

# **SELF-ASSEMBLAGE AND QUORUM-RELATED BEHAVIOR IN *Lumbricus rubellus* AND *Eisenia fetida***

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**ANIMAL BIOSCIENCES  
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Bogor, July 2026

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## SUMMARY

RIZKI RAHMA HAYATI. Self-Assemblage and Quorum-Related Behavior in *Lumbricus rubellus* and *Eisenia fetida*. Supervised by KANTHI ARUM WIDAYATI and ANDY DARMAWAN.

Collective behavior arises from interactions among individuals and may include self-assemblage and quorum. Self-assemblage refers to the tendency of individuals to associate with conspecifics and form aggregations, whereas quorum is a threshold response in which collective dynamics change once the number of interacting individuals exceeds a critical level. Self-assemblage has previously been reported in the epigeic earthworms *Eisenia fetida* and *Eudrilus eugeniae*, whereas quorum behavior has only been investigated in *E. fetida*. The present study therefore uses the term quorum-related behavior, as behavioral responses associated with group size were evaluated without directly identifying a quorum threshold. However, whether similar responses occur in other earthworm species remains poorly understood. Therefore, this study aimed to investigate self-assemblage and quorum-related behavior in *Lumbricus rubellus* and *E. fetida*.

Self-assemblage was evaluated using Y-tube and circular arena assays by comparing preferences for conspecific, heterospecific, and empty stimuli, whereas quorum-related behavior was evaluated by measuring leaving time across different group sizes. In the Y-tube assay, both *L. rubellus* and *E. fetida* showed significant preferences for conspecific groups over empty and heterospecific stimuli ( $P < 0.05$ ). Similar preferences were observed in the circular arena, where *L. rubellus* also showed a significant preference for conspecific groups ( $P = 0.011$ ). Group size significantly affected leaving time in *L. rubellus*, *E. fetida*, and mixed-species groups ( $P < 0.001$ ), with the longest leaving times observed in the largest aggregations. These findings provide evidence of self-assemblage and quorum-related behavior in both *L. rubellus* and *E. fetida*. Together, the results suggest that social interactions contribute to the formation and maintenance of aggregations, providing further evidence of collective behavior in epigeic earthworms.

**Keywords:** aggregation behavior, conspecific attraction, epigeic earthworm, quorum-related behavior, self-assemblage



## RINGKASAN

RIZKI RAHMA HAYATI. Perilaku *Self-Assemblage* dan Perilaku Terkait *Quorum* pada *Lumbricus rubellus* dan *Eisenia fetida*. Dibimbing oleh KANTHI ARUM WIDAYATI dan ANDY DARMAWAN.

Perilaku kolektif muncul sebagai hasil interaksi antarindividu dan dapat mencakup *self-assemblage* dan *quorum*. *Self-assemblage* mengacu pada kecenderungan individu untuk berasosiasi dengan sesama spesies (*conspecific*) dan membentuk agregasi, sedangkan *quorum* merupakan respons ambang (*threshold response*) ketika dinamika kolektif berubah setelah jumlah individu yang berinteraksi melampaui batas kritis. *Self-assemblage* sebelumnya telah dilaporkan pada cacing tanah epigeik *Eisenia fetida* dan *Eudrilus eugeniae*, sedangkan perilaku *quorum* baru diteliti pada *E. fetida*. Oleh karena itu, penelitian ini menggunakan istilah *quorum-related behavior* karena respons perilaku yang berkaitan dengan ukuran kelompok dievaluasi tanpa mengidentifikasi ambang *quorum* secara langsung. Namun demikian, apakah respons serupa juga terjadi pada spesies cacing tanah lainnya masih belum banyak dipahami. Oleh karena itu, penelitian ini bertujuan untuk mengkaji *self-assemblage* dan *quorum-related behavior* pada *Lumbricus rubellus* dan *E. fetida*.

*Self-assemblage* dievaluasi menggunakan uji tabung-Y (*Y-tube*) dan arena melingkar (*circular arena*) dengan membandingkan preferensi terhadap stimulus *conspecific*, heterospesifik, dan tanpa stimulus, sedangkan *quorum-related behavior* dievaluasi berdasarkan waktu meninggalkan kelompok (*leaving time*) pada berbagai ukuran kelompok. Pada uji tabung-Y, *L. rubellus* dan *E. fetida* menunjukkan preferensi yang signifikan terhadap kelompok *conspecific* dibandingkan stimulus kosong maupun heterospesifik ( $P < 0,05$ ). Preferensi serupa juga diamati pada arena melingkar, di mana *L. rubellus* menunjukkan preferensi yang signifikan terhadap kelompok *conspecific* ( $P = 0,011$ ). Ukuran kelompok berpengaruh nyata terhadap waktu meninggalkan kelompok pada *L. rubellus*, *E. fetida*, maupun kelompok campuran ( $P < 0,001$ ), dengan waktu meninggalkan kelompok terlalu lama diamati pada agregasi berukuran terbesar. Temuan ini memberikan bukti adanya *self-assemblage* dan *quorum-related behavior* pada *L. rubellus* dan *E. fetida*. Secara keseluruhan, hasil penelitian menunjukkan bahwa interaksi sosial berkontribusi terhadap pembentukan dan pemeliharaan agregasi, sehingga memperkuat bukti mengenai perilaku kolektif pada cacing tanah epigeik.

Kata kunci: cacing tanah epigeik, daya tarik terhadap sesama spesies, perilaku agregasi, perilaku terkait *Quorum*, *self-assemblage*



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**SELF-ASSEMBLAGE AND QUORUM-RELATED BEHAVIOR  
IN *Lumbricus rubellus* AND *Eisenia fetida***

**RIZKI RAHMA HAYATI**

Thesis  
Submitted in partial fulfillment of the requirements for a  
Master's Degree  
in  
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FACULTY OF MATHEMATICS AND NATURAL SCIENCES  
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The author sincerely hopes that this thesis will be beneficial to readers and contribute to the advancement of knowledge, particularly in the field of biology.

Bogor, July 2026

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