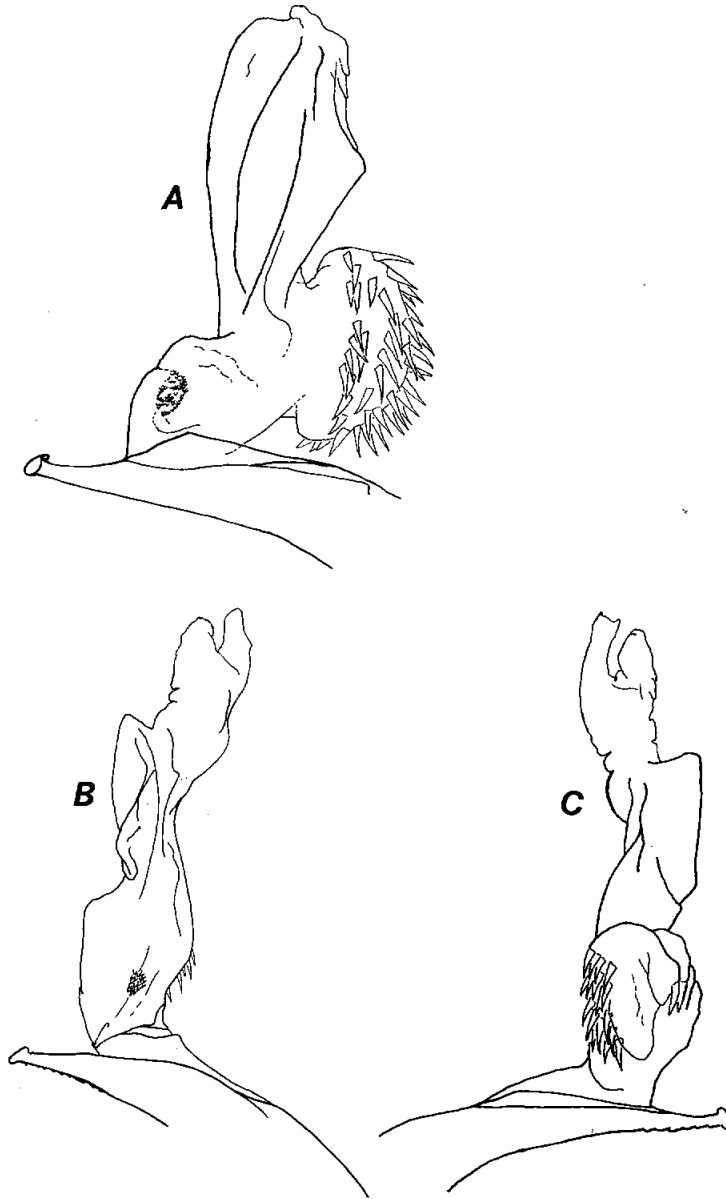


Fig. 3. Left lateral view of medial lobe of aedeagus. A) *H. caliginosus*. B) *H. kattiae*.



**Fig. 4.** Right lateral view of everted sac of aedeagus. **A)** *H. caliginosus*. **B)** *H. katiae*. Left lateral view of sac of aedeagus. **C)** *H. katiae*.

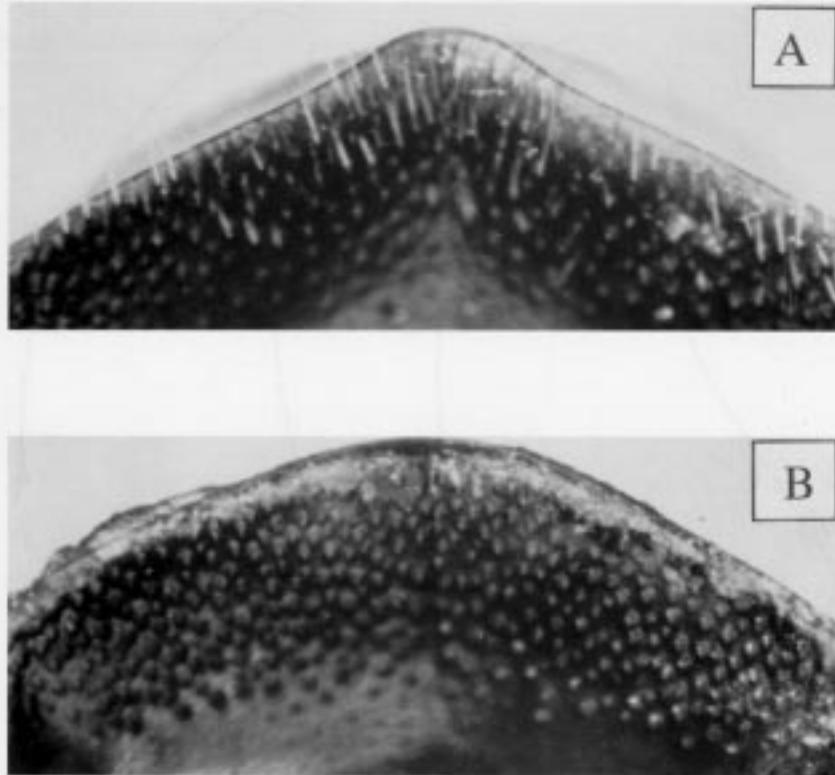


Fig. 5. Dorsal view of the tip of the sixth abdominal tergite of female. A) *H. caliginosus*. B) *H. katiar*.

ka: North Platte 16.X.1934 (1). **North Carolina:** ††Catawba Co., Hog Hill 21–27.VI.1976 coll. R. Turnbow, EX Blacklight (1). **Tennessee:** ††Shelby Co., Meeman Biolog. Stat., 20 km N. Memphis, 1–10.VII.1991 (1), 21–31.VII.1991 (1) coll. M. Ritke. **Mexico:** Reynosa, Tamaulipas 14.IX.1975, elev [handwriting illegible] coll. M. H. Monncol (1), Reynosa, (Tamps.) 26.IX.1984, Mészáros Z. (4).

**Additional Sympatric Collections.** **Oklahoma:** ††Caddo Co. 3.IX.1979, ††Pottawatomia Co. 30.VII.1973. **Texas:** ††Austin, 2–3.VII.1948, at light, G. E. Ball, (2), ††Dallas, 13.VI.1948, at light, G. E. Ball (2)

#### Taxonomic Discussion

My basis for recognizing these two forms as distinct species is the phylogenetic species concept as defined by Nixon and Wheeler (1990): "the smallest aggregation of populations (sexual) or lineages (asexual) diagnosable by a unique combination of character states in comparable individuals (semaphorants)." Clearly these two forms fulfil the criteria as species under this concept. Alternatively, if one wished to invoke the biological species concept one could hypothesize that lack of intermediates between these syntopic forms, and ap-

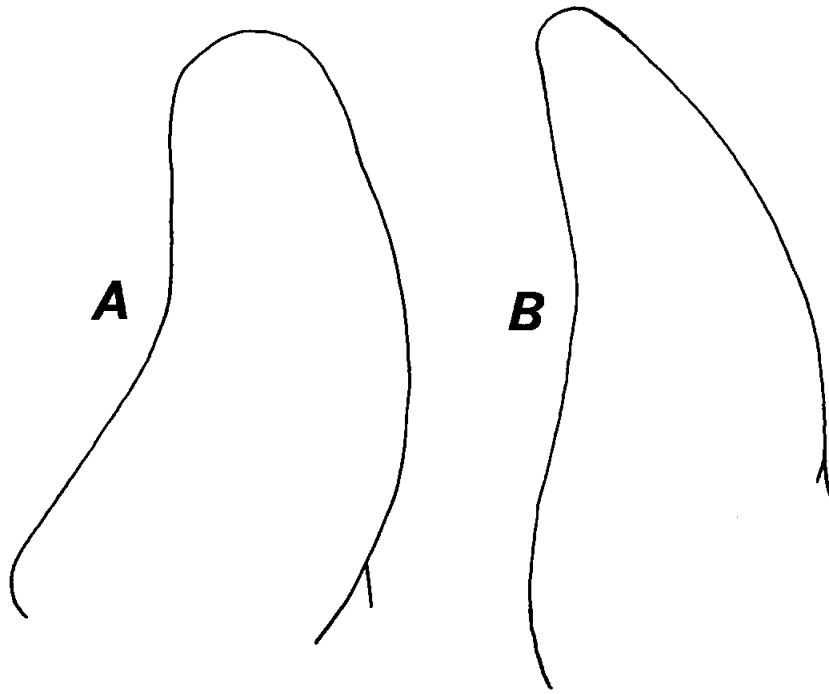


Fig. 6. Dorsal outline of gonocoxa. A) *H. caliginosus*. B) *H. katiae*. Setae and punctation omitted.

parent reproductive isolation by structure of the genitalia are enough evidence for recognizing two distinct species. Variation and distribution do not suggest a clinal effect.

Noonan (1991) places *H. caliginosus* as the sister taxon to subgenus *Plectralidus* Casey, in a clade termed "*caliginosus* stock". This relationship is supported by three synapomorphies: 1) eight or more setae on posterior margin of hind femora, 2) hairy field on anterior sloped base of elytra, and 3) lack of dorsal elytral punctures. Most species of *Harpalus* have not been studied and character polarity remains uncertain. However, phenotypic similarity of the endophallis of *Megapangus* and species in *nigratarsis* and *desertus* groups (sensu Noonan 1991) and additional setae found in the *caliginosus* group and some species of the *nigratarsis* and *desertus* groups at least suggests possible affinities among these species.

Nothing is certain concerning differences or similarities in behaviors or habitats of these two species. However, by examination of range and morphological differences reasonable hypotheses can be made. The generally lighter color, thinner structure of the gonocoxae, greater abundance in coastal areas and records in the north associated with major rivers all seem to point to a preference of *H. katiae* for sandy soils. This is corroborated by the data on one specimen from Illinois that reads "sandunes active daytime". The broad range of *H. caliginosus* suggests it is a eurytopic species. Its darker color and thickened gonocoxae imply the ability to use more compacted soils.



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