# First Discovery of the Family Tanaostigmatidae (Hymenoptera: Chalcidoidea) from China with a Description of a New Gall-Making Species Utilizing Kudzu Leaves[1]

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**Abstract** A new species of *Tanaostigmodes* (Hymenoptera: Chalcidoidea, Tanaostigmatidae) is described from China—*Tanaostigmodes puerariae* sp. nov. This is the first record of this family in China. This new species has potential as a biological control agent for control of kudzu, *Pueraria lobate*, in the U. S., because its preference for making leaf galls on kudzu. It was determined that the wasp has two generations per year, with the second generation overwintering as mature larvae in the gall on leaves that have dropped to the ground. Normally, only one wasp was found per gall, and a single kudzu leaf could have as many as 20 to 50 galls on its surface.

**Key Words** Kudzu, gall-maker, biocontrol agent

Kudzu is a perennial, semi-woody, climbing vine in the family Fabaceae (tribe Phaseoleae, subtribe Glycininae) (Van Der Maeson 1985). The kudzu species present in the U.S. is currently considered *Peuraria montana* (Lour.) Merr. var. *lobata* (Wild) Maesen & S. Almeida (Ward 1998), while in China it is called *P. lobata* (Wu et al. 1994). Kudzu is widely recognized as an important invasive weed in the southeastern U. S. A variety of means have been explored for kudzu management, including herbicides, mechanical removal, industrial exploitation, and intensive livestock grazing. However, none has provided satisfactory suppression. As an exotic invasive weed, classic biological control comes into consideration. A joint cooperative program surveying natural enemies feeding on kudzu in China was initiated in 1999 with aim to screen potential biological control agents for kudzu in the U. S.

A gall-making wasp was found on kudzu during a survey in Anhui, Hubei and Shaanxi Provinces, China. In some of the surveyed areas, the number of kudzu plants infested by the wasp reached 45%, and, for some plants, 100% of their leaves were infested. As such, it may have potential as a biocontrol agent for control of kudzu in the U.S. After careful taxonomic study, the wasp was found to be an undescribed species belonging to the genus *Tanaostigmodes* (Hymenoptera: Tanaostigmatidae). This new species is described and discussed below.

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## Materials and Methods

The specimens studied are based on those reared by Yang Zhong-qi or Jiang Jia-fu from *Pueraria lobate* leaves collected in the Anhui, Hubei and Shaanxi Provinces of China (see material examined). The specimens were studied via scanning electron micrographs (SEM) taken with a HITACHI II EM. For the SEM, the wasps were dehydrated in ethanol, critical point dried, and sputter-coated with gold. Morphological terminology for the species description follows that of LaSalle (1987) and Boucek (1988). All the type materials are deposited in the Insect Museum of Chinese Academy of Forestry, Beijing.

### *Tanaostigmodes puerariae* Yang and Pitts, sp. nov. (Fig. 1)

**Females.** Length 1.2 to 2.2 mm, whole body dark red-brown with light nitidus. Head with eyes fusco-ferruginous, and ocelli ignitus. Antennal scape yellow with apex brown; pedicel and flagellum dark brown. Prepectus and tegula light brown. Setae on head and dorsum of mesosoma black, short, and sparse, those on gaster greyish. Wings hyaline with veins light fulvous. Legs concolorous with body except trochanters, apical 1/3 of tibia and whole tarsi light testaceous. Last tergite of gaster and ovipositor contrasting yellow. Cerci dark brown.

***Head*** (Fig. 1a). About as broad as mesosoma, in dorsal view 2.5 times as broad as long; occiput curved forward slightly and abruptly descended, medially forming carina that touches lateral ocellus and posterior margin of eye, temple absent; eyes bare; POL 2.1 times OOL and 0.4 LOL. Head in front view 1.3 times broader than long; eyes with inner orbit sinuate slightly and convergent dorsally; scrobes moderately deep; antennae inserted distinctly above lower ocular line; ventral to toruli face with two transverse impressions; integument shallowly coriaceous.

***Antenna*** (Fig. 1b,c). With 13 segments. Scape little flatten, 5.5 to 6.0 times longer than broad. Pedicel 2 times longer than broad, ventral side concaved with pit containing tuft of setae (usually 4) (Fig. 1c). Combined length of two anelli about 0.5 times length of first segment of funicle, second anellus 2.0 times as long as first anellus. Funicle with six segments present, first five segment longer than wide (first 1.5 times), and sixth segment as long as broad. Club truncate apically, as long as two preceding segments of funicle. Each funicle segment and club segment with one row of sensilla. Anelli with setae.

***Mesosoma*** (as Fig. 1g,h). Conspicuously convex with coriaceous sculpture on mesonotum, axillae and scutellum shining with faint sculpture. Pronotum descended and invisible in dorsal view. Mesoscutum with width 1.3 to 1.4 times its medial length. Notaulic complete and meeting at about posterior 1/5, then combining into one suture reaching hind margin. Axillae convex, touching each other at interior angles, scutello-axillar suture deep. Scutellum elongate, 1.3 times as long as broad. Propodeum abruptly descended, its surface smooth and shining without trace of sculpture; hind margin of propodeum medially angled forward; median area triangle-shaped, formed by two conspicuous oblique plicae and divided by median carina. Mesopleuron smooth and shining. Sternopleural suture reaching mesopleuron groove. Fore leg with tibial spur very strong (Fig. 1j); mid leg with tibial spur digitiform and as long as basitarsus, all tarsi having two rows of peg-like teeth on ventral surface (Fig. 1k); hind leg with coxa reticulate on dorsal surface, its femur having ventral edge expanding into a tooth-like lobe at posterior 2/5 (Fig. 1i).

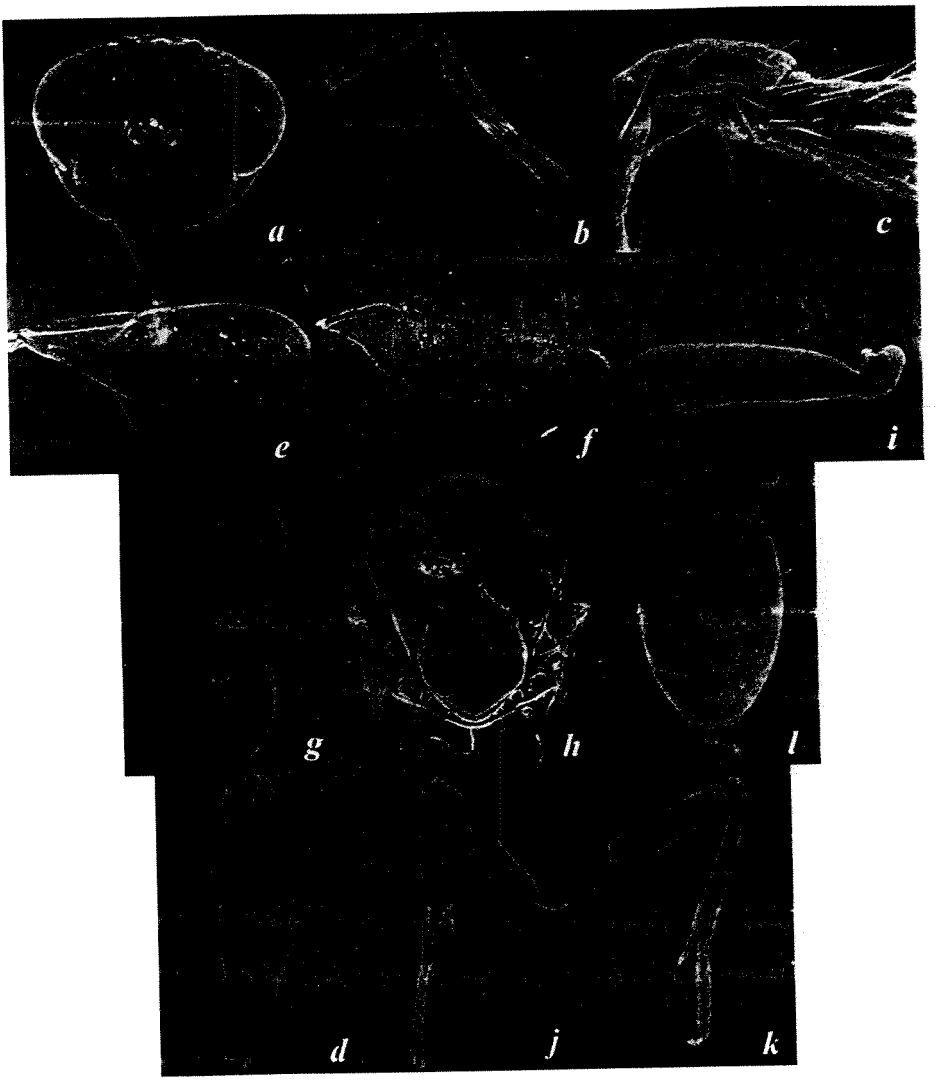


Fig. 1. a. *Tanaostigmodes puerariae* sp. nov. Head in dorsal view (♀); b. Antenna (♀); c. Pedicel and anelli of antenna (♀); d. Scape and pedicel of antenna (♂); e. Forewing (♂); f. Hind wing (♂); g. Mesosoma and metasoma (♂); h. Mesosoma (♂); i. Hind femur (♀); j. Foreleg (♀); k. Midleg (♀); l. Metasoma (♂).

***Wings.*** Forewing costal cell without hairs on upper surface, basal cell scattered with about 20 setae, and speculum big, beneath open; there are 12 to 15 setae on submarginal vein; marginal vein as long as posterior, and 1.6 times stigmal; all vein slender, stigma nearly not capitate. Hind wing with anal margin sinuate.

***Metasoma*** (as Fig. 1l). Elliptical in dorsal view, with distinct median dorsal ridge, length about as long as mesosoma and slightly narrower than later (68:80). Tergite 1 smooth, tergites 2 through 6 coriaceous and having a row of setae dorsally; tergite 1

long, 0.3 whole length; last tergite forming a short point with length 0.16 metasoma and ovipositor exposed a little beyond point; each circus having three sinuate bristles with two being very long and about 2.0 times short one, longest one about as long as last four tergites together. Hypopygium located 0.3 of anterior part of metasoma.

**Male** (Fig. 1d-h.l). Length 1.6 mm, coloration as in female. Antennal scape reached median ocellus, with flattened ventral expansion and 2.5 times longer than broad. Pedicel with length same as broad and excavated remarkably on upper side. Two anellus same length and about 2/3 of pedicel. Unfortunately, flagellum was destroyed. Forewing with capitate stigma, relatively bigger than that of female. Metasoma round dorsally without medial ridge (Fig. 1l). Genitalia exposed a little. Circus bristles short, equal in length.

**Diagnosis.** The female of the new species is similar to *T. kyushuana* (Masi), but can be distinguished from the latter by the following characters: Head under toruli with two impressions; scutellum smooth without minute punctures; forewing with marginal vein as long as the poststigmal; propodeum with hind margin medially angled forward, the plicae conspicuouslly convergent backwards, nearly touched the median carina posteriorly.

**Distribution.** China: Anhui, Hubei, Shaanxi Provinces and perhaps all the areas with distribution of lobed kudzu in China.

**Biology and host.** This species make galls on the leaves of *Pueraria lobata*. At first, the gall appears blister-like and whitish (Fig. 2a). Later on, a nipple-like projection is formed in the center of the gall on both sides of leaf. At this time, the color varies from red-brown on the upper side to grayish-brown on the underside (Fig. 2b). A single kudzu leaf could have from 20 to 50 galls. According to our preliminary observation, the wasp has two generations per year. The color of the mature larva in the summer generation is whitish, while in the overwintering stage it is red-orange (Fig. 2c). The wasps overwinter as mature larvae in the gall on kudzu leaves, which drops to the ground as litter, and usually one larva develops per gall (Fig. 2c).

**Material examined.** Holotype♀, Liping Forest Farm, Nanzheng, Shaanxi, China, 25-VII-1999 collected, emerged 15-VIII-1999, Yang Zhong-qi leg.. Paratypes 5♀, as holotype; 2♀1♂, Qiyunshan Mountain, Xiuning, Anhui, 18-VIII-1998. Jiang Jia-fu leg., 5♀, Yichang, Hubei, 30-X-2000, reared from the leaves with overwinter gall collected on litter, Yang Zhong-qi leg.

## Discussion

*Tanaostigmodes* is the largest genus in the Family Tanaostigmatidae. Species of this genus are found in Neotropics ranging to the southern U. S., in South-East Asia, Australia and Africa. LaSalle 1987) recorded and described 45 species in the genus from New World, and Boucek (1988) recorded seven species from Australo-Papua areas. Previously, *Tanaostigmodes* was not known from China and the only closely related genus was *Protanaostigma*, which occurs in Japan. This represents the first record of Tanaostigmatidae from China.

Classification problems exist for the two aforementioned genera and not everyone agrees that *Protanaostigma* should be of generic status (Boucek 1988). Ferriere (1929) erected the genus *Protanaostigma* for a new species that he thought to be closely related to *Tanaostigmodes*. Later, another species of *Protanaostigma*, *P. kyushuana*, was described from Japan (Masi 1940). After study of the description of Fieriere and Masi, as well as LaSalle (1987), the only notable difference between

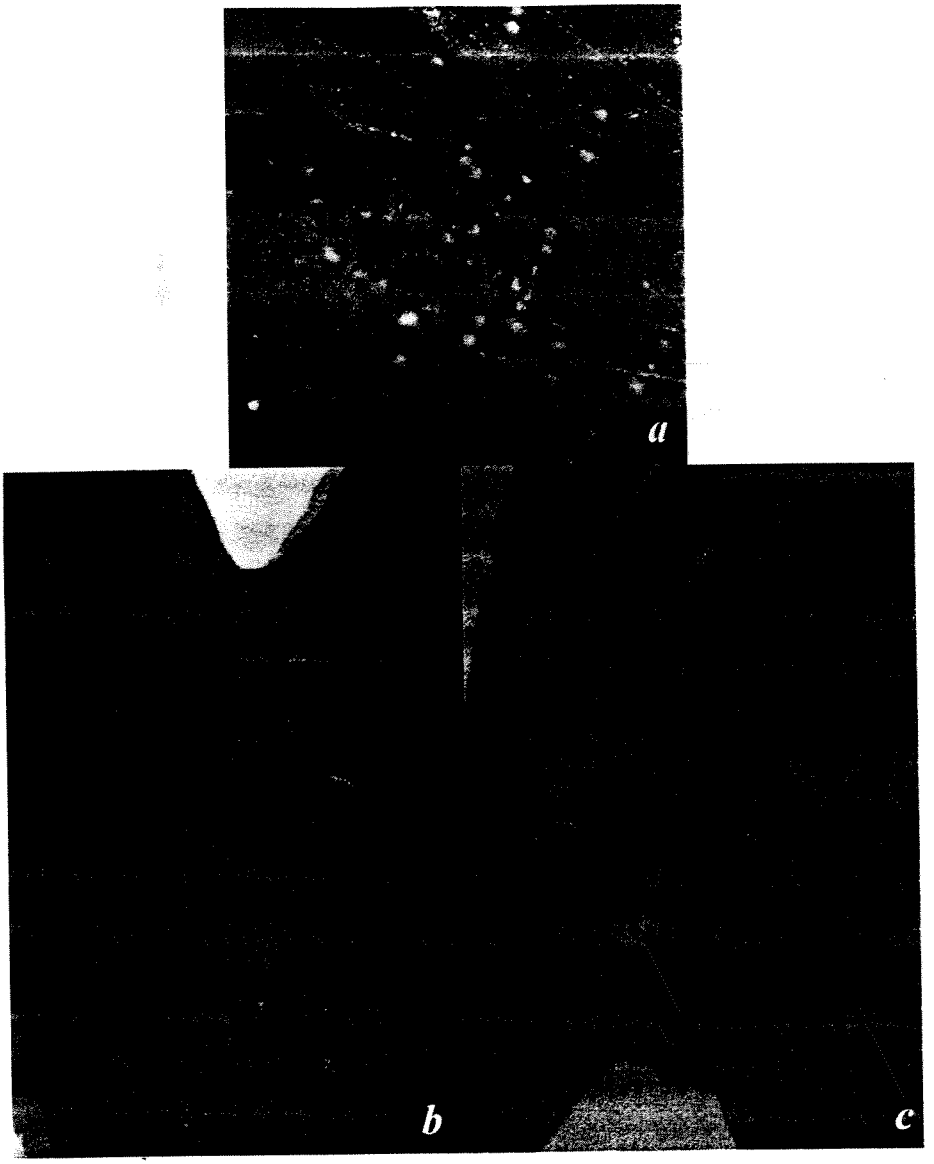


Fig. 2. Galls made by *Tanaostigmodes puerariae* sp. nov. on kudzu leaves and its mature larva, a. Newly formed galls; b. Old galls on upper side of kudzu leaf; c. Old galls on lower side of kudzu leaf.

*Protanaostigma kyushuana* and *Tanaostigmodes* is that the former has the ventral edge of hind femur expanded into a tooth-like lobe, but the latter lacks this expansion. This character may not be of generic importance, because both of these conditions exist for species in *Tanaostigmodes*, and if not other characters exist differentiating this genera, then it is probable that *Protanaostigma* is a synonym of *Tanaostigmodes*.

We agree with the opinion of Boucek (1988) that *Protanaostigma* may just be an eccentric species-group in *Tanaostigmodes*. Furthermore, it is also plausible that *P. kyuahunan* should be placed into *Tanaostigmodes*, due the morphological data suggesting that the new species described here seems to be closely related to *P. kyuahunan*.

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